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Case report / Reporte de caso

First record in México of *Caloptilia perseae* (Busck, 1920) (Lepidoptera: Gracillariidae) as a pest of avocado crop *Persea americana* Mill. (Lauraceae).

Primer registro para México de *Caloptilia perseae* (Busck, 1920) (Lepidoptera: Gracillariidae) como plaga del cultivo del aguacate *Persea americana* Mill. (Lauraceae).

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ABSTRACT

Caloptilia perseae (Busck, 1920) first record as a pest on avocado crop for Mexico, on a commercial orchard in Jalisco State. This gracillarid only has been reported feeding on trees of the genus *Persea* in the United States of North America, Cuba, Costa Rica, Puerto Rico and Panama in the American Continent and in Europe in Spain.

KEY WORDS: New, gracilariid, leafroller, pest, avocado tree, Mexico.

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RESUMEN

Se registra por primera vez a *Caloptilia perseae* (Busck, 1920) (Lepidoptera: Gracillariidae) para México como plaga del cultivo del aguacate en una huerta convencional establecida en el Estado de Jalisco. Este gracilaríido solo ha sido reportado alimentándose de árboles del género *Persea* en Estados Unidos de Norteamérica, Cuba, Costa Rica, Puerto Rico y Panamá en el Continente Americano y en España.

PALABRAS CLAVE: Nuevo, gracilálido, enrollador, plaga, aguacatero, México.

Introduction

Mexico is the world's leading producer and exporter of avocado, accounting for more than 50% of total export volume, with up to 2.8 million tons of fruit, 80% of which are destined for the United States of America (FAO, 2024).

According to Salinas & Calderón (2021), the most important insect pests affecting avocado cultivation in Mexico include thrips such as *Frankliniella occidentalis* (Pergande) and *Scirtothrips dorsalis* Hood; mites such as *Oligonychus perseae* (Tuttle, Baker & Abbatiello), *Oligonychus punicae* Hirst, and *Tetranychus urticae* Koch; armored scales such as *Abgrallaspis aguacatae (*Evans, Watson & Miller) and *Hemiberlesia lataniae (*Signoret); gall psyllid (*Trioza anceps* Tuthil); and branch and fruit borers such as *Copturus aguacatae* Kissinger, *Heilipus lauri* Boheman, *Conotrachelus aguacatae* (Barber), *Conotrachelus perseae* (Barbenor), and *Stenoma catenifer* Walsingham, as well as leafrollers.

Although avocado leafroller *Lepidoptera* are considered secondary pests (Yefremova & Kravchenko, 2015), their identification remains problematic, as several species displaying this behavior have been recorded in avocado orchards. For example, *Amorbia emigratella* Busck (Lepidoptera: Tortricidae), which not only rolls leaves but also damages flower buds and inflorescences, as well as fruits gnawed by larvae. Although fruit damage has not yet been quantified, it represents an important economic impact, warranting chemical control with insecticides such as chlorantraniliprole, spinosad, and spinetoram (Aceves Núñez *et al.,* 2017; APEAM, 2025). Similarly, *Sabulodes aegrotata* (Gueneé), another leafroller and defoliator, attacks fruits of different sizes, causing rind perforations that reduce quality, also requiring control with methoxyfenozide (APEAM, 2025). This underscores the need to study these insects to generate

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technical and scientific knowledge that ensures accurate identification of the species present, as well as their distribution and incidence in commercial orchards (Aceves Núñez *et al.,* 2017).

Worldwide, nine gracillariid leaf miners species have been reported feeding on *Persea trees* (Family Lauraceae): *Caloptilia crinotibialis* Kumata (Kumata, 1982); *C. staintoni* Wollaston (Aguiar, 1999); *Marmara gulosa* Guillén & Davis (Guillén *et al.,* 2001; De Prins & De Prins, 2006,2022); *Phyllocnistis hyperpersea* Davis & Wagner, *P. subpersea* Davis & Wagner, *P. longipalpa* Davis & Wagner, and *P. perseafolia* Davis & Wagner (Davis & Wagner, 2011); *C. burserella* (Busck); and *C. perseae* (Busck) (Robinson *et al.,* 2023).

