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New genus and species of Yponomeutidae (Lepidoptera: Yponomeutoidea) associated with *Maytenus boaria* Molina (Celastraceae) from Chile, with descriptions of immature stages and natural history observations

Danilo E. Cepeda
Museo Entomológico Luis Peña, Departamento de Sanidad Vegetal
Universidad de Chile
Casilla 1004, Santiago, Chile

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New genus and species of Yponomeutidae (Lepidoptera: Yponomeutoidea) associated with *Maytenus boaria* Molina (Celastraceae) from Chile, with descriptions of immature stages and natural history observations

Danilo E. Cepeda
Museo Entomológico Luis Peña, Departamento de Sanidad Vegetal
Universidad de Chile
Casilla 1004, Santiago, Chile
museoent@uchile.cl

Abstract. A new genus and species of Yponomeutidae (Lepidoptera: Yponomeutoidea) from Chile, *Chileporter huemeri* n. gen. and n. sp., is described based on adults, larvae and pupae. This is the second record of a specific herbivore associated with *Maytenus boaria* Molina.

Key words. Yponomeutinae, *Zelleria*, Neotropical, taxonomy, chaetotaxy.

Resumen. Se describe un nuevo género y especie de Yponomeutidae (Lepidoptera: Yponomeutoidea) de Chile, *Chileporter huemeri* n. gen. y n. sp., basado en caracteres morfológicos del adulto, larva y pupa. Este corresponde al segundo registro de un herbívoro específico asociado a *Maytenus boaria* Molina.

Palabras clave. Yponomeutinae, *Zelleria*, Neotropical, taxonomía, quetotaxia.

Introduction

The moths in the family Yponomeutidae usually have the following combination of diagnostic morphological characters: ocellus absent, galea elongated, forewing elongated oval, labial palpus never recurved, male with pleural expansions of abdominal segment 8, abdominal terga with spines, sternum 2 of tineoid type, larvae with group L trisetose on prothorax, and pupae lacking abdominal dorsal spines (Dugdale et al. 1998; Gershenson and Ulenberg 1998). The family Yponomeutidae is poorly known from the Neotropical region; comprising less than 6% of total known species (Lewis and Sohn 2015). In Chile, the family is represented by one species, *Kessleria ematynus* Cepeda. This species is associated with *Maytenus boaria* Molina (Celastraceae); but the immature stages have not been described (Cepeda 2016). The purpose of this paper is to describe a new genus and species of Yponomeutidae from Chile, which is also associated with *M. boaria*. This includes figures of male and female genitalia and a description of the immature stages. Natural history observations of its development on the host are provided. The new genus is compared with three genera that are thought to be closely related, based on morphological similarities: *Zelleria* Stainton, *Kessleria* Nowicki and *Paradoxus* Stainton.

Materials and Methods

The specimens examined in this study, including permanent slides, are deposited in:

MEUC Luis Peña Entomology Museum Department of Plant Protection, College of Agronomic Sciences, University of Chile, Santiago.
TLMF Tiroler Landesmuseum Ferdinandeum. Innsbruck, Austria.
USNM National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA.
ZMUC Zoological Museum University of Copenhagen, Denmark.

In September and November of 2016 and 2017, larvae and pupae were collected from the host *M. boaria*, in Metropolitan Region, Chile. The material was separated into two groups, one for studies of immature stages and another to be reared in the laboratory until emergence of adults. Adult specimens deposited in the MEUC collection from previous rearing were also included. The larval integument was

examined using the methodology of Cepeda and Cubillos (2011). Terms for larvae and pupae follow MacKay (1972), Heppner (1987), Vargas (2007) and Patočka (1997). The adult descriptions follow Cepeda (2016). A Leitz 50× stereoscopic magnifier was used to observe the adults. A Leica DM500 microscope was used to observe the genitalia, and the photographs were taken with a 14 megapixel resolution Fujifilm HD Movie digital camera. The photographs and drawings were processed using Adobe Photoshop CS5.1.

Results

Chileporter Cepeda, new genus

Type species. *Chileporter huemeri* Cepeda, **new species.**

Diagnosis. (Fig. 1–5). *Chileporter* n. gen. can be separated from other yponomeutids by morphological characters of the male and female genitalia. The male differs by the absence of the cornuti and by the unique shape of the uncus, socii, and gnathos, and the female differs by the form of the corpus bursae and signum. Also, the forewing lacks a pterostigma and has an open discal cell, and the hindwing has veins M_3+CuA_1 not at a right angle with M_1, and vein A_3 absent. This genus is likely in a clade with the yponomeutid genera *Zelleria*, *Kessleria*, and *Paradoxus*, because of similarities in both male genitalia (valva simple, saccus slender) and female genitalia (ductus bursae elongated, signum usually present). The morphological features that distinguish *Chileporter* n. gen. from these closely related genera are presented comparatively in Table 1.

