

First record in Mexico of *Caloptilia stigmatella* (Fabricius, 1781) (Lepidoptera:Gracillariidae) and first report on *Serjania recemosa* Schumach (Sapindaceae).

Nuevo registro para México de *Caloptilia stigmatella* (Fabricius, 1781) (Lepidoptera:Gracillariidae) y primer reporte sobre *Serjania recemosa* Schumach (Sapindaceae).

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RESUMEN

Caloptilia stigmatella (Fabricius) is recorded for the first time as part of the flora-mining microlepidoptera in the Chapala Riviera in Jalisco