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First discovery of *Quercus* feeding Nepticulidae (Lepidoptera) in Central America

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Abstract

Despite the high taxonomic diversity of oaks in Mexico and Central America, no *Quercus* feeding Nepticulidae have ever been recorded from the region. Here, we present seven species whose larvae are leaf-miners of *Quercus* (section Lobatae) in Guatemala. Except *Stigmella nigriverticella* (Chambers 1875), which was previously known from the United States, all other discovered species are new. We describe and name five new species (*Stigmella jaguari* Remeikis & Stonis, **sp. nov.**, *S. lauta* Diškus & Stonis, **sp. nov.**, *S. sublauta* Remeikis & Stonis, **sp. nov.**, *S. aurifasciata* Diškus & Stonis, **sp. nov.** and *S. guatemalensis* Diškus & Stonis, **sp. nov.**); the remaining new species is described but left unnamed because of lack of adults (i. e. moths and genitalia are described from developed pupae). All seven treated species are illustrated with photographs of the leaf-mines, adults, and genitalia.

Key words: Central America, Guatemala, leaf-mines, Nepticulidae, new species, *Quercus*, *Stigmella*

Introduction

Oaks (*Quercus*), with about 600 species, are native to the northern hemisphere, extending from temperate to tropical latitudes in South East Asia and the Americas, with greatest taxonomic diversity and most important centres of endemism in South East Asia and North America (particularly southeastern United States, southern Mexico and the mountainous part of Central America) (Menickiy 1984, Nixon 2006, Torres-Miranda *et al.* 2011).

In contrast to Europe and East Asia, where leaf-mining or bark-mining Nepticulidae have extensively been studied (e. g. Johansson *et al.* 1990, Puplesis 1994, Puplesis & Diškus 2003, van Nieukerken & Liu 2000, Nieukerken & Johansson 2003, Stonis & Rocienė 2013, Rocienė & Stonis 2013), Central America has been neglected, with no *Quercus* feeding nepticulid species known. This paper is the first to report the Central American Nepticulidae species associated with *Quercus* as a host-plant.

Material and methods

Adults of all species were collected by the Lithuanian-Guatemalan scientific expedition' 2012 in montane forests of Guatemala (Quetzaltenango, or more commonly known as Xela, 14°47'27"N, 91°32'09"W; Santa Cruz del Quiché, 15°01'22"N, 91°10'17"W; Panajachel, 14°45'06"N, 91°09'43"W) at elevations ca 1655–2500 m (Figs 2–6) by rearing imagos from mining larvae using the standard method (Puplesis 1994 and Diškus & Stonis 2012). Collecting methods, techniques for genitalia preparation, and protocols for description are outlined in Puplesis & Robinson (2000), Puplesis & Diškus (2003) and Diškus & Stonis (2012).

Permanent slides were photographed and studied using a Leica DM2500 microscope and Leica DFC420 digital camera.

The descriptive terminology of morphological structures follows van Nieukerken (1985, 1986), Johansson *et al.* (1990), Puplesis & Robinson (2000) and van Nieukerken & Johansson (2003). The classification of Nepticulidae follows Puplesis (1994), Puplesis & Robinson (2000), Puplesis *et al.* (2002) and Puplesis & Diškus (2003).

Abbreviation for specimen depository:

ZMUC Zoological Museum, University of Copenhagen, Denmark.

Descriptive taxonomy

All *Quercus* feeding species discovered in Central America (Guatemala) belong to the genus *Stigmella* Schrank and fall into two species groups: the *saginella*-group and the *quercipulchella*-group (diagnostics of the species groups associated with *Quercus* as a host-plant are extensively discussed in Stonis *et al.* 2013). Only one of the species discovered, *S. nigriverticella* (Chambers) described from the United States, was previously known; it is redescribed below from specimens that we collected in Guatemala. All remaining species from Guatemala are new and they are described below.

The *saginella* group

Stigmella nigriverticella (Chambers, 1875)

(Figs 1, 7–12, 30, 32–34, 46–54)

Material examined. 6♂, 14♀, Guatemala, Quetzaltenango, 14°47'27"N, 91°32'09"W, mining larvae on *Quercus* spp., 2500 m, 08.ii.2012, field card no. 5120, LT-GT Scientific Expedition, genitalia slides nos RA483, RA484, RA485, RA486, RA487, RA488, RA490 (ZMUC); 2♂, Panajachel, 14°45'06"N, 91°09'43"W, elevation ca. 1657 m, montane forest, larva on *Quercus* spp., 22.ii.2012, ex pupa iii.2012, LT-GT Scientific Expedition, genitalia slides nos AD516, AD514 (from pupa) (ZMUC).

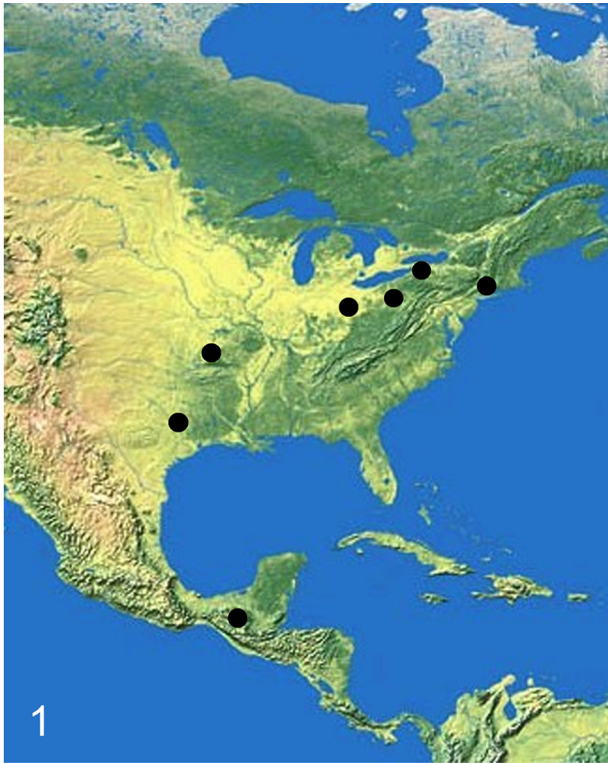
Diagnosis. The male genitalia differ from *Stigmella castaneaefoliella* (Chambers 1875) and *S. flavipedella* (Braun 1914) by the absence of cornuti. From all other species of the *saginella* group, it differs by the combination of elaborated gnathos, narrow uncus, relatively slender valva and X-shaped juxta.

Male (Figs 32–34). Forewing length 2.2–3.0 mm; wingspan 4.8–6.4 mm. Head: palpi cream to yellowish cream; frontal tuft always black on vertex, sometimes yellowish cream in frontal part; collar and scape yellowish cream, occasionally greyish cream; antenna with 27–30 segments, slightly longer than half of forewing; flagellum grey-brown or blackish on upper side, grey-cream to grey on underside. Thorax yellowish cream; tegulae black in front. Forewings yellow-cream with black markings (the pattern may considerably vary; see figs 32, 33); cilia grey to fuscous (on tornus) to cream (on apex); underside of forewing usually blackish, sometime grey-cream to dark grey, but always with elongated yellow-cream spot on forewing apex (Fig. 34). Hindwings and cilia of hindwings vary from usually grey to dark grey. Legs dark grey or black on upper side, yellowish cream on underside. Abdomen black to dark grey on upper side, yellow-cream on underside; anal tufts cream to pale grey.

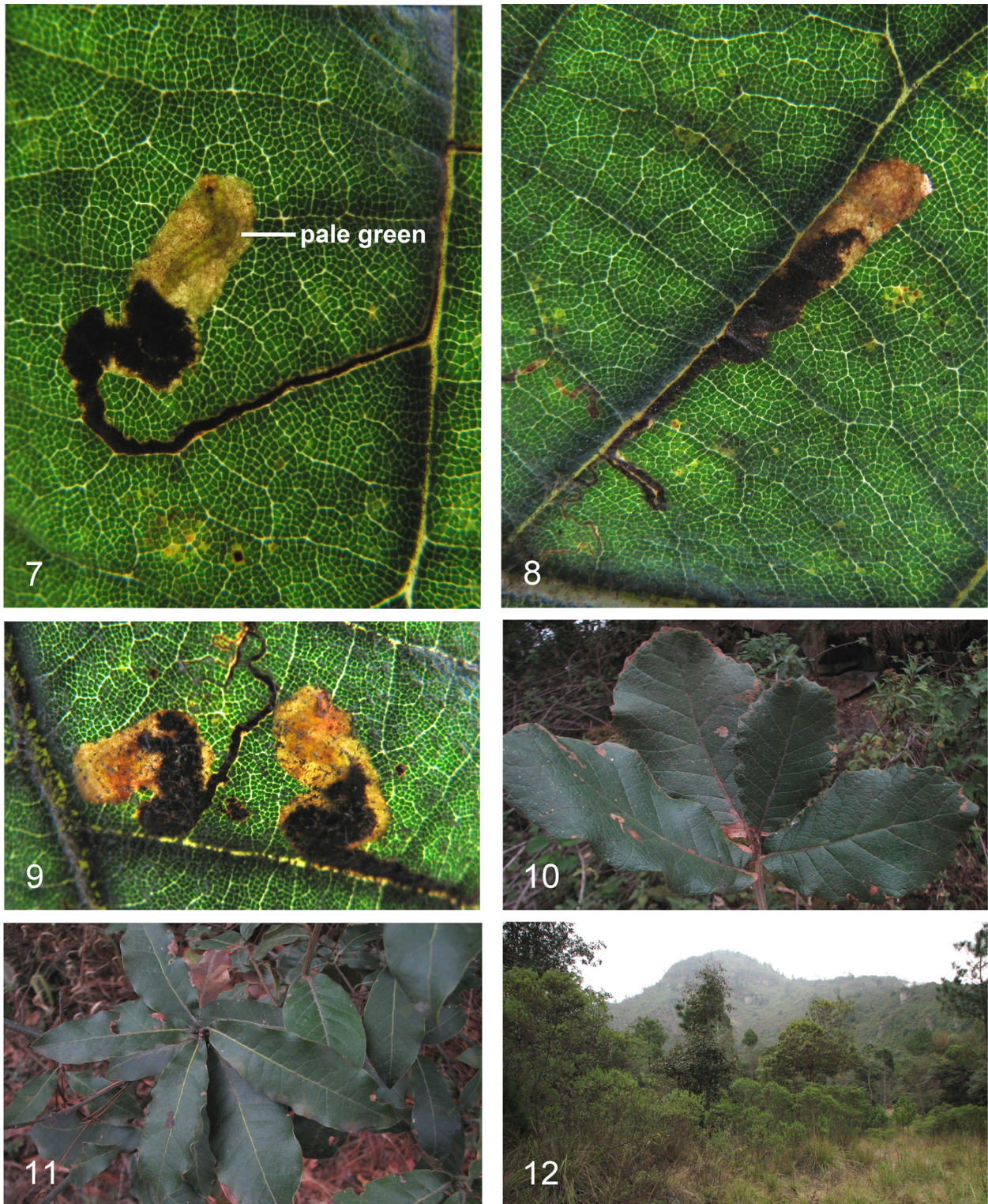
Female. Antenna with ca. 26–28 segments. Abdomen vary from yellow-cream to blackish grey on upper side, yellow-cream on underside; anal tufts cream to yellowish cream. Otherwise as male.