Table 1. Comparison of male and female genitalic characters in *Chileporter* n. gen., and the related yponomeutid genera *Zelleria* Stainton, *Kessleria* Nowicki and *Paradoxus* Stainton.

Character	*Chileporter*	*Zelleria*	*Kessleria*	*Paradoxus*
Uncus	Rounded	Subtruncated	Subtruncated	Subtruncated
Socii	Subtriangular	Elongated	Elongated (part)	Elongated
Gnathos	Spined	Spined (part)	No spines	No spines
Valva	Simple	Simple	Simple	Simple
Sacculus	Not developed	Developed	Developed	Developed
Saccus	Thin, short	Thin, short	Thin (part)	Thin, elongate
Cornuti	Absent	Absent	Present	Present
D. bursae	Elongated	Elongated	Elongated	Elongated
C. bursae	Ovate	Rounded (part)	Rounded (part)	Rounded
Signum	Present	Present (part)	Absent	Present

Description. *Adult.* 11–13.5 mm wingspan ($n = 20$). Labial palpi held obliquely, third segment subequal in length to first. Forewing lanceolate with acute apex; pterostigma absent; discal cell open; Sc does not reach costa; R_3, R_4 and R_5 sub-parallel. Hindwing with termen acute; Sc strongly sclerotized; M_1 and M_2 widely separated towards termen; M_3 + CuA_1 parallel to CuA_2, not arranged at right angle with M_1; A_3 absent. Second abdominal sternum with small sclerotized central bar. Synapomorphic presence of spine-like setae on the abdominal tergum (Sohn et al. 2013). *Larva.* Seta V1 on the larval head is elongated. In the last stage larvae, the formula of SV-setae on abdominal segments A1, 2, 7, 8, 9 corresponds to 2: 3: 2: 1: 1; A8 with SV uni-setose; in A9, seta D1 is not so close to D2; SV uni-setose; integument with star-shaped micro-processes. *Pupa.* Front with small central incision. Clypeus trapezoidal, wider than long. Labium less than a third the length of proboscis. Antennae slightly longer than forewing.

Male genitalia. (Fig. 6–11). Uncus wide, anterior margin rounded, tuba analis with broad base and sclerotized. Socii elongate, sub-triangular, covered with long setae with bifid apex. Tegumen wider than long. Gnathos rounded with strong marginal spinose processes. Saccus slender and moderately short. Valva simple, longer than wide; costa arched in the middle and cucullus oriented upwards. Sacculus not

developed. Phallus slender, elongated and acutely lanceolate towards apex. Pleural lobe on A8 enlarged with broadly rounded margin.

Female genitalia. (Fig. 12–15). Papillae anales simple. Apophyses anteriores with widely open dorsal and ventral arms, apophyses posteriores slender. Lamella post-vaginalis with central incision and covered with abundant setae. Antrum short and sclerotized. Ductus bursae elongated, completely clothed with spiniform circular processes. Corpus bursae ovoid. Signum digitiform, strongly sclerotized, with serrate margins; located on dorsal area of corpus bursae.

Host. *Maytenus boaria* Molina (Celastraceae).

Etymology. The name combines the country of Chile with the surname of the eminent Chilean naturalist Carlos Emilio Porter Mosso (1867–1942). The noun is male in gender.

Remarks. The host is a widely distributed species of Celastraceae in Chile and South America. It should be noted that other genera of Yponomeutidae also have Celastraceae hosts, are generally widely distributed in the Palearctic region. Otherwise, most botanical records for Yponomeutidae include the families Celastraceae, Rosaceae, Saxifragaceae, Pinaceae, and Betulaceae (Gershenson and Ulenberg 1998; Lewis and Sohn 2015).

Chileporter huemeri Cepeda, new species

Diagnosis. Forewing pale gray, with scattered white, yellowish and black scales; with a small group of raised black scales in ante-medial area. Hindwing whitish. Socii sub triangular with bifid apex. Gnathos with marginal spines. Ductus bursae elongated with micro-processes. Corpus bursae ovoid. Signum projecting with serrated edges. Because of their morphological similarity, this new species is compared with Neotropical and Nearctic species of *Zelleria*. For example, it is distinguished from *Z. cirrhoscia* Meyrick by its sub-triangular socii with bifid apices, and valva with costa arched, from *Z. leucoschista* Meyrick by having a thin, slender saccus and an elongated phallus, and from *Z. pistopis* Meyrick by its digitiform and serrated signum (Meyrick 1931; Clarke 1965). This combination of genitalic characters also distinguishes *C. huemeri* from *Z. arizonica* Braun, *Z. pyri* Clarke, *Z. haimbachi* Busck and *Z. semitincta* Meyrick (Busck 1915; Meyrick 1930, Braun 1940; Clarke 1942, 1965; La Gasa 2016). Finally, *C. huemeri* can be distinguished from *Z. celastrusella* Kearfott and *Z. retiniella* Forbes (Kearfott 1903; Forbes 1923) by the forewing color patterns. In *Z. celastrusella*, the basal fourth of the forewing has a dark fascia, and there are multiple well-defined white patches toward the apex; these markings are absent in *C. huemeri*. In *Z. retiniella*, the forewing is bright gold instead of pale gray.

Description of male holotype. Wingspan, 12 mm. Head with frons covered by whitish scales; vertex and occiput covered by elongated erect white scales, and some scattered yellowish scales. Antennae filiform, non-ciliate. Scape with bicolored pecten, yellowish and brown. Flagellomeres with dark basal band. Labial palpus white and non-acute; second segment with scattered dark scales. Thorax and tegulae white, with scattered yellowish scales. Scutellum covered with dark scales. Forewing light gray, covered with scattered white, yellowish, and dark scales. Ante-medial sub-basal area; with small triangular shaped group of raised black scales. Termen fringed with long golden-yellow scales. Hindwing brilliant, whitish and both margins fringed with yellowish scales; which are more elongated in basal margin.

Male genitalia. As described for the genus.

Female paratypes. Similar to male in coloration of wings, head and thorax, but with a larger black patch on sub-medial region of forewing.

Female genitalia. As described for the genus.

Final larval instar (Fig. 16–20). Maximum length 9 mm (n = 3). Body with light-green coloration and with a dark dorsal central longitudinal band that extends from T2 to A10. Head brown with few scattered flecks. Antennae first and second segments darker brown than third. Stemmatal zone, clear with black stemmata. Clypeus bilobed, light-colored, with a large V-shaped notch in middle, with 12

spines on the outer surface. Mandible strongly sclerotized with four acute teeth. Spinneret short and sub-triangular, with rounded apex. Labial palpus cylindrical and elongated. Prothorax with distinct thoracic shield, lighter in color than the rest of tegument, with few scattered macules, medial dorsal groove present. Spiracle small, circular. Thoracic legs green, with a simple and acute tarsal claw. Prolegs with biordinal crochets in a circle. Anal shield well differentiated, rounded, light-green with a few scattered dark maculae. Integument covered by star-shaped micro-processes (Fig. 19). Antennal microstructure: First segment annular and short, second segment cylindrical, with five sensilla, one campaniform near the base, two trichodeal, the larger in distal half and two basiconic sensilla, third segment cylindrical, elongated, larger than half the length of the second segment, with three sensilla, one styloconic and two basiconic.

Chaetotaxy of final larval instar (Fig. 21–24). *Head.* Epicranial notch in contact with epicranial suture. Six stemmata, arranged in oblique rectangle, 1 and 2 dorsal, 5 and 6 ventral. S1 antero-ventral to stemmata 2; S2 anteriorly to stemmata 1; S3 postero-ventral to S2; SS2 postero-ventral to stemmata 5; SS3 postero-ventral to SS2; SS1 antero-ventral to SS3; A1, A2, A3 forming an extended obtuse angle; AF1, AFa and AF2 present; P1 below AF2-P2 line; V1 elongated, V2, Va and V3 present.

Thorax. Prothorax with SD1 close to SD2. L trisetose, slightly antero-dorsal to spiracle, with L1, L2 and L3 unaligned. SV bisetose on pinaculum ventral to L group. V1 present ventrally. Mesothorax and metathorax; with D bisetose, both setae located on the same pinaculum; D2 slightly postero-dorsal to D1. Group SD bisetose, located on the same pinaculum, SD2 postero-dorsal to SD1. L2 and L1 on the same pinaculum, L2 slightly antero-dorsal to L1, L3 posteriorly to L1. SV uni-setose and postero-ventral to L3. V1 near the base of coxa.

Abdomen. A1 and A2, D bisetose, with both setae on separate pinaculum, D1 antero-dorsal to D2. SD bisetose, slightly antero-dorsal to spiracle and postero-ventral to D1, SD2 separate from SD1. L2 antero-ventral to L1, and L3 ventral to L2. SV bisetose in A1, and trisetose in A2. V1 present. A3-A6 similar to A1 and A2, but with SV trisetose. V1 present. A7 similar to A2, but with SV bisetose. A8 similar to A1 and A2, but with SD bisetose and slightly antero-dorsal to spiracle; with SD2 separate from SD1 and SV uni-setose. In A9, D1 setae on pinaculum separated from D2. SD1 postero-dorsal to L group. L bisetose, on the same pinaculum. SV uni-setose. V1 present. A10 (Anal shield) with 4 pairs of setae, with SD1, D1 and SD2 forming an acute angle, SV1-SV3 and V1 present. Crochets biordinal.