The *Caloptilia* genus comprises 329 species worldwide, though only 21 have been reported from tropical America. Of these, only three species have been documented in Mexico: *C. burserella* (Busck), distributed from Florida (USA) to Cuba, Mexico, and the Virgin Islands, affecting avocado cultivation; *C. perseae* (Busck), found in Florida (USA) on *Persea persea* trees, as well as in Costa Rica, Puerto Rico, Cuba, and Mexico; and *C. stigmatella* (Meyrick), which is cosmopolitan (Europe, China, India, Japan, Korea, Russia, Canada, USA, and Mexico) but has not been reported to affect any cultivated plant (De Prins *et al.,* 2016; De Prins *et al.,* 2019; López-Muraira *et al.,* 2023; Shin *et al.,* 2015). This genus, established by Hübner in 1825, is characterized by males bearing two pairs of coremata located on the seventh and eighth abdominal segments, and females possessing two sickle-shaped signa in the bursa (Kumata, 1982).

C. perseae is recognized more as a leafroller than as a leafminer. However, other Lepidoptera are also known as avocado leafrollers, such as *S. aegrotata* (Lepidoptera: Geometridae), a polyphagous specie whose larvae feed on a wide variety of plants, including commercial crops such as avocado, citrus, and walnut. This insect occurs in Mexico and in California and Oregon, USA (Rindge, 1978). *A. emigratella*, known as the Mexican leafroller, is distributed from Texas, Arizona, and the Hawaiian Islands (USA) to Costa Rica and Mexico. It has been recorded on a wide range of host plants, including carrot, cotton, raspberry, blackberry, broccoli, papaya, beet, peanut, soybean, avocado, guava, maize, macadamia, tomato, potato, cacao, tea tree, and ornamentals (Powell & Brown, 2012).

C. perseae was originally described as *Gracillaria persea* Busck in 1920 and was first reported as a new avocado pest species in Florida (USA), where it caused severe damage to young avocado plantations. It was subsequently documented in Cuba, Costa Rica, Honduras, Puerto Rico, and the Canary Islands, Spain (Alfonso, 2008; Busck, 1933; De Prins *et al.,* 2019; Heppner, 1984). Although it has been reported as an avocado pest in Mexico under the name *Gracillaria persea*, according to Posada & Arévalo (2021), the damage reported by SENASICA in 2018 does not correspond to *Caloptilia perseae* but rather to a species of the genus *Phyllocnistis*. This highlights the relevance of the present study, the objective of which was to identify and describe the leafroller species present in avocado orchards in the Atotonilco El Alto municipality, Jalisco, Mexico.

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Material and Methods

Study area

The Atotonilco el Alto municipality, where the collections were carried out, is located in the Ciénega region of the Jalisco state. It lies at 20°34′04.8″N, 102°35′06.7″W, at 1,875 masl, and comprises 800 hectares planted with avocado. The natural vegetation of the municipality covers 1,800 hectares of forest, where several oak and madrone species predominate (Camarena & Garibay, 2005).

Sampling

For this study, a 15-year-old avocado orchard in its productive stage (harvest) was selected. Sampling followed the methodology proposed by Coria *et al*. (2007). Collections were conducted on two sampling dates during September 2024. A completely randomized strip design was used, in which three rows of the orchard were selected, and from each row, five trees were randomly chosen as experimental units. From each tree, four branches showing leafroller damage were selected, and from each branch, four damaged leaves were collected. This resulted in 80 leaves per sampling date and a total of 160 leaves from the two collections. The leaves were placed in one-liter plastic containers with No. 30 mesh lids (600 µm openings) and maintained in an incubation chamber at a controlled temperature of 25 °C (López-Muraira *et al*., 2022).

For the dissection and staining of adult genitalia, the technique described by Robinson (1976) was employed. Abdomens were placed in a KOH solution (10 %) and heated to boiling for 2-10 minutes. They were then rinsed with 10 % ethanol, and the genital structures were separated from the abdomen, stained with Chlorazol Black, and temporarily mounted on slides using glycerin. Both the insect specimens and the genital structures were deposited in the entomological collection housed within the CREG Herbarium at the Instituto Tecnológico de Tlajomulco, Jalisco, Mexico.