Male genitalia (Figs 46–50). Capsule longer (250–270 µm) than wide (200–220 µm). Vinculum without lateral lobes, ventral plate short (35–40 µm). Uncus with short thickened lateral lobes. Gnathos with two caudal, 35–40 µm long processes (Fig. 49). Valva (Figs 47, 48) 200–205 µm long, with numerous long chaetae; apical process weakly individualized; transtilla with very short sublateral processes. Juxta X-shaped (Fig. 48). Aedeagus (Fig. 50) 170 µm long; vesica without cornuti.

Female genitalia (Figs 51–54). Total length 1055 µm. Apophyses anteriores (about 110 µm) much shorter than apophyses posteriores (about 145 µm) (Fig. 52). Vestibulum relatively narrow, without sclerites. Accessory sac very small. Corpus bursae oval, 590–600 µm, covered with numerous pectinations and with long (360–375 µm), strongly chitinized signa (Figs 53, 54).



FIGURES 1–6. Major collecting localities and distribution of the species discovered in Guatemala. 1, distribution of *Stigmella nigriverticella* (Chambers); 2, distribution of the new *Stigmella* species; 3, Quetzaltenango, 14°47'27"N, 91°32'09"W, montane mixed forests at elevation 2500 m; 4, same, moist broadleaf tropical forest at elevation 2000 m; 5, Santa Cruz del Quiché, 15°01'22"N, 91°10'17"W, elevation ca 2020 m; 6, Panajachel, 14°45'06"N, 91°09'43"W, elevation ca. 1660 m (Maps – courtesy of T.Patterson, USA).

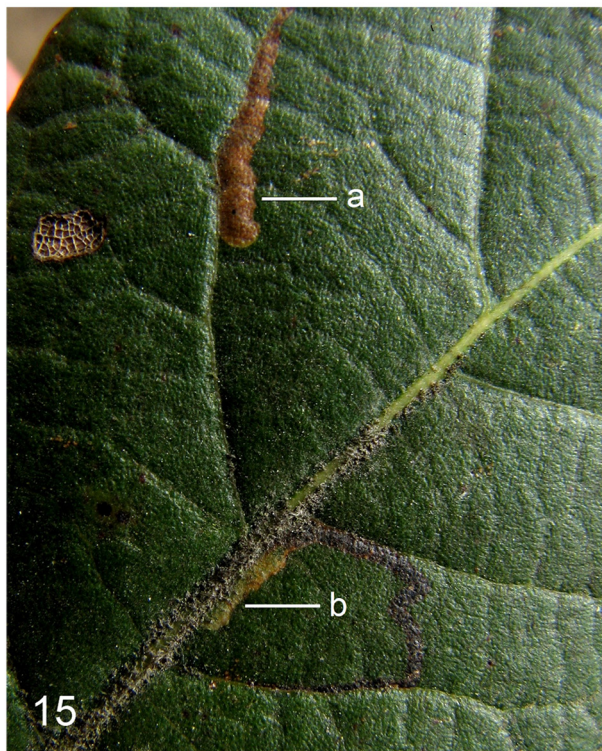


FIGURES 7–12. Bionomics of *Stigmella nigriverticella* (Chambers). 7–9, leaf-mines; 10, major host-plant *Quercus crassifolia* Humb. & Bonpl.; 11, other host-plant *Q. crispipilis* Trel.; 12, habitat, montane mixed forest at elevation 2500 m.

Bionomics. Mines in leaves (Figs 7–9). Host-plants: *Quercus* spp., incl. *Q. crassifolia* Humb. & Bonpl. and *Q. crispipilis* Trel. (section Lobatae) in Guatemala (Figs 10, 11). Egg on upper side of the leaf. Larvae mine in February. Sinuous gallery of mine filled with blackish frass (Figs 7–9). Larva pale green, with brownish intestine. Larval exit slit on upper side of the leaf. Cocoon (Fig. 30) whitish; length 2.4 mm, maximal width 1 mm. Adults emerged in March.

Distribution (Figs 1, 2). USA (from Cincinnati, Ohio and Pennsylvania to Texas) (Newton & Wilkinson 1982); Guatemala in montane mixed forests at elevation 1655–2500 m (Figs 3, 12).

Note. The specimens from Guatemala strongly vary in head markings (frontal tuft from fully black to yellowish cream in frontal part) and forewing markings (see figs 32, 33). However, the male and female genitalia fully correspond with those illustrated in Newton & Wilkinson (1982).



FIGURES 13–17. Bionomics of *Stigmella jaguari* Remeikis & Stonis, **sp. nov.** 13–15, leaf-mines (a—old mine, b — with feeding larva); 16, host-plant *Quercus crispipilis* Trel; 17, habitat, montane mixed forest at elevation 2500 m.

***Stigmella jaguari* Remeikis & Stonis, sp.nov.**

(Figs 2, 13–17, 31, 35–37, 55–59)

Type material. Holotype: ♂, Guatemala, Quetzaltenango, 14°47'27"N, 91°32'09"W, mining larvae on *Quercus* sp., 2500 m, 08.ii.2012, field card no. 5119, LT-GT Scientific Expedition, genitalia slide no. RA491 (ZMUC). Paratype: 1♂, label data as holotype, genitalia slide no. RA489 (ZMUC).

Diagnosis. In male genitalia the new species differs from all other species of the *saginella* group except *Stigmella lauta* sp. nov. by the long vinculum and rounded juxta. From related *S. lauta* sp. nov. it differs by the short cornuti, bulged valva, and tiny sublateral processes of transtilla (*S. lauta* possesses long cornuti, stright valva, and large sublateral processes of transtilla).

Male (Figs 35–37). Forewing length 2.2–2.5 mm; wingspan 4.8–5.4 mm. Head: palpi cream; frontal tuft black; collar and scape large, yellowish cream; antenna with 27–29 segments, slightly shorter than half of forewing; flagellum pale grey to dark grey upper side, grey to cream-grey on underside. Thorax, tegulae and forewings yellow-cream or grey-cream densely but irregularly speckled (irrorated with black scales, no distinct forewing pattern); cilia grey (including forewing apex); underside of forewing black-grey, with cream spot on apex. Hindwings and cilia grey. Legs fuscous on upper side, cream on underside. Abdomen fuscous on upper side, grey-cream on underside, anal plates and tufts cream.

Female. Unknown.

Male genitalia (Figs 55–59). Capsule longer (250 µm) than wide (175 µm). Vinculum without lateral lobes; ventral plate large. Uncus with short, distally chitinized lateral lobes (Figs 55, 57). Gnathos with slender transverse bar and two caudal processes (Fig. 57). Valva (Figs 55, 57) 120 µm long, bulged medially, with pointed apical process; transtilla with short pointed sublateral processes. Juxta rounded caudally (Fig. 55). Aedeagus (Figs 58, 59) 175–195 µm long, 60–70 µm broad; vesica with 7–8 large spine like cornuti and some minute cornuti.

Bionomics. Mines in leaves (Figs 13–15). Host-plants: *Quercus crispipilis* Trel. (section Lobatae) (Figs 16, 11). Egg on upper side of the leaf. Larvae mine in February. Sinuous gallery of mine filled with blackish frass (Figs 13, 14). Larva deep green, with dark green or brown-green intestine. Larval exit slit on upper side of the leaf. Cocoon (Fig. 31) whitish; length 2.3 mm, maximal width 1 mm. Adults emerged in March.

Distribution (Fig. 2). Known only from Guatemala in montane mixed forests at elevation 2500 m) (Figs 3, 17).

Etymology. This species is named after the jaguar, a sacred animal of the Maya people, in reference to the yellow-cream forewing of *S. jaguari* irregularly speckled with black scales.

