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A new species of *Crocidosema* Zeller (Lepidoptera, Tortricidae) from the Andes of northern Chile

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Abstract. *Crocidosema nitsugai* **sp. nov.** (Lepidoptera, Tortricidae, Olethreutinae, Eucosmini) is described and illustrated from the Andes of northern Chile based on adults obtained from larvae collected on leaves, flowers and unripe fruits and seeds of *Lupinus oreophilus* Phil. (Fabaceae). This represents the first record of insect herbivory on this Chilean endemic perennial herb. The genitalia morphology of *C. nitsugai* suggests a close evolutionary relationship with two congenerics from high elevation environments of the Ecuadorian and Peruvian Andes.

Introduction

Crocidosema Zeller, 1847 (Lepidoptera, Tortricidae, Olethreutinae, Eucosmini) is a mainly Neotropical genus with 69 described species, 45 of which have their type locality in South America (Gilligan et al. 2018). Many of the South American representatives were described in the last fifteen years based on the study of specimens collected relatively recently using light traps in different localities of Brazil, Colombia, Ecuador, Peru and Venezuela (Razowski and Wojtusiak 2006a, b, 2008a, b, 2009, 2010, 2011, 2013; Razowski and Becker 2014, 2017). *Crocidosema insulana* Aurivillius, 1922, is the only species of the genus native to Chile, originally described from Masatierra, Juan Fernandez Islands, and subsequently recorded from most of the mainland part of the country (Razowski and Pelz 2010). *Crocidosema aporema* Walsingham, 1914, an important pest of several legume crops described from Costa Rica and currently widespread in Central and South America (Gilligan and Epstein 2014), is also recorded from Chile in the agricultural literature (Artigas 1994).

The northernmost part of Chile has a considerable diversity of arid environments along a wide elevational gradient from the lowlands of the Atacama Desert to the highlands of the Andes (Luebert and Pliscoff 2006). Within this elevational gradient, records of native species of Tortricidae are mainly restricted to habitats below 1000 m elevation (Clarke 1987; Brito and Vargas 2018), with the exception of one species that reaches about 2000 m in the transverse valleys of the Atacama Desert (Vargas-Ortiz and Vargas 2018). However, the high elevation habitats of this region harbor a distinctive native flora (Gatica-Castro et al. 2015), some of whose species support populations of host-specific Lepidoptera (Vargas 2014; Ramírez-Fischer et al. 2016), suggesting that the current absence of records of Tortricidae in this area is likely a sampling artifact. In support of this suggestion, adults of this family were recently obtained from larvae collected on *Lupinus oreophilus* Phil.

(Fabaceae), a perennial herb endemic to the elevational belt between 2700 and 4400 m in the Andes of northern Chile (Orrego et al. 2013). The Near Threatened status of populations of the shrub was recently proposed (Gatica-Castro et al. 2015). Subsequent examination of the morphology of the micromoths revealed that they represent a previously unknown species of *Crocidosema*, whose description is provided below.

Material and methods

The sampling was undertaken near Putre (18°12'58"S; 69°33'38"W), Parinacota Province, at 3670 m elevation on the western slopes of the Andes of northern Chile. The site has a tropical xeric bioclimate with seasonal rains mainly concentrated between December and March (Luebert and Pliscoff 2006). This rainfall regime allows the development of a seasonal vegetation growth that reaches higher coverage shortly after the rains (Muñoz and Bonacic 2006). Larvae were collected on leaves, flowers and fruits of *L. oreophilus* in March 2019 following the summer rainfall. The collected larvae and the respective plant organs were placed in plastic vials with paper towel at the bottom and brought to the laboratory, where the vials were periodically cleaned and fresh leaves, flowers and fruits were provided until the larvae finished feeding and pupated. After pupation the vials were regularly observed until the emergence of adults, which were mounted. The abdomen of the adults was removed, cleared in hot 10% KOH for a few minutes, stained with Eosin Y and Chlorazol black and slide-mounted with Euparal. Images were captured with Sony CyberShot DSC-HX200V and Micropublisher 3.3 RTV-QImaging digital cameras attached to a Leica M125 stereomicroscope and an Olympus BX51 optical microscope, respectively.