Results and Discussion

A total of 45 adults of *Caloptilia persea* (Busck) were obtained, of which 7 males and 9 females were examined (H.R. Iruegas leg.). The larvae of this microlepidopteran begin as leaf miners on avocado leaves; subsequently, they exit the mine and roll the apices of young leaves downward toward the abaxial surface (Figure 1). In contrast, newly hatched larvae of *Sabulodes aegrotata* feed on the epidermal tissue of the adaxial leaf surface, and from the second instar onward, they consume the entire leaf, leaving only the midrib (SAG, 2005). *Amorbia sp*. differs in that its larvae consume the whole leaf and produce silk to roll two or more leaves together, as well as to bind two fruits, thereby creating a protective shelter while feeding (Urías-López & Salazar-García, 2008).

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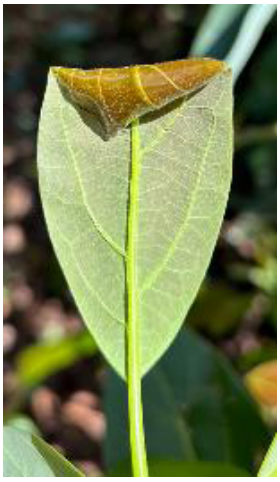

Figure 1. Apex of avocado leaf rolled by *Caloptilia perseae* (Busck).

C. perseae is described here as a potential pest of avocado in Mexico and is assigned a new common name, “avocado leaf apex roller,” referring to its characteristic behavior in late larval stages of rolling the tip of the avocado leaf toward the abaxial surface as a protective strategy for pupation.

The antennae of *C. perseae* are slightly longer than the forewings, which are clay-colored and marked with a diagonal series of black spots across the medial region, along with additional scattered spots in the apical and basal areas. The hindwings are dark gray (Figures 2 and 3).

Figure 2. Adult male of *Caloptilia perseae* (Busck).

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Figure 3. Detail of forewing with dark punctuations and hindwing with gray coloration of *Caloptilia perseae* (Busck).

The male genitalia present entire, unlobed valvae, paddle-shaped with a straight dorsal margin rather than rounded (Figure 4). The aedeagus is cylindrical and straight, bearing a denticulate line (Figures 5 and 6).

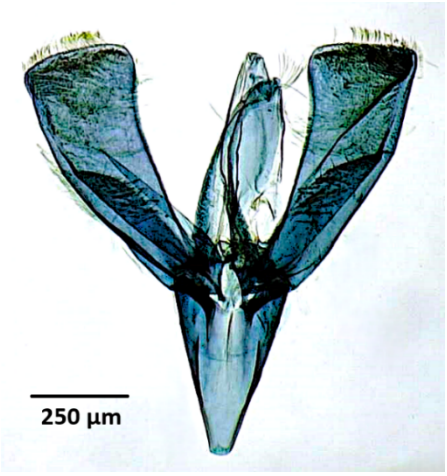

Figure 4. Male genitalia of *Caloptilia perseae* (Busck).

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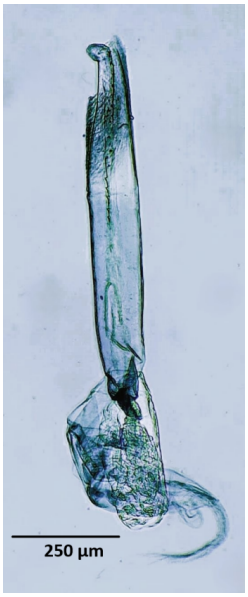

Figure 5. Aedeagus of the male genitalia of *Caloptilia perseae* (Busck).

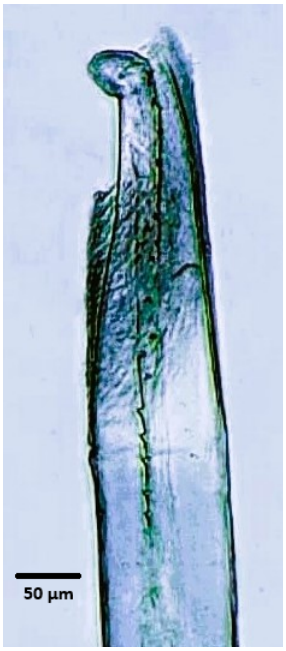

Figure 6. Detail of the aedeagus of *Caloptilia perseae* (Busck).