***Stigmella lauta* Diškus & Stonis, sp.nov.**

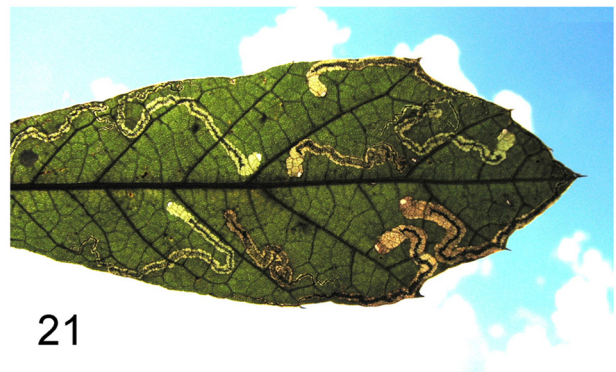
(Figs 2, 18–23, 38–40, 60–69)

Type material. Holotype: ♂, Guatemala, Santa Cruz del Quiché (Uatatlán Ruins), 15°01'22"N, 91°10'17"W, elevation ca. 2023 m, montane forest, larva on *Quercus* sp., 20.ii.2012, ex pupa iii.2012, field card no. 5103, LT-GT Scientific Expedition, genitalia slide no AD505 (ZMUC). Paratypes: 2♂, 2♀, same label data as holotype, genitalia slide nos AD506♂, AD512♂, AD507♀, AD518♀.

Diagnosis. In male genitalia the new species differs from all other species of the *saginella* group by the very long vinculum, rounded sublateral processes of transtilla, and very long spine-like cornuti. Also see Diagnosis of related *S. sublauta* sp. nov.

Male (Figs 38–40). Forewing length 2.2–2.3 mm; wingspan 4.8–5.0 mm. Head: palpi cream; frontal tuft black on vertex, yellowish cream in smaller frontal part; collar and scape large, yellowish cream; antenna with 27–29 segments, slightly shorter than half of forewing; flagellum dark grey on upper side, grey to cream-grey on underside. Thorax, tegulae and forewings yellow-cream or grey-cream densely irrorated with brown-black or black scales (no distinct forewing pattern); sometimes dark scales prevail and forewings look dark brown with a few scattered pale scales; cilia grey to blackish grey (including forewing apex); underside of forewing black-grey, with distinct or indistinct elongated cream spot on apex. Hindwings and cilia grey. Legs fuscous on upper side, yellowish cream on underside. Abdomen fuscous on upper side, cream on underside.

Female. Similar to male.



FIGURES 18–23. Bionomics of *Stigmella lauta* Diškus & Stonis, **sp. nov.** 18–22, leaf-mines; 21, host-plant *Quercus* sp. (section Lobatae); 23, habitat, montane mixed forest at elevation 2020 m.

Male genitalia (Figs 60–64). Capsule longer (335 μm) than wide (185 μm). Vinculum without lateral lobes; ventral plate very large. Uncus with short triangular, distally thickened lateral lobes (Fig.62). Gnathos with slender transverse bar and two caudal processes (Figs 60, 62). Valva (Fig.61) 145 μm long, slender, pointed apically; transtilla with broad rounded sublateral processes. Juxta rounded caudally (Figs 60, 61). Aedeagus (Figs 63,64) 214–235 μm long, 55–60 μm broad; vesica with 6 very long spine-like cornuti.

Female genitalia (Figs 65–69). Total length 905 µm. Apophyses anteriores slightly shorter than apophyses posteriores (Fig. 67). Vestibulum relatively narrow, without sclerites. Accessory sac very small. Corpus bursae oval, 410 µm, covered with numerous pectinations and with short (55–110 µm) chitinized signa (Figs 68, 69).

Bionomics. Mines in leaves (Figs 18–23). Host-plants: *Quercus* sp. (section Lobatae) (Figs 21). Egg on upper side of the leaf. Larvae mine in February. Sinuous or contorted gallery of mine filled with coiled dark brown or black frass (Figs 18–22). Larva deep green, with brownish green intestine (Fig. 18). Larval exit slit on upper side of the leaf. Cocoon beige-brown. Adults emerged in March.

Distribution (Fig. 2). Known only from Guatemala in mixed montane forests at elevation about 2000 m (Fig. 23).

Etymology. The species name is derived from Latin *lautus* (elegant; gaudy) in reference to the very large ventral plate of the vinculum, and transtilla with unusually broad, rounded sublateral processes.

Stigmella sublauta Remeikis & Stonis, sp. nov.

(Figs 2, 3, 24–26, 41, 70–75)

Material examined. Holotype: ♀, Guatemala, Quetzaltenango, 14°47'27"N, 91°32'09"W, mining larvae on *Quercus crassifolia*, 2500 m, 08.ii.2012, field card no. 5118, LT-GT Scientific Expedition, genitalia slide no. RA481 (ZMUC). Paratypes: 2♀, the same label as holotype (ZMUC).

Diagnosis. It differs from all other species of the *saginella* group by combination of speckled forewings, long apophyses anteriores and asymmetrical signa. From most similar *S. lauta* sp. nov. it also differs by the paler forewing, much longer apophyses anteriores and signa: in *S. sublauta* signa are 175 and 280 µm long (in *S. lauta* 55–110 µm).

Male. Unknown.

Female (Fig. 41). Forewing length 2.3–2.4 mm; wingspan 5.0–5.2 mm. Head: palpi cream; frontal tuft black; collar and scape cream; antenna with 19–20 segments, slightly shorter than half of forewing; flagellum dark grey to fuscous on upper side, grey to cream-grey on underside. Thorax, tegulae and forewings yellow-cream or grey-cream densely irrorated with dark brown or black-brown scales (with no distinct forewing pattern); cilia pale grey; underside of forewing very pale brownish grey, except dorsal and tornal edges and apex where it remains cream. Hindwings and cilia pale grey. Legs fuscous to grey on upper side, yellowish cream on underside. Abdomen pale grey on upper side, yellowish cream on underside.

Female genitalia (Figs 70–75). Total length 1050 µm. Anterior and posterior apophyses equally long, ca. 150 µm (Fig. 70). Vestibulum narrow, heavily wrinkled, without sclerites. Accessory sac very small. Corpus bursae elongated, 660 µm, covered with numerous pectinations and with distinctly asymmetrical, 175 and 280 µm, chitinized signa (Figs 73–75).

Bionomics. Mines in leaves (Figs 24, 25). Host-plant: *Quercus crassifolia* Humb. & Bonpl. (section Lobatae) (Fig. 26). Egg on upper side of the leaf. Larvae mine in February. Sinuous gallery of mine filled with blackish frass (Figs 24, 25). Larva yellowish, with brownish intestine. Larval exit slit on upper side of the leaf. Cocoon whitish. Adults emerged in March.

Distribution (Fig. 2). Known from Guatemala (mixed montane forests at elevation 2500 m (Fig. 3)).

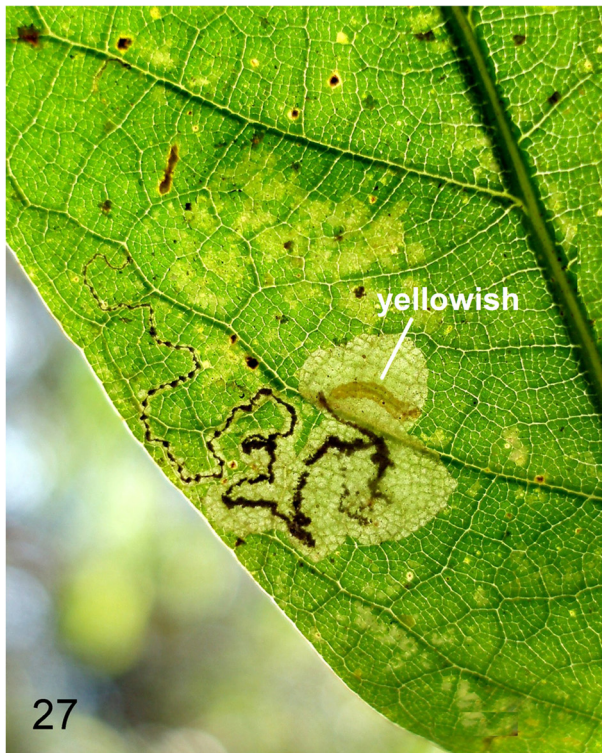
Etymology. This species is named after related *Stigmella lauta* Diškus & Stonis.

Stigmella aurifasciata Diškus & Stonis, sp. nov.

(Figs 2, 42, 76–80)

Material examined. Holotype: ♀, Guatemala, Panajachel, 14°45'06"N, 91°09'43"W, elevation ca. 1657 m, montane forest, larva on *Quercus* sp., 22.ii.2012, ex pupa iii.2012, LT-GT Scientific Expedition, genitalia slide no AD499 (ZMUC).

Diagnosis. It differs from all other species of the *saginella* group by combination of very broad golden cream median and two black basal and apical fasciae of forewing, very long apophyses posteriores, and asymmetrical signa.



FIGURES 24–29. Bionomics of *Stigmella* species. 24, 25, *S. sublauta* Remeikis & Stonis, **sp. nov.**, leaf-mines; 26, same, host-plant *Quercus crassifolia* Humb. & Bonpl. (section Lobatae); 27, *S. aurifasciata* Diškus & Stonis, **sp. nov.**, leaf-mine; 28, same, host-plant *Quercus* sp. (section Lobatae); 29, same, type locality, 1660 m (Panajachel).

Male. Unknown.