Pupa (Fig. 25–27). Maximum length 5.5 mm, maximum width 1.5 mm (n = 3). Greenish initially, later dark brown. Head, frons with a small central incision. Clypeus broad and convex. Labrum small, sub-trapezoid, with short posterior margin. Labium short and lanceolate, less than one third the length of proboscis. Antennae extend slightly the mesothoracic legs, and the forewing tip. Abdominal segments 2 to 9 without spinal processes, few spiracles apparent. Segment 10 acute, anal pore (on ventral surface) with Y-shaped sulcus. Cremaster with two pairs of elongated filaments.

Host. *Maytenus boaria* Molina (Celastraceae).

Natural history. The larvae were observed feeding on leaves and the small inflorescences of *M. boaria* in the austral spring (September through November). This action left an abundant trail of silky threads adhered to the feeding areas. To pupate, the larva builds an elongate compact silky cocoon sharpened at its ends (Fig. 28), usually on the underside of a leaflet. A similar behavior has been recorded for most Yponomeutidae, including some species of *Zelleria* (Agassiz 1996; Gershenson and Ulenberg 1998). Initially the pupa is greenish, and after hardening it gradually becomes dark brown. In a laboratory setting at room temperature, adults emerged 7–19 days after initial formation of the pupae. The host plant appeared to tolerate the degree of larval feeding that was encountered.

Distribution. Colina, Province of Chacabuco; La Pintana, Province of Santiago, both localities of the Metropolitan Region. This distribution corresponds to the central Chile sub-region, Province of Santiago (Morrone 2015).

Etymology. The name is dedicated to Peter Huemer, Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria, who is always willing to collaborate and share knowledge.

Material examined. 20 specimens. **1 Holotype** ♂, La Pintana, Provincia de Santiago, Región

Metropolitana, CHILE; larva 4 octubre, nac. 20 octubre 2016, en *Maytenus boaria*, Coll. D.E. Cepeda (MEUC); **7 Paratypes** ♂ and ♀ from the same location as holotype, nac. 30 noviembre 1984, Coll. G. Barria en maitén (MEUC); **1 Paratype** ♀ Colina, Región Metropolitana, 18 noviembre 2001, ex. maitén, Coll. G. Barría (MEUC); **4 Paratypes** ♂ and ♀ from the same location as holotype, nac. 26, 29 octubre, 3 noviembre 2016 Coll. D. E. Cepeda (TLMF); **4 Paratypes** ♂ and ♀ from the same location as holotype, nac. 10, 11, 17 octubre 2017 Coll. D. E. Cepeda en *Maytenus boaria* (ZMUC); **3 Paratypes** ♂ and ♀ from the same location as as holotype, nac. 23, octubre, 6 noviembre 2017 Coll. D. E. Cepeda en *Maytenus boaria* (USNM)

Discussion

Chileporter n. gen. is a newly proposed Neotropical taxon and separated from other Yponomeutidae genera, which are mainly of Oriental-Palearctic origin and which differ from *Chileporter* n. gen., by characters outlined in Table 1, (and detailed in the description of *C. huemeri,* above).

This study contributes to an understanding of the biodiversity of Neotropical Microlepidoptera. *Chileporter* n. gen. is defined by its unique morphology in the male and female genitalia and in the final immature stages. It should be noted that the systematic definition of the superfamily Yponomeutoidea has been varied and widely discussed (see Kyrki 1990).Recently, molecular phylogenetic studies have been included, although without the inclusion of neotropical fauna (Sohn et al. 2013).

Its host, *M. boaria*, is a widely distributed South American species. With *Chileporter huemeri* n. gen. and n. sp., a second trophic association with the Neotropical Celastraceae is provided, as there is a first record, but without natural history observations (*Kessleria ematynus* Cepeda, 2016).

In the genus *Maytenus* (Celastraceae) there is a single previous record, the Palearctic species *Zelleria wolfii* (Klimesch, 1983), assigned to *Maytenus umbellata* (R. Br.) Mabb. (Lewis and Sohn, 2015). Therefore, it is possible to hypothesize that there are other new species of Yponomeutidae associated with the other three species of *Maytenus* recorded for Chile, *Maytenus chubutensis* (Speg.) Lourt. O'Don. et Sleum., *Maytenus disticha* (Hook. f.) Urban, and *Maytenus magellanica* (Lam.) Hook. F. (Marticorena and Quezada, 1985). These possible new taxa, perhaps correspond to species of cryptic habits or formed by allopatry.

Because of their morphological similarity with Neotropical and Nearctic species of *Zelleria*. It would undoubtedly be useful to have a phylogenetic analysis of all known species of *Zelleria*, as well as studies of their ecological relations. For example, for all the described *Zelleria* species of Argentina (*Z. cirrhoscia, Z. leucoschista* and *Z. pistopis*; Meyrick 1931), there are no new additions from their original descriptions. In addition, the difficulty for defining a genus of such broad distribution like *Zelleria*, with 48 known species, requires a serious revision.

Another additional contribution is to present the first natural history observations of this family on their hosts. Although isolated, we can claim minor economic significance for *M. boaria*. *Chileporter huemeri* n. gen. and n. sp., exhibits a univoltine cycle. Consequently, the current knowledge of Yponomeutidae from Chile is based on only two genera, *Kessleria* and *Chileporter* n. gen., with only two endemic species that are both associated with the same host. As a result, it is possible to infer two biological observations: 1) A plurality of Chilean yponomeutid host records are on Celastraceae (34%), followed by Rosaceae (13 %) and Saxifragaceae (11%), according to Lewis and Sohn (2015), and 2) Both species exhibit ecological specializations on their hosts. This is similar to the known specialization of the Palearctic species of *Kessleri*a: 44% of its species (18/41) are directly associated with *Saxifraga* spp. (Saxifragaceae) and have adapted to habitats in high, montane areas (Huemer and Tarmann 1991; Huemer and Mutanen 2015).

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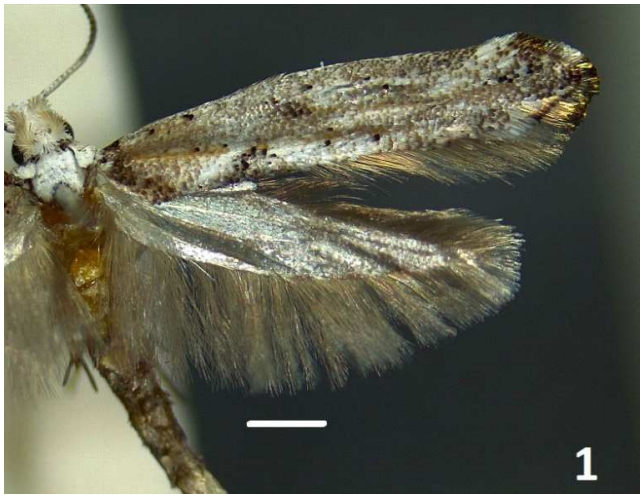
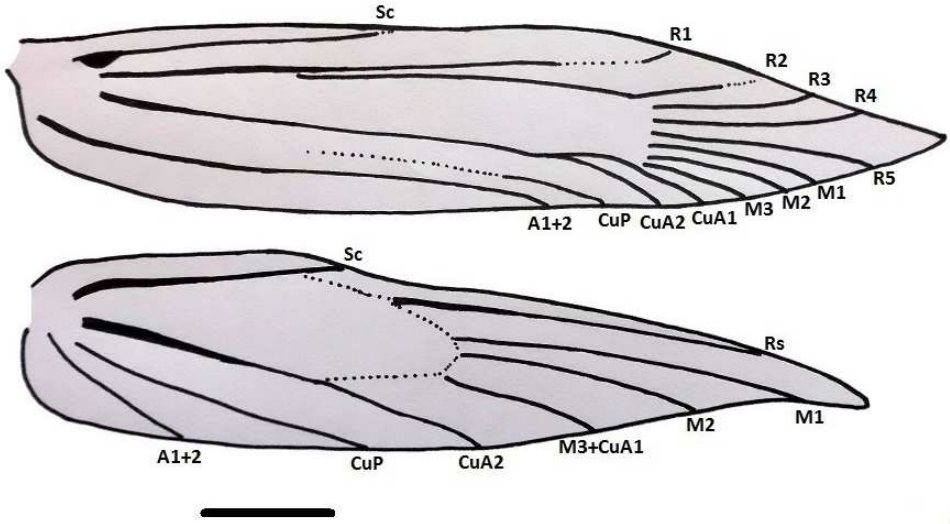
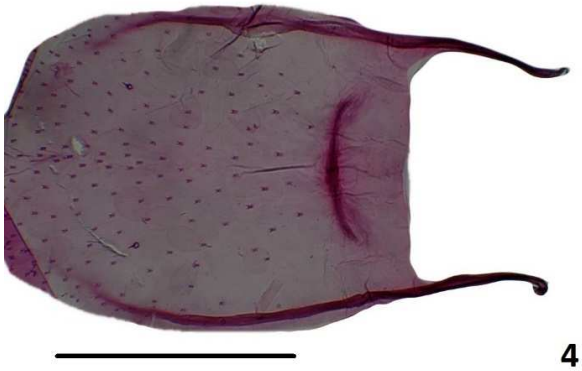
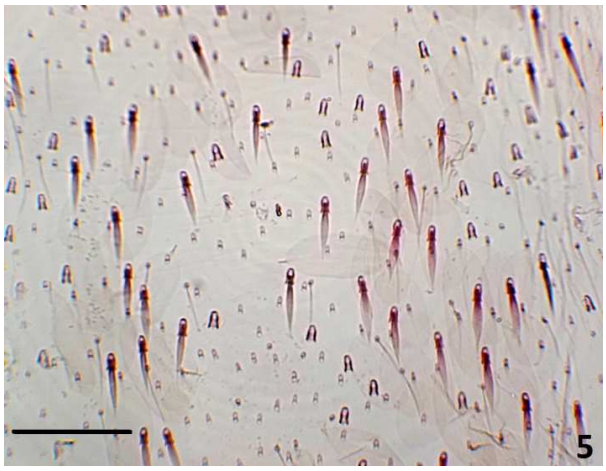
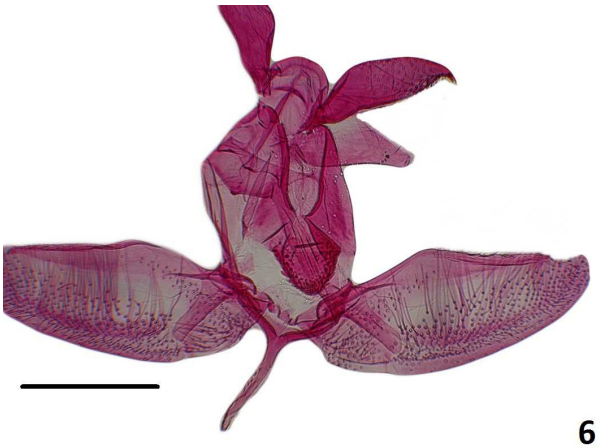


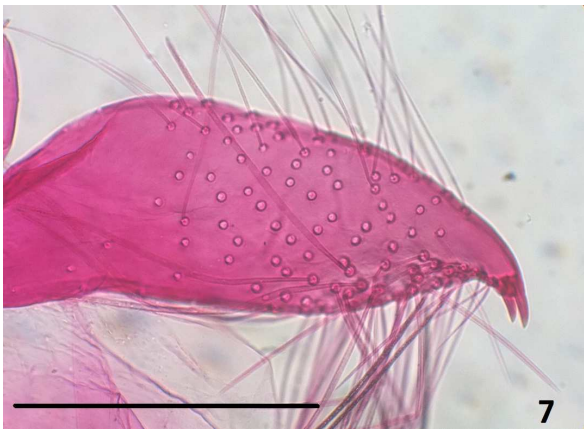


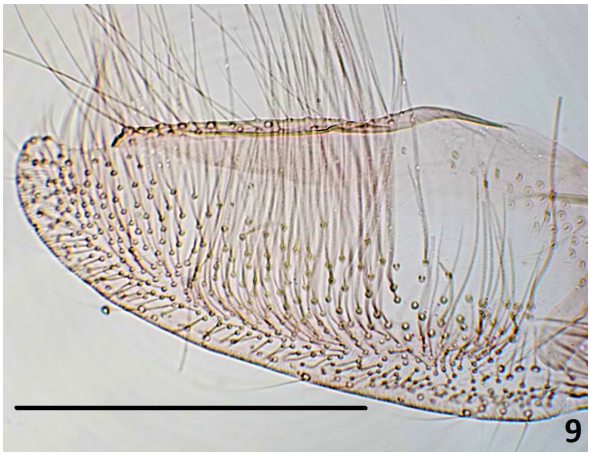


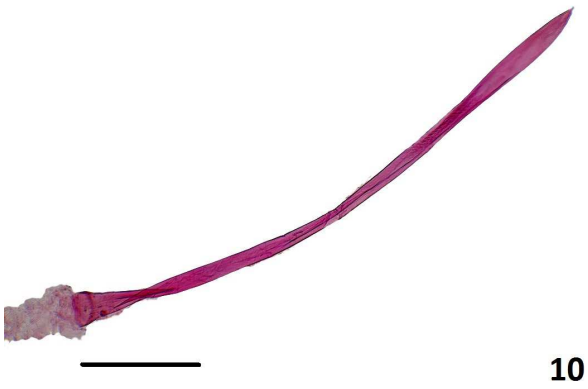


Figures 1–5. *Chileporter huemeri* n. gen. and n. sp., adult. **1)** Wings, dorsal view. **2)** Head, side view. **3)** Wing veins. Scale bar: 1 mm (1, 2, 3). **4)**. Sternum 2. Scale bar: 0.5 mm. **5)**. Tergum spiny setae. Scale bar: 0.25 mm.

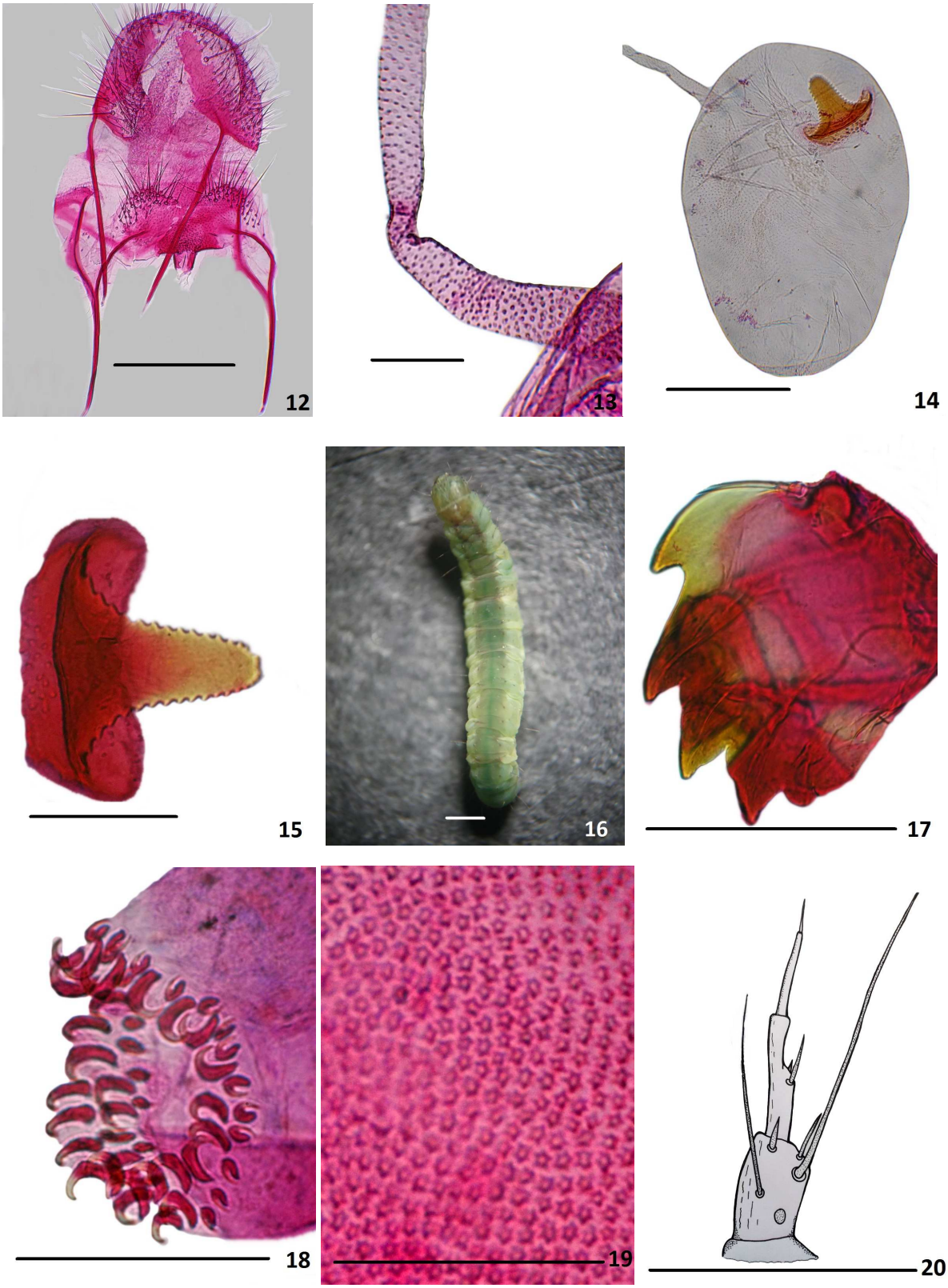




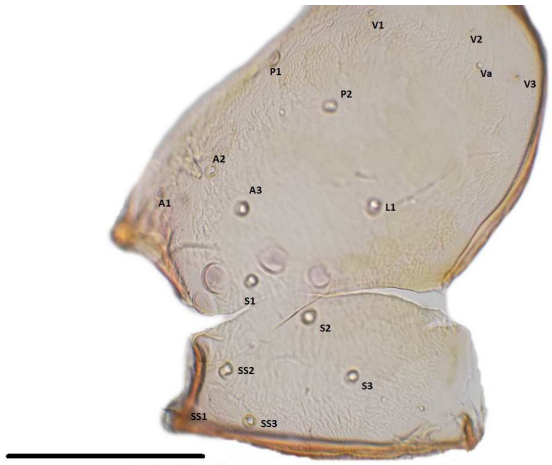




Figures 6–11. *Chileporter huemeri* n. gen. and n. sp., adult male. **6)**. Male genitalia. **7)** Socii. **8)** Gnathos. **9)** Valva. **10)** Phallus. **11)** Eighth pleural segment. Scale bar: 0.25 mm.



Figures 12–20. *Chileporter huemeri* n. gen. and n. sp. **12–15.** Adult female. Scale bar: 0.25 mm. **12)** Female genitalia. **13)** Ductus bursae. **14)** Corpus bursae. **15)** Signum. **16)** Larva, dorsal view. Scale bar: 1.0 mm. **17–20.** Larval structures. Scale bar: 0.20 mm. **17)** Mandible. **18)** Crochets. **19)** Microprocesses on integument. **20)** Antennae.



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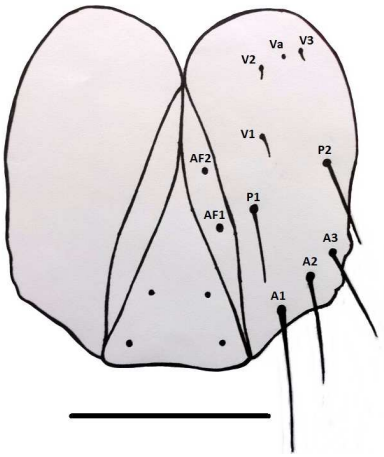

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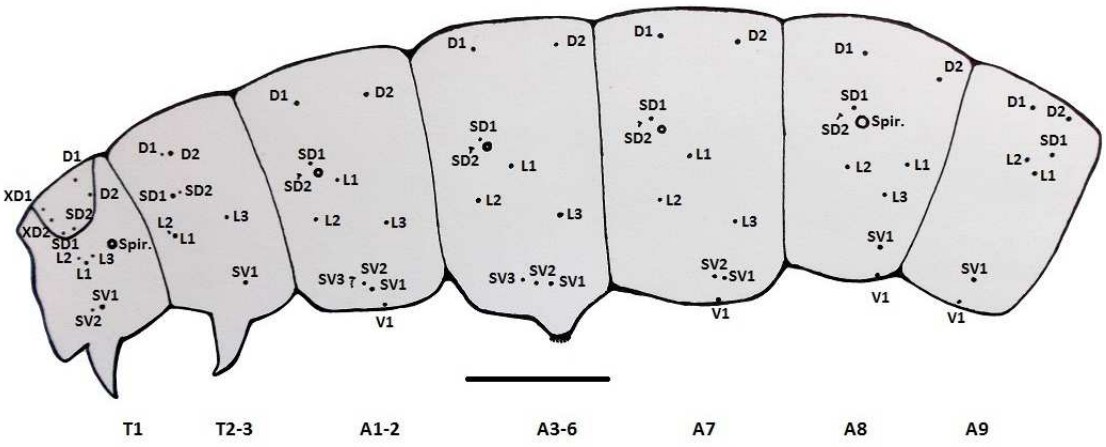

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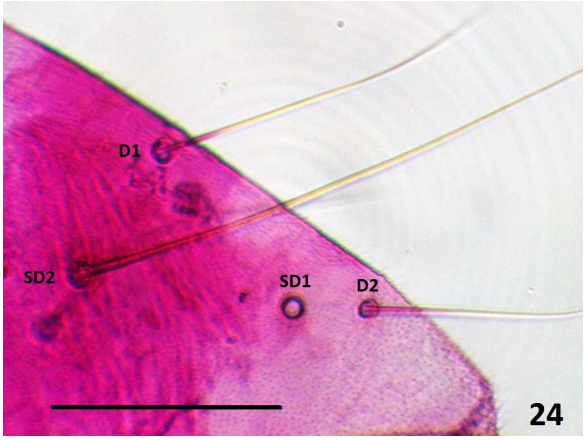

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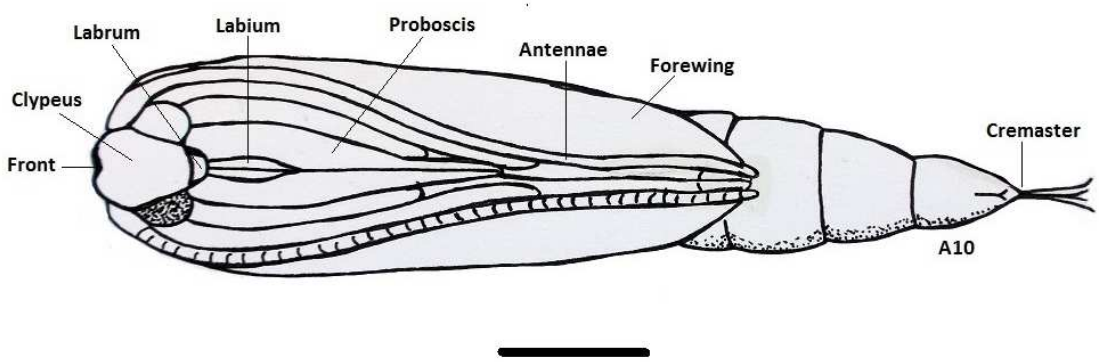
Figures 21–25. *Chileporter huemeri* n. gen. and n. sp. **21–24.** Larva, chaetotaxy. Scale bar: 0.5 mm. **21)** Head, lateral view. **22)** Head, frontal view. **23)** Thorax and abdomen, lateral view. **24)** Anal shield. **25)** Pupa, developing.



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Figures 26–28. *Chileporter huemeri* n. gen. and n. sp., pupa. Scale bar: 1.0 mm. **26)** Ventral view. **27)** Cremaster. **28)** Cocoon on leaflet.