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The female genitalia exhibit a bursa entirely covered with fine granulations and two sickle-shaped signa, one larger and thicker than the other, arranged in a convergent position (Figures 7 and 8).

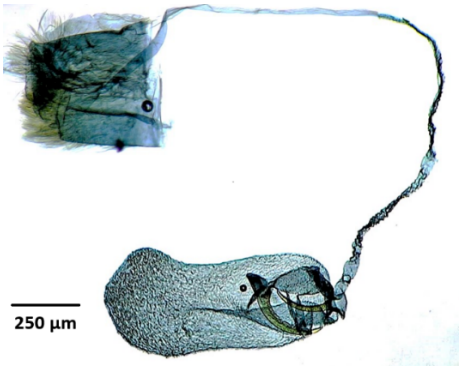

Figure 7. Female genitalia of *Caloptilia perseae* (Busck).

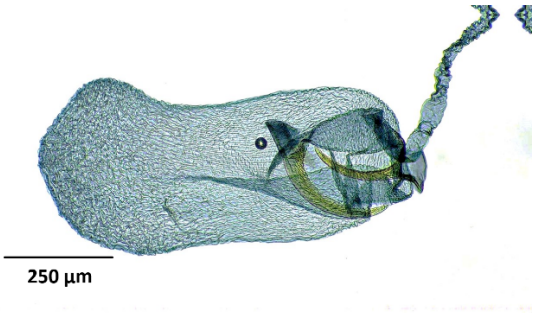

Figure 8. Detail of the bursa of *Caloptilia perseae* (Busck).

Although this microlepidopteran has been reported in several articles, clear images of the adult and its genitalia have not been available. The present study, therefore, provides new data and photographs that can aid in the rapid and accurate identification of *C. perseae*.

Superfamily Gracillarioidea Stainton, 1854

Family: Gracillariidae Stainton, 1854

Subfamily: Gracillariinae Stainton, 1854

Genus: *Caloptilia* Hübner, 1825

Species: *Caloptilia perseae* (Busck, 1920).

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This species is distributed across several tropical American countries, from Florida in the United States of America to Central America and the Caribbean, as well as the Canary Islands in Spain. For its identification, the original description by Busck (1920) was used in conjunction with the works of De Prins *et al.* (2016), De Prins *et al.* (2019), Park & Han (1986), and Shin *et al.* (2015), which provide descriptions, distribution records, and illustrations of adults and genitalia. Finally, the classification system developed by Kawahara et al. (2017) was followed for the Gracillariidae family.

Conclusions

Though C. *perseae* is considered a secondary avocado pest, its leaf-rolling behavior may lead to confusion among technicians and growers, since at least two other Lepidoptera species are also known as avocado leafrollers: *Amorbia emigratella* (Lepidoptera: Tortricidae), an important pest widely known as the "Western Avocado Leafroller" in English, and in Mexico as "gusano telarañero" or "gusano enrollador de las hojas"; and *Sabulodes aegrotata* (Guenée) (Lepidoptera: Geometridae), another important defoliator known as "gusano medidor" or "enrollador de la hoja del aguacate," whose larvae also damage small fruits. If such confusion is not clarified, it may lead to poor management decisions for avocado pest control, resulting in significant economic losses in crop yield.

Given the importance of avocado cultivation in Mexico, recognized as the center of origin of this species, with the largest planted area worldwide and as the leading global exporter, it is essential to understand the limiting factors of production and to describe, as thoroughly as possible, the insect pests involved. Such knowledge will contribute to improved understanding and informed decision-making for the integrated management of this Lepidoptera complex.

This research is part of an ongoing effort to document the leaf-mining insects of the Gracillariidae family in Mexico, where only 13 species have been reported, despite the country's wide diversity of habitats (Heppner & López-Muraira, 2021).

Author contributions

Work conceptualization: Iruegas-Buentello, H.R.; López Muraira, I.G.; Methodology: Iruegas-Buentello, H.R.; Mancilla-Margalli, N.A.; Writing-original draft preparation: Iruegas-Buentello, H.R.; López Muraira, I.G.; Writing-review and editing: Flores-Martínez. H; Mancilla-Margalli, N.A.; Project administration: Flores-Martínez. H; Funding acquisition: Flores-Martínez. H.

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Conflict of interest

The authors declare no conflict of interest.

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