Abbreviations of institutional collections

MNNC Museo Nacional de Historia Natural de Santiago, Santiago, Chile
IDEA Colección Entomológica de la Universidad de Tarapacá, Arica, Chile

Results

***Crocidosema nitsugai* sp. nov.**

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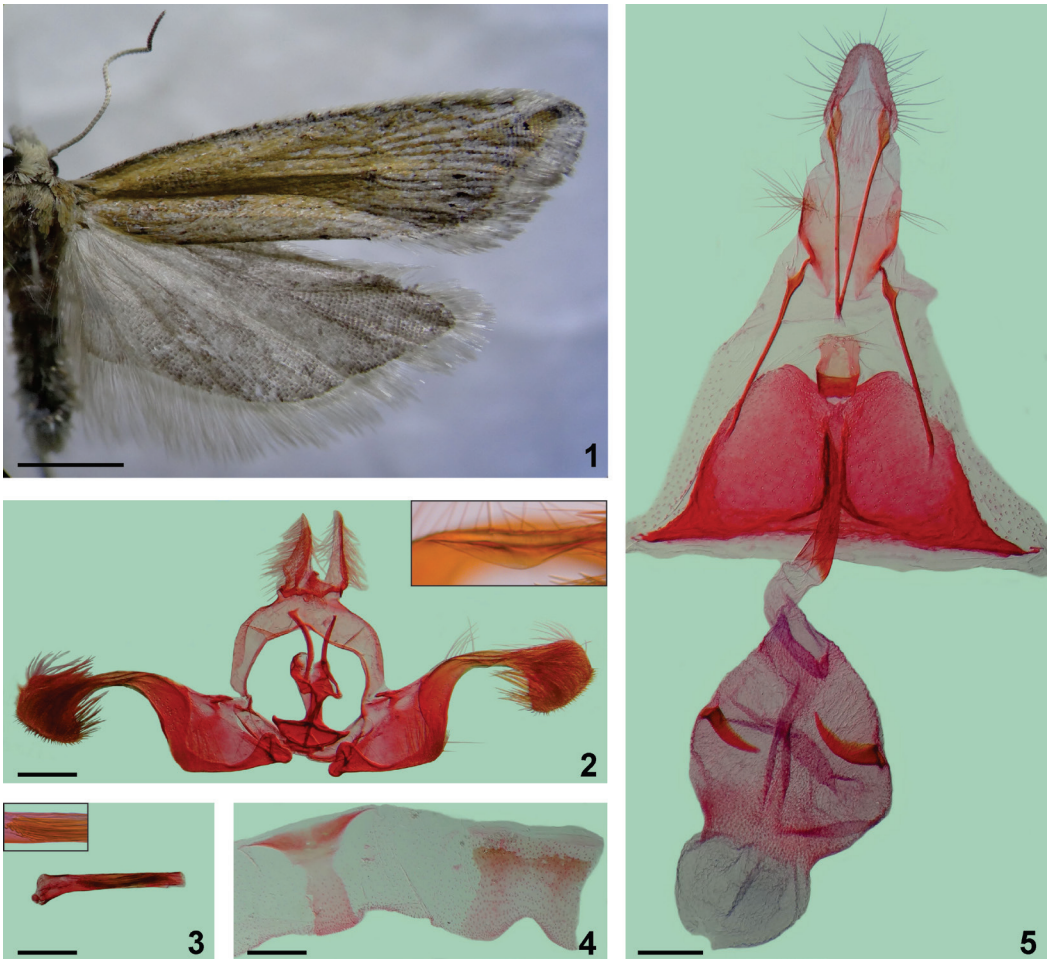
Figs 1–5

Type material. HOLOTYPE, male, CHILE: Putre, Parinacota, Chile, emerged April 2019, H.A. Vargas coll., ex-larva *Lupinus oreophilus*, March 2019, genitalia slide HAV-1278 (MNNC).

Paratypes, CHILE. One male, two females, same data as holotype, genitalia slides HAV-1261, 1270, 1271 (MNNC); four males, one female, same data as holotype, genitalia slides HAV-1259, 1275, 1276, 1277, 1279 (IDEA).

Diagnosis. The genitalia of *C. nitsugai* are remarkably similar to those of *C. marcapatae* (Razowski & Wojtusiak, 2010), described under *Epinotia* Hubner, [1825] from Cusco, Peru. However, the female genitalia of *C. nitsugai* have a parallel-sided antrum with the dorsal wall posteriorly



Figures 1–5. Adult stage of *Crocidosema nitsugai* sp. nov. **1.** Holotype male in dorsal view. **2.** Male genitalia in ventral view, phallus removed; upper right rectangle showing longitudinal carina on the neck of the right valva. **3.** Phallus in lateral view; upper left rectangle showing base of cornuti. **4.** Tergum (left) and sternum (right) of male abdominal segment VIII. **5.** Female genitalia in ventral view. Scale bars: 2 mm (**1**), 0.3 mm (**2-4**), 0.25 mm (**5**).

projected and the posterior margin of sternum VII widely notched at the middle. In contrast, those of *C. marcapatae* have a cup-shaped antrum without posterior projection of dorsal wall and posterior margin of sternum VII almost straight. In the male genitalia of *C. nitsugai* the neck of the valva is almost uniform in height throughout its length with a narrow longitudinal carina, and dorsal and ventral lobes of the cucullus are similar in size. In contrast, in *C. marcapatae* the neck of the valva is broadened on basal half and lacks carina, and the dorsal lobe of the cucullus is conspicuously smaller than the ventral lobe. The female genitalia of *C. nitsugai* also resemble those of *C. pusula* Razowski & Becker, 2014, described from Carchi, Ecuador. However, the parallel-sided antrum, cingulum longer than the larger signum and two longitudinal stripes along the middle of sternum VII of *C. nitsugai* contrast with the cup-shaped antrum, cingulum slightly shorter than the smaller

signum and absence of longitudinal stripes on the sternum VII of *C. pusula*. The male of *C. pusula* is unknown, impeding comparisons with *C. nitsugai*.

Description. Male. (Figs 1–5) Forewing length 8.5–9.5 mm.

Head. Vertex and frons mainly whitish gray with a few scattered grayish brown scales. Labial palpus mainly grayish brown with a few scattered whitish gray scales. Antenna whitish gray.

Thorax. Mainly yellowish brown dorsally with a few scattered dark gray scales, whitish gray latero-ventrally; patagium grayish brown. Foreleg with anterior face grayish brown, posterior face whitish gray. Midleg similar to foreleg in coloration, tibial spurs whitish gray. Hindleg whitish gray, including tibial spurs. Forewing mainly yellowish brown with abundant whitish gray and grayish brown scales intermixed outside the discal cell, a few scattered dark gray scales near external margin; fringe grayish brown. Hindwing mainly grayish brown, scattered whitish gray scales, fringe whitish gray.

Abdomen. Grayish brown. Tergum VIII (Fig. 4) somewhat T-shaped; anterior margin straight; lateral margin widely excavated on anterior half; posterior margin about 1/3 the width of anterior margin. Sternum VIII somewhat square-shaped, posterior margin widely excavated in the middle.

Male genitalia (Figs 2, 3). Tegumen with anterior and posterior margins mainly parallel. Uncus cylindrical, slightly sclerotized, broadened basally, apex rounded, covered with hair-like setae. Socius slightly longer than uncus, narrow, tapering apically. Juxta semicircular, dorsal margin straight. Henion (sclerite between anellus and gnathos) narrow, elongated, well sclerotized, slightly longer than socius. Valvae symmetrical, wide incision on ventral margin; base of valva triangular; sacculus narrow; neck of valva almost uniform in height throughout its length, a narrow longitudinal carina on medial face; cucullus densely covered with hair-like scales, dorsal and ventral lobes similar in size. Phallus cylindrical, slightly longer than sacculus, slightly broadened basally; vesica with several spine-shaped cornuti.

Female. Similar to male in maculation and size.

Female genitalia (Fig. 5). Papillae analis narrow, elongated, slightly sclerotized, with hair-like setae. Posterior apophysis spine-shaped, slightly broadened basally, about twice length of papillae analis. Anterior apophysis similar to posterior apophysis in shape and length. Tergum VIII with U-shaped notch on anterior margin. Sternum VII with anterior margin straight; lateral margin widely excavated close anterior margin; posterior margin bilobed, widely notched in middle; two mainly parallel longitudinal stripes along the middle diverging close the anterior margin. Antrum parallel-sided, dorsal wall posteriorly projected. Ductus bursae slightly curved, membranous basally and apically; a well-developed cingulum with apex exceeding anterior margin of sternum VII. Corpus bursae membranous, pear-shaped, about 1.5 times length of ductus bursae; two slightly curved saw-like signa laterally.

Geographic distribution. *Crocidosema nitsugai* is known only from the type locality, in the surroundings of Putre, Parinacota Province, at 3670 m elevation on the Andes of northern Chile (Fig. 6).

Host plant. The only host plant currently known for *C. nitsugai* is the perennial herb *Lupinus oreophilus* Phil. (Figs 7–9), upon which the larvae feed on leaves, flowers and unripe fruits and seeds.

Etymology. The specific epithet is dedicated to the memory of the great Paraguayan guitarist and composer Agustín Pío Barrios, also known as Nitsuga Mangoré, as an acknowledgement to his amazing musical contribution.

Figures 6–9. Habitat and host plant of *Crocidosema nitsugai* sp. nov. **6.** Habitat of *C. nitsugai* in the type locality, near Putre, Parinacota Province, at 3670 m elevation on the Andes northern Chile. **7.** The host plant *Lupinus oreophilus*. **8.** Inflorescence of *L. oreophilus*. **9.** Fruits of *L. oreophilus*.

Discussion

Although many species of *Crocidosema* have been described recently from the Neotropics, the discovery of *C. nitsugai* during a short field trip following the summer rainfall in the type locality highlights the need for additional sampling in different Neotropical environments to more accurately characterize the taxonomic diversity of this genus. Surveys of native plants appear to be

especially valuable, because these provide the first insights on the host range of each newly found species (e.g. Brito and Vargas 2018). Host plants have been recorded for only nine species of *Crocidosema*, six of which feed on plants of only one family, whereas three feed on plants of more than one family. At one extreme is the widespread *C. plebejana* Zeller, 1847, whose larvae have been collected on representatives of nine families (Brown et al. 2008). Fabaceae has been recorded as host for four species of *Crocidosema* (Brown et al. 2008), among which only the Neotropical pest *C. aporema* feeds on *Lupinus* (Callohuari et al. 2018).

Crocidosema nitsugai represents the first record of insect herbivory on *L. oreophilus*. Previous studies indicated consumption of *L. oreophilus* by two herbivorous rodents in high elevation environments of the Andes of northern Chile (Cortés et al. 2002). The host plant range of *C. nitsugai* appears to be narrow, as it was absent in surveys undertaken on about ten plants of each of the additional native species of Fabaceae found in the study site: *Adesmia verrucosa* Meyen, *A. spinosissima* Vogel, *Dalea pennellii* (J.F. Macbr.) J.F. Macbr. var. *chilensis* Barneby and *Senna birostris* (Dombey ex Vogel) H.S. Irwin & Barneby var. *arequipensis* (Meyen ex Vogel) H.S. Irwin & Barneby. However, surveys for *C. nitsugai* should be expanded to additional Fabaceae of northern Chile outside the study site, where three other species of *Lupinus* have been recorded (Gatica-Castro et al. 2015). In addition, as Near Threatened status was recently proposed for *L. oreophilus* (Gatica-Castro et al. 2015), further studies are needed to understand better the effect of herbivory by larvae of *C. nitsugai* on populations of this plant.

The Andes uplift has been recognized as an important event in the diversification of several Neotropical animal groups, including Lepidoptera (Massardo et al. 2015; De-Silva et al. 2016). Unfortunately, despite a few recent additions (Vargas and Mundaca 2016; Vargas 2018), the taxonomy and natural history of the micromoths of the Andes of northern Chile have been little studied, impeding further evolutionary studies with these organisms. Indeed, *C. nitsugai* is the first species of Tortricidae described from these arid high elevation environments. Its genitalia are remarkably different of those of *C. insulana*, the only other representative of the genus native to Chile (Razowski and Pelz 2010), suggesting that they are only distantly related. The close morphological resemblance of the genitalia of *C. nitsugai* with those of other two highland species, *C. marcapatae* (Cusco, Peru, 3600 m) and *C. pusula* (Carchi, Ecuador, 2200 m), suggest that a group of closely related *Crocidosema* diversified along the still underexplored high elevation environments of the Andes, an evolutionary scenario that should be assessed in further studies.

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