Female (Fig. 42). Forewing length 2.3 mm; wingspan 5.0 mm. Head: palpi; frontal tuft brownish orange; collar and scape yellow-cream; antenna with about 26 segments, slightly shorter than half of forewing; flagellum fuscous on upper side, cream on underside. Thorax golden cream (or yellow-cream); tegulae slightly darker, yellow-cream. Forewings with very broad golden cream (or yellow-cream) median fascia and two broad black

fasciae: basal and apical; tiny basal area before basal fascia remains yellow-cream; fuscous scales with some purple iridescence; cilia yellowish cream on apex, greyish on tornus; underside of most of forewing fuscous, apex yellowish cream. Hindwings pale grey on upper side; grey to dark grey on underside; cilia of hindwings grey. Legs dark grey to fuscous on upper side, yellow-cream on underside. Abdomen black on upper side, yellow-cream on underside.

Female genitalia (Figs 76–80). Total length 845 μm . Anterior apophyses shorter than posterior apophyses (Figs 77, 78). Vestibulum narrow, without sclerites. Accessory sac very small. Corpus bursae elongated, 460 μm , covered with numerous pectinations (Fig. 79) and with asymmetrical, 135 and 230 μm , chitinized signa (Figs 76, 80).

Bionomics. Mines in leaves. Host-plant: *Quercus* sp. (section Lobatae). Larvae mine in February. Adults emerged in March.

Distribution (Fig. 2). Known only from Guatemala in mixed montane forests at elevation about 1660 m.

Etymology. The species name is derived from Latin *aureus* (golden) and *fasciata* (with fascia) in reference to the forewing with a broad golden cream fascia.

The *quercipulchella* group

Stigmella guatemalensis Diškus & Stonis, sp. nov.

(Figs 2, 43–45, 81–84)

Type material. Holotype: ♂, Guatemala, Santa Cruz del Quiché (Utatlán Ruins), 15°01'22"N, 91°10'17"W, elev. ca. 2023 m, montane forest, larva on *Quercus* sp., 20.ii.2012, ex pupa iii.2012, LT-GT Scientific Expedition, genitalia slide no. AD513 (ZMUC).

Diagnosis. The new species differs from other species of the *quercipulchella* group by the large apical process of valva, large triangular process of inner lobe of valva, very long and narrow anterior processes of gnathos, and lack of sublateral processes of transtilla. Also see Diagnosis of *S.* species 515.

Male (Figs 43–45). Forewing length 1.8 mm; wingspan 4.0 mm. Head: palpi cream; frontal tuft dark orange; collar and scape cream; antenna with 29 segments, slightly longer than half of forewing; flagellum grey on upper side, pale grey on underside. Thorax, tegulae and forewing fuscous with distinct purple and blue iridescence; fascia of forewing postmedian, broadening at tornus, cream with distinct golden lustre; cilia fuscous; underside of forewing fully black. Hindwings fuscous grey, covered with black androconia (most overlapping over cilia) (Fig. 44); cilia of hindwings blackish grey. Legs dark grey to fuscous on upper side, grey-cream on underside. Abdomen shiny, fuscous, with purple and green iridescence on upper side, silvery grey with some purple and greenish iridescence on under side; genital plates fuscous, with some purple iridescence; anal tufts fuscous, very short, indistinct.

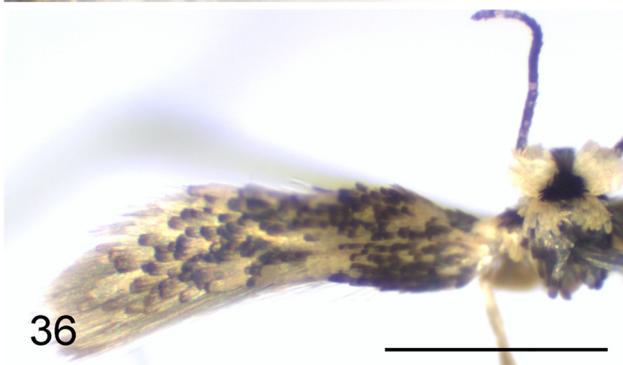
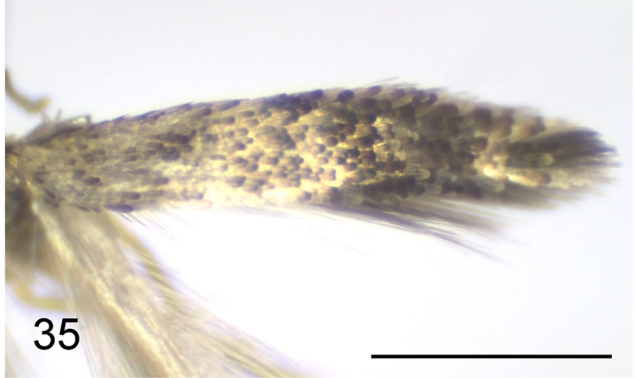
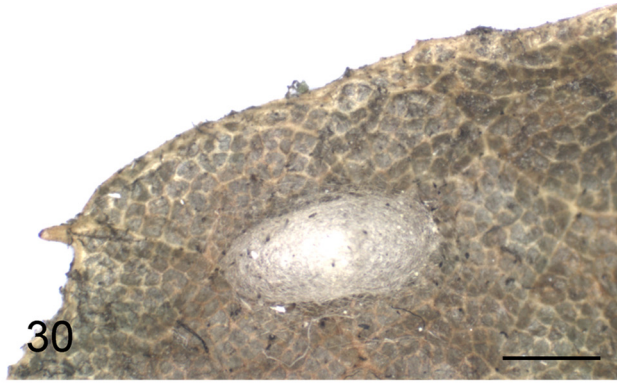
Female. Unknown.

Male genitalia (Figs 81–84). Capsule longer (255 μm) than wide (190 μm). Vinculum with triangular lateral lobes. Uncus distinctly bilobed, laterally thickened (Fig. 82). Gnathos with short caudal processes and very long, narrow anterior processes (Fig. 82). Valva 155 μm long, with very large apical process and large triangular process on inner lobe; transtilla without sublateral processes. Aedeagus (Fig. 84), 240 μm long, 120 μm broad; vesica with numerous spine-like cornuti collected into a long curved band and with an apical group of larger spine-like cornuti; manica present.

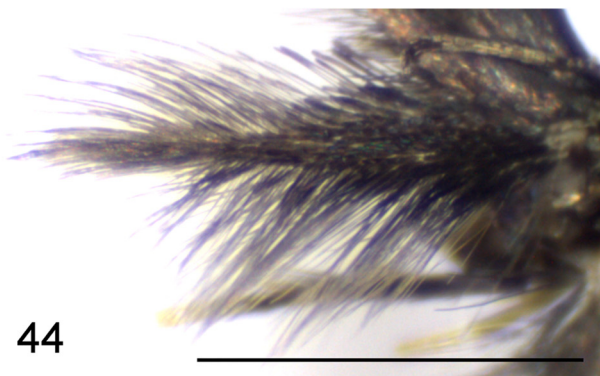
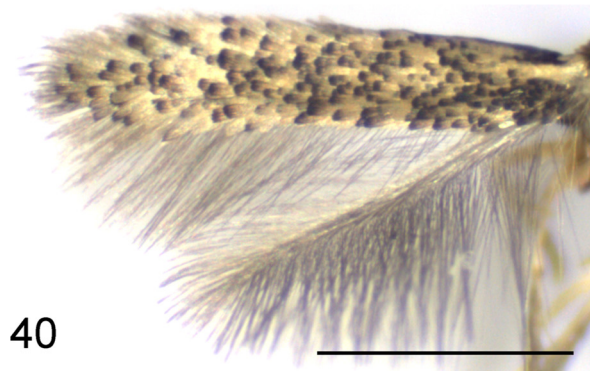
Bionomics. Mines in leaves. Host-plant: *Quercus* sp. (section Lobatae). Egg on upper side of the leaf. Larvae mine in February. Sinuous or contorted gallery of mine filled with blackish frass. Larva deep green, with dark green intestine. Larval exit slit on upper side of the leaf. Cocoon ochre-brown. Adults emerged in March.

Distribution (Fig. 2). Known only from Guatemala in mixed montane forests at elevation about 2000 m.

Etymology. This species is named after Guatemala, a beautiful and megadiverse country from where it was found.



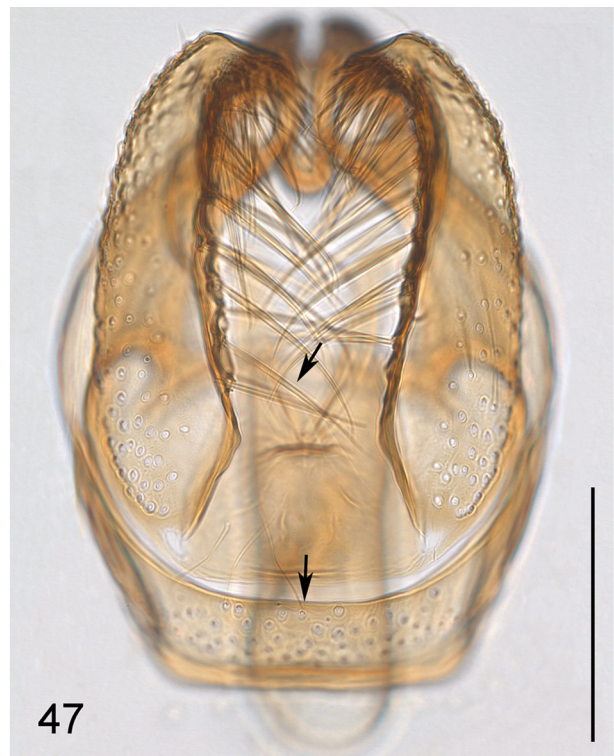
FIGURES 30–37. Details of *Stigmella* species discovered in Guatemala. 30, cocoon of *S. nigriverticella* (Chambers); 31, cocoon of *S. jaguari* Remeikis & Stonis, **sp. nov.**; 32, 33, adults of *S. nigriverticella* (Chambers); 34, same, underside of forewing with the elongated yellow-cream spot; 35–37, forewing of *S. jaguari* Remeikis & Stonis, **sp. nov.** Scale 1 mm.



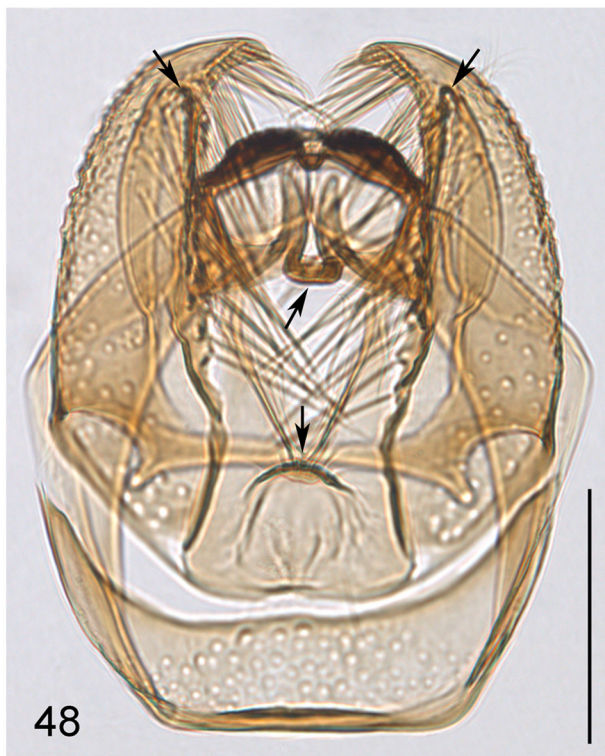
FIGURES 38–45. Adults of *Stigmella* species discovered in Guatemala. 38–40, *S. lauta* Diškus & Stonis, **sp. nov.**; 41, *S. sublauta* Remeikis & Stonis, **sp. nov.**; 42, *S. aurifasciata* Diškus & Stonis, **sp. nov.**; 43–45, *S. guatemalensis* Diškus & Stonis, **sp. nov.** (44, hindwing with androconial scales). Scale 1 mm.



46



47



48



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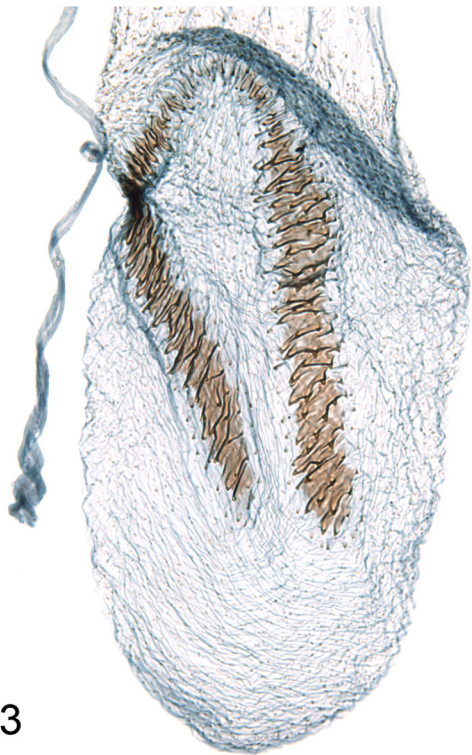
FIGURES 46–50. Male genitalia of *Stigmella nigriverticella* (Chambers), Guatemala; 46, 47, general view, genitalia slide no. RA486. Scale 100 μ m; 48, general view, genitalia slide no. RA485. Scale 100 μ m; 49, gnathos, genitalia slide no. RA486. Scale 50 μ m; 50, aedeagus, genitalia slide no. AD516. Scale 100 μ m.



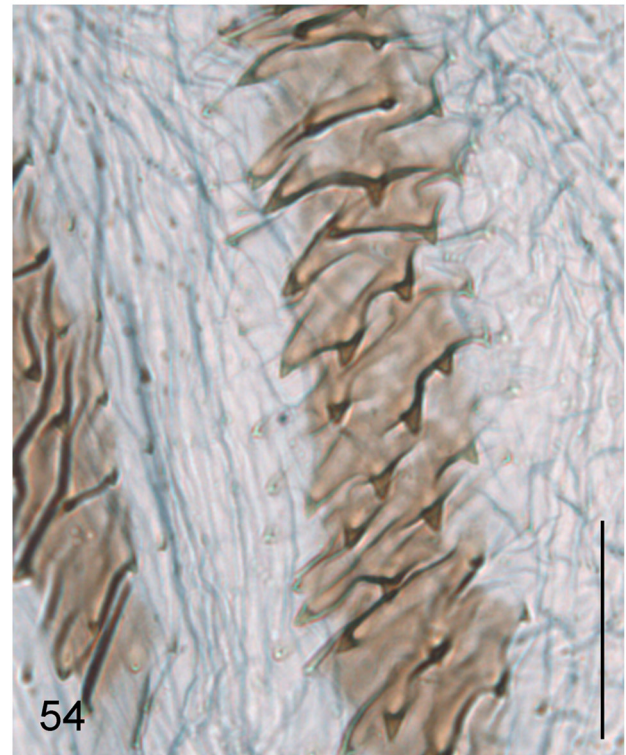
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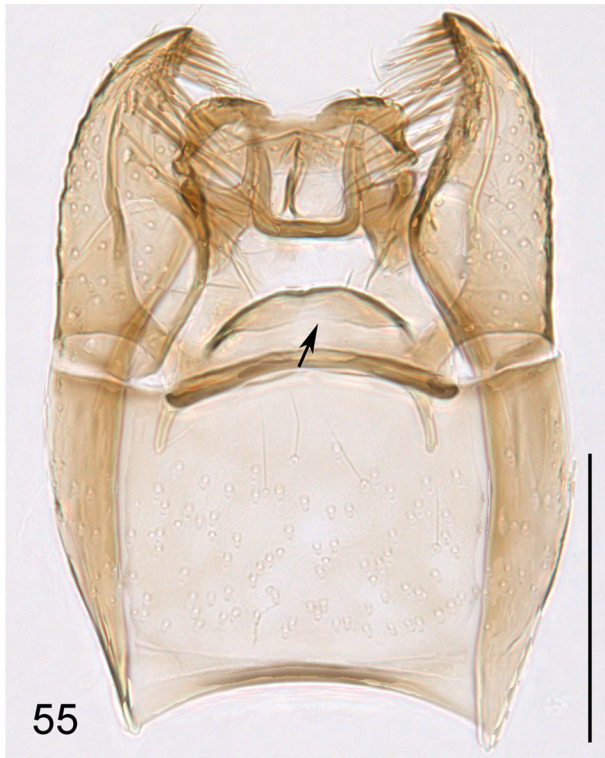


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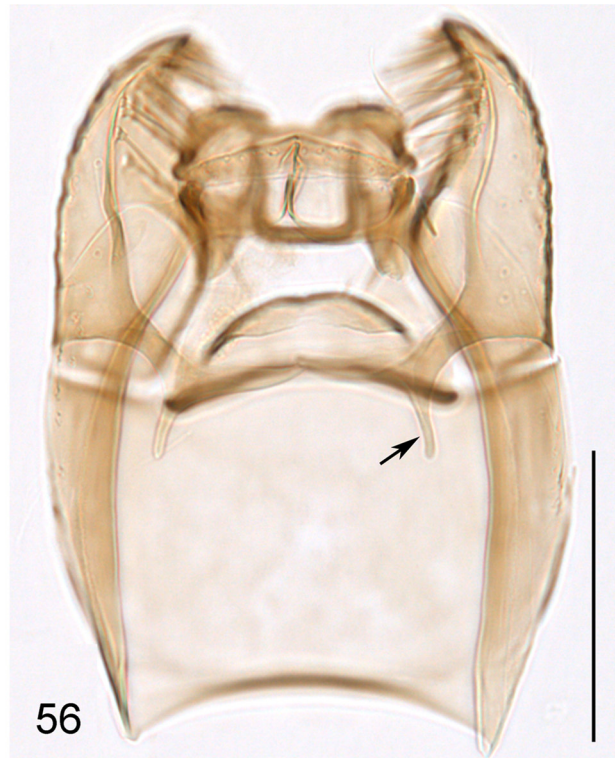


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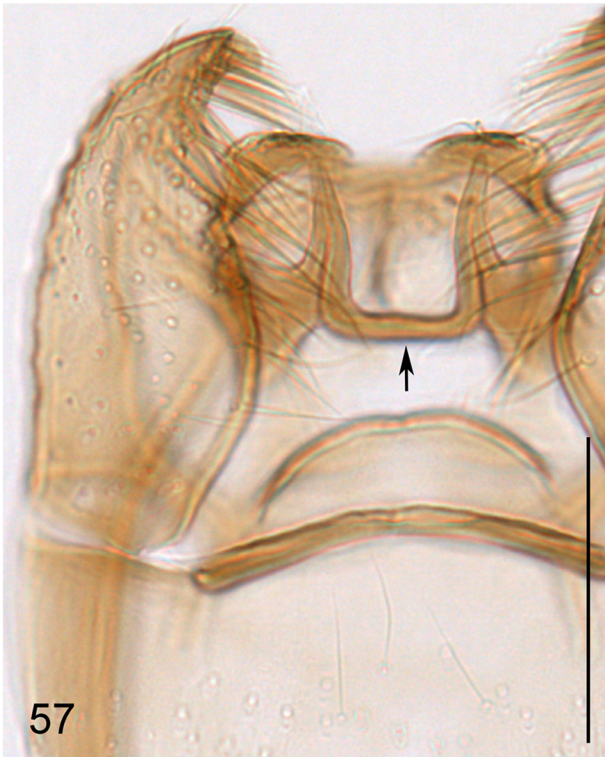
FIGURES 51–54. Female genitalia of *Stigmella nigriverticella* (Chambers), genitalia slide no. RA483. 51, general view. Scale 300 μm ; 52, caudal part with apophyses. Scale 100 μm ; 53, corpus bursae with signa. Scale 200 μm ; 54, details of signa. Scale 50 μm .



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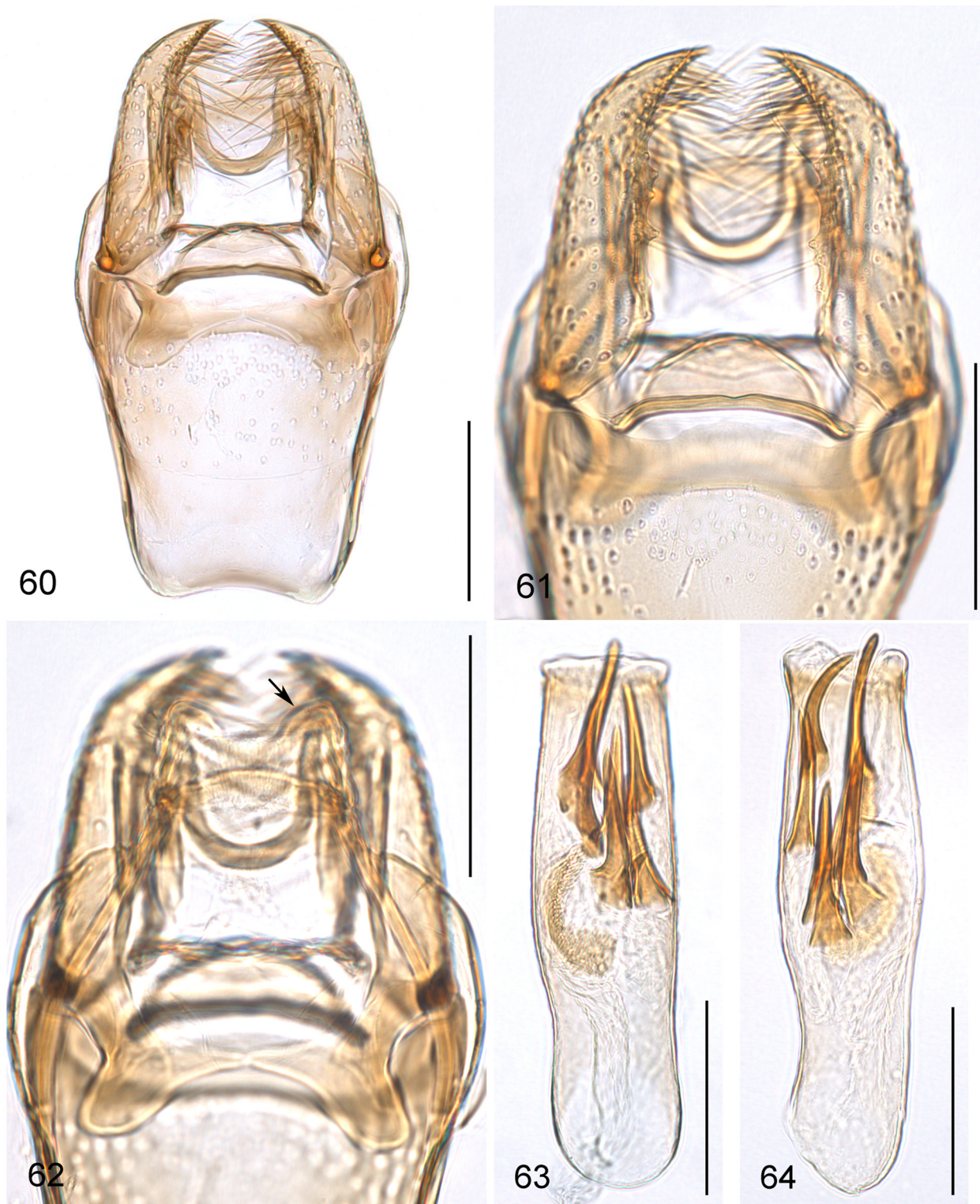


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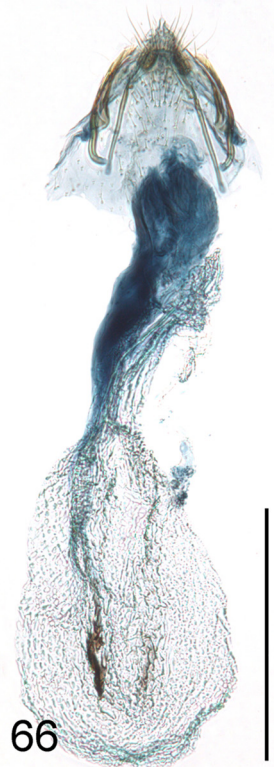
FIGURES 55–59. Male genitalia of *Stigmella jaguari* Remeikis & Stonis, **sp. nov.**; 55, general view, genitalia slide no. RA491. Scale 100 μ m; 56, more dorsal view, genitalia slide no. RA491. Scale 100 μ m; 57, uncus and gnathos, genitalia slide no. RA491. Scale 75 μ m; 58, aedeagus, genitalia slide no. RA489. Scale 75 μ m; 59, same, genitalia slide no. RA491. Scale 75 μ m.



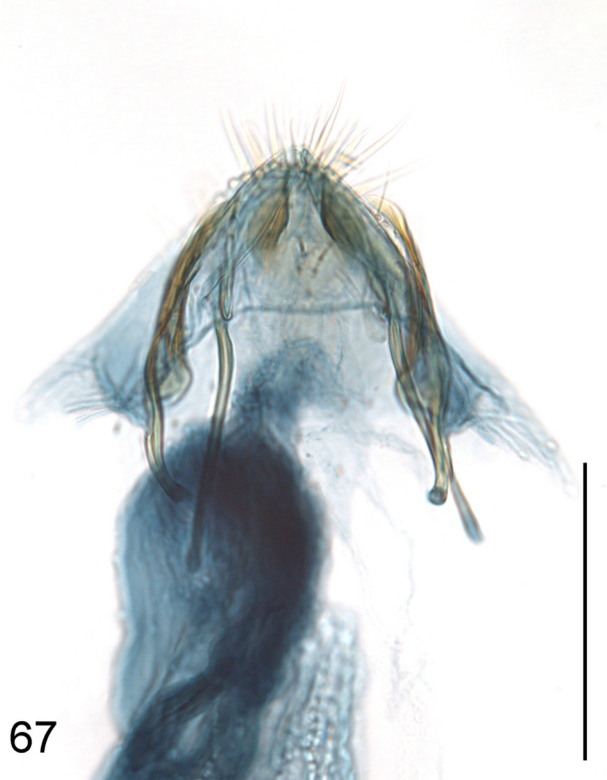
FIGURES 60–64. Male genitalia of *Stigmella lauta* Diškus & Stonis, *sp. nov.*; 60, capsule, general view, genitalia slide no. AD505. Scale 100 μ m; 61, valvae and juxta, genitalia slide no. AD505. Scale 100 μ m; 62, uncus and transtilla, genitalia slide no. AD505. Scale 100 μ m; 63, aedeagus, genitalia slide no. AD505. Scale 75 μ m; 64, same, genitalia slide no. AD506. Scale 75 μ m.



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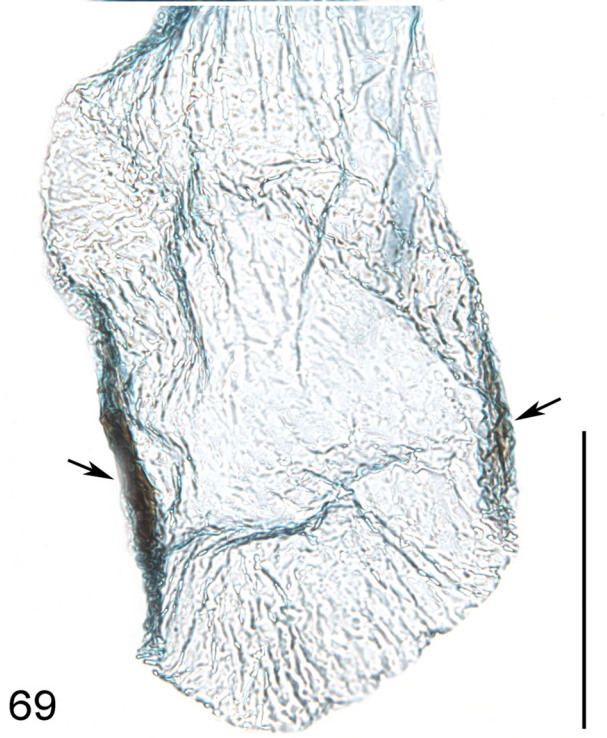
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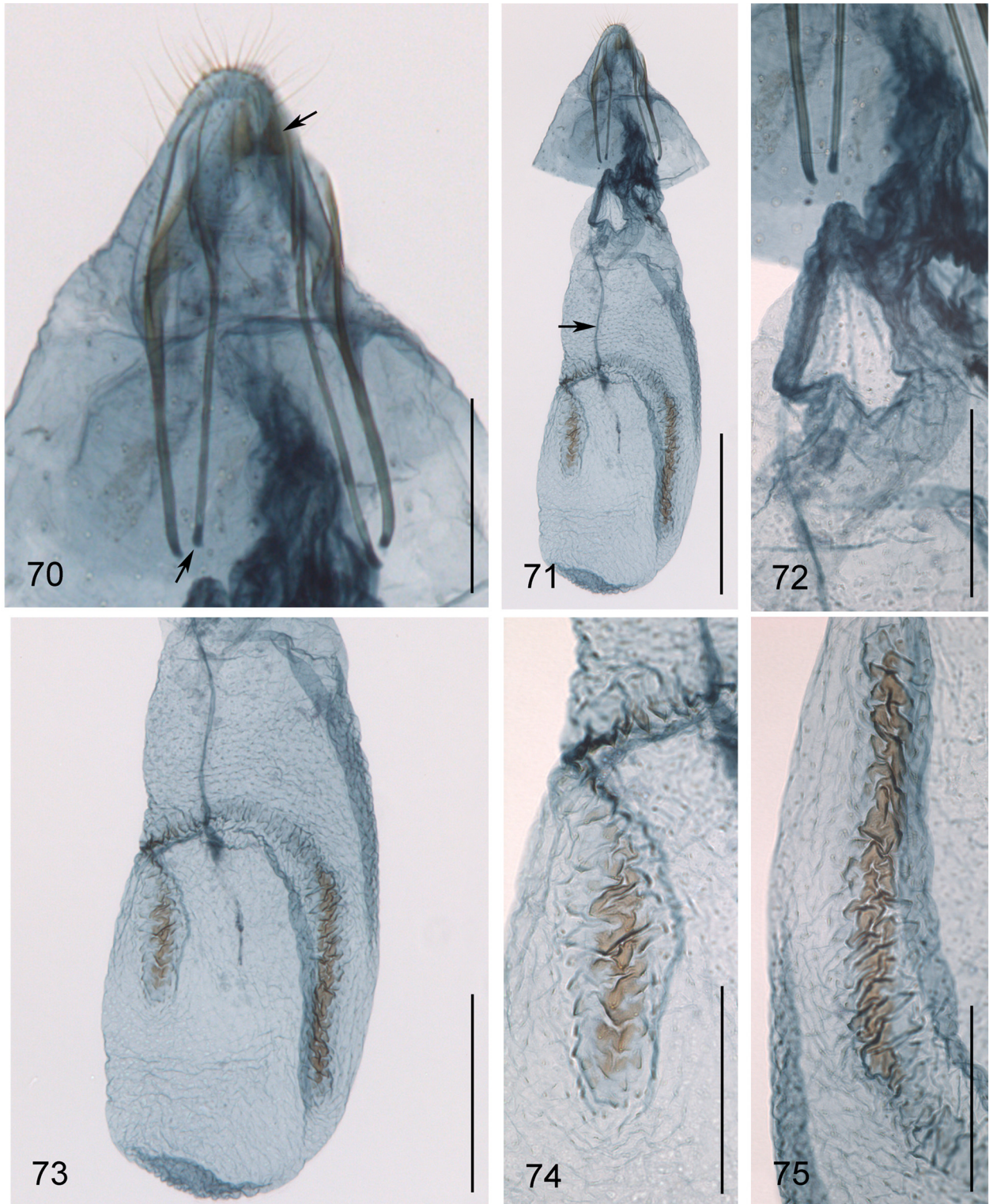


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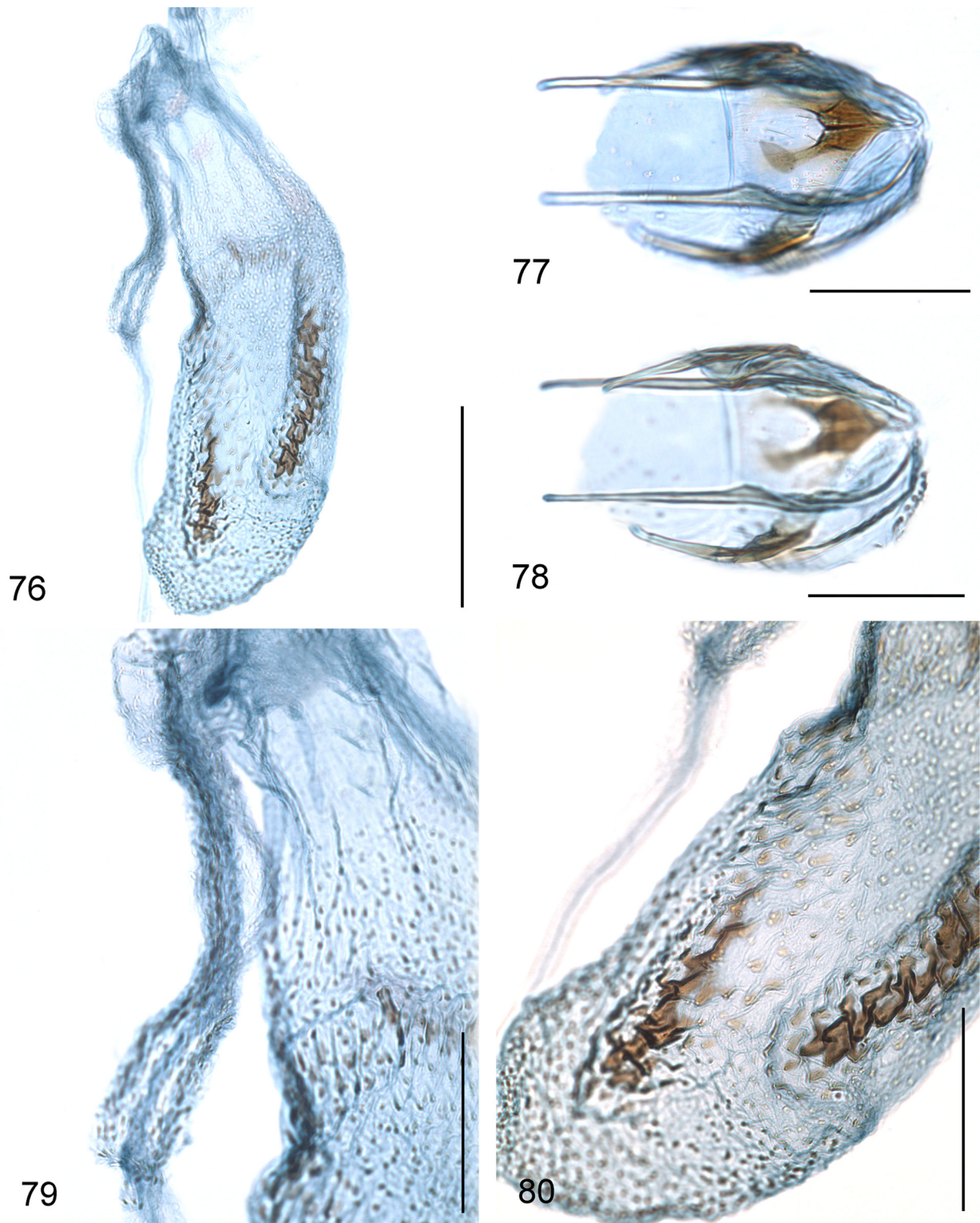


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FIGURES 65–69.Female genitalia of *Stigmella lauta* Diškus & Stonis, **sp. nov.**; 65, general view, genitalia slide no. AD507. Scale 300 µm; 66, same, genitalia slide no. AD518. Scale 300 µm; 67, caudal part and apophyses, genitalia slide no. AD507. Scale 150 µm; 68, corpus bursae with signa (see the arrows), genitalia slide no. AD518. Scale 150 µm; 69, same, genitalia slide no. AD507. Scale 200 µm.



FIGURES 70–75. Female genitalia of *Stigmella sublauta* Remeikis & Stonis, **sp. nov.**, genitalia slide no. RA481. 70, apophyses. Scale 100 μm ; 71, general view. Scale 300 μm ; 72, accessory sac. Scale 100 μm ; 73, corpus bursae with signa. Scale 200 μm ; 74, left signum. Scale 100 μm ; 75, right signum. Scale 100 μm .



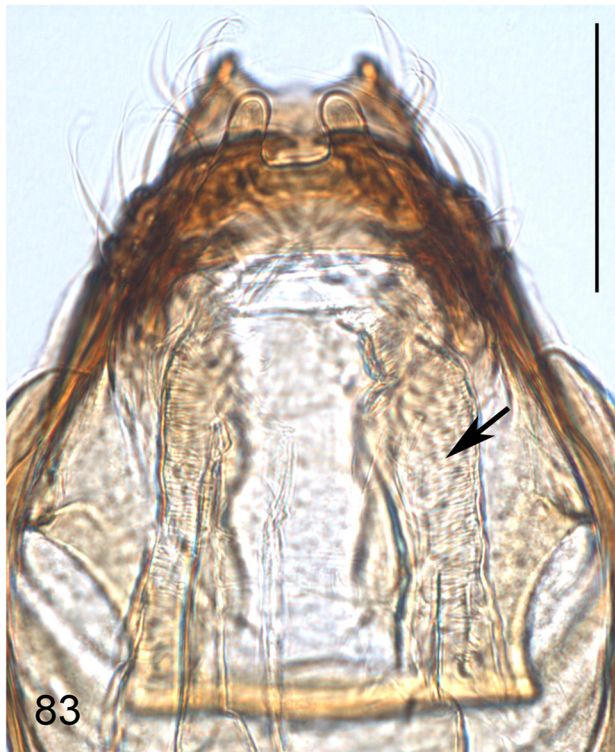
FIGURES 76–80. Female genitalia of *Stigmella aurifasciata* Diškus & Stonis, **sp. nov.**, genitalia slide no. AD499. 76, bursa copulatrix. Scale 200 µm; 77, apophyses, ventral view. Scale 100 µm; 78, same, dorsal view. Scale 100 µm; 79, accessory sac and basal part of ductus spermathecae. Scale 100 µm; 80, corpus bursae with signa. Scale 100µm.



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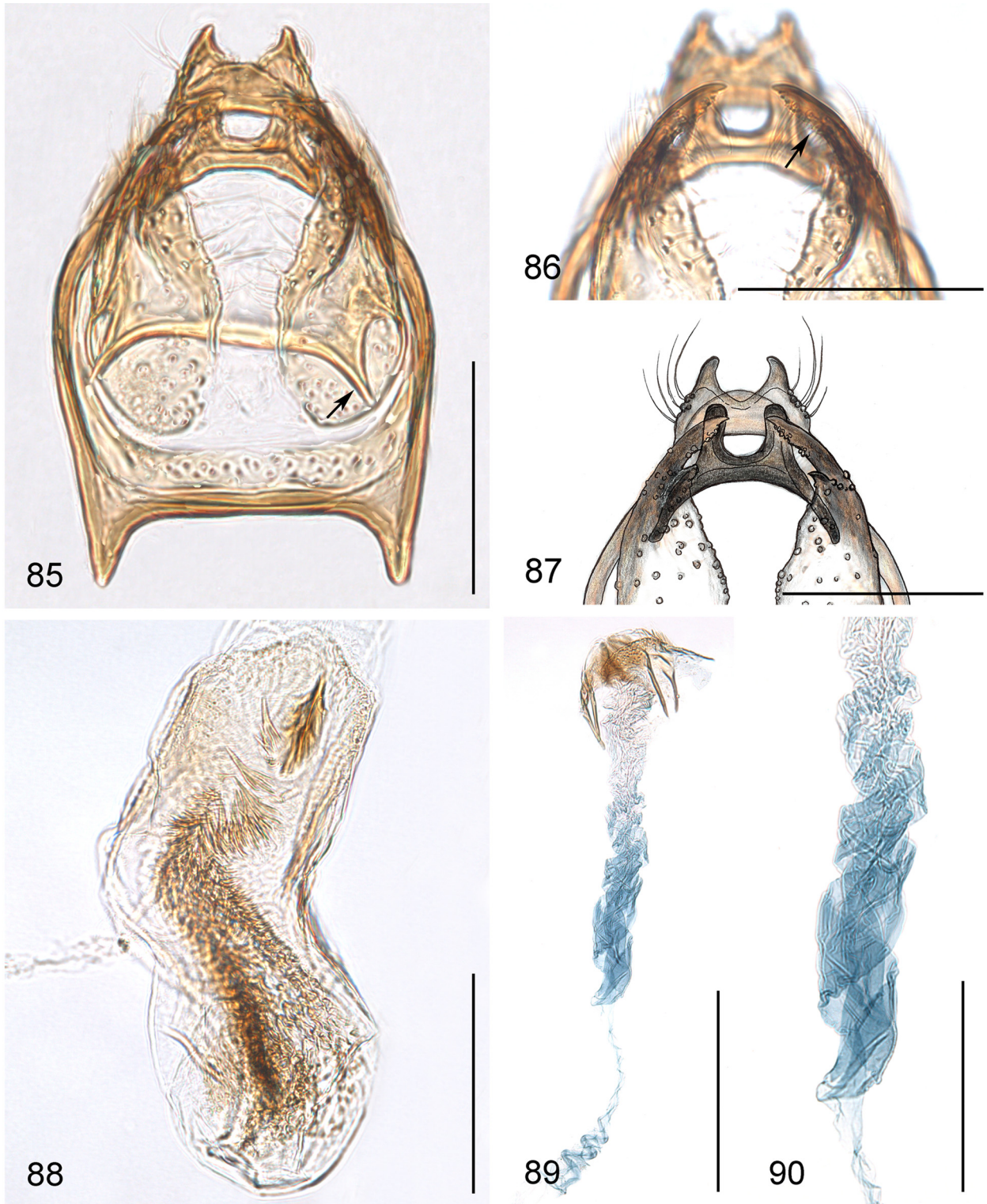


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FIGURES 81–84. Male genitalia of *Stigmella guatemalensis* Diškus & Stonis, **sp. nov.**, holotype, genitalia slide no. AD513. 81, general view. Scale 200 μm ; 82, valvae, gnathos, uncus and transtilla. Scale 100 μm ; 83, juxta. Scale 100 μm ; 84, aedeagus. Scale 100 μm .



FIGURES 85–90. Genitalia of *Stigmella* species 515. 85, male genitalia, capsule. Scale 100 μm ; 86, same, distal part. Scale 100 μm ; 87, same, reconstruction. Scale 100 μm ; 88, aedeagus. Scale 100 μm ; 89, female genitalia, general view (with bursa copulatrix lost). Scale 400 μm ; 90, same, accessory sac. Scale 200 μm .

***Stigmella* species 515**
(Figs 2, 27–29, 85–90)

Material examined. 1♂, 1♀, Guatemala, Panajachel, 14°45'06"N, 91°09'43"W, elevation ca. 1657 m, montane

forest, larva on *Quercus* sp., 22.ii.2012, ex pupa iii.2012, field card no. 5108, LT-GT Scientific Expedition, genitalia slide nos AD515♂, AD517♀ (both from developed pupae, no adult moths available) (ZMUC).

Diagnosis. It differs from the other species of the *quercipulchella* group by the very long and slender apical process of valva, the small triangular process on the inner lobe of the valva, very long and narrow anterior processes of gnathos, and lack of sublateral processes of transtilla. From closely related *S.guatemalensis* **sp. nov.** it differs by presence of sublateral processes of transtilla, slender apical process of valva and medially bent aedeagus. Also from *S. guatemalensis* **sp. nov.** it differs by the yellow larva and distally widened leaf-mine with thin line of frass.

Male (described from fully developed pupa). Head: palpi cream; frontal tuft orange to dark orange; collar and scape cream; antenna grey. Thorax and tegulae dark grey. Forewing fuscous with distinct purple and green-blue iridescence; median fascia of forewing silvery-white, shiny.

Female. Similar to male.

Male genitalia (Figs 85–88). Capsule longer (245 µm) than wide (150 µm). Vinculum with narrow lateral lobes; ventral plate very short (35µm) (Fig. 85). Uncus distinctly bilobed; lobes narrowed and chitinized caudally (Fig. 87). Gnathos with two caudal processes and longer but narrower anterior processes (Fig. 87). Valva 150 µm long, with very long but slender apical process, and small triangular process on inner lobe; transtilla with small slender sublateral processes. Aedeagus (Fig. 88), 260 µm long, 95 µm broad, bent medially; vesica with numerous spine-like cornuti collected into a long curved band and with an apical group of larger spine-like cornuti; manica present, but very small, indistinct.

Female genitalia (Figs 89, 90). Apophyses anteriores and posteriores almost equally long (Fig. 89). Vestibulum narrow, without sclerites. Accessory sac heavily folded and coiled, very long (490 µm) (Fig. 90). Ductus spermathecae with 3 coils. Corpus bursae weakly developed, signa absent; shape of bursae unknown (lost in genitalia slide no. AD517).

Bionomics. Mines in leaves. Host-plant: *Quercus* sp. (section Lobatae) (Fig. 28). Egg on upper side of the leaf. Contorted gallery of mine strongly widens in distal half, with very thin line of black frass (Fig. 27). Larva yellowish, with brownish intestine. Larval exit slit on upper side of the leaf. Cocoon ochre-brown. Larvae mine in February. Adults emerged in March.

Distribution (Fig. 2). Known from Guatemala (mixed montane forests at elevation about 1660 m) (Fig. 29).

Remark. The moth and genitalia are described from developed pupa (no pinned adults available). Therefore, the new species is left unnamed.

Discussion

Currently the fauna of Nepticulidae of Central America and adjacent Mexico counts 50 species. Until now, *Quercus* feeding species in the region were unknown. Oaks are dominant members of a wide variety of habitats, including savannah, chaparral, premontane or montane tropical forest, oak-pine forest, and cloud forest of Central America (Nixon 2006). The *Quercus*-feeding species treated here represent a significant portion of the currently known Central American fauna of Nepticulidae: the species of *quercipulchella* group account for 5% of the known nepticulid fauna of Central America (in North America, 3%), whereas the species of the *saginella* group account for 11% (in North America, 6%).

Undoubtedly the Central American *Quercus* feeding fauna of Nepticulidae is much richer than the seven species we collected; our short visit during late January-February sampled only a relatively small part of the diverse region. Nevertheless, the observation of numerous fresh empty leaf-mines and few old mines from other periods allows us to presume that late December-early February is probably best time of year to find mining larvae in Guatemala (both the mountainous or lowland areas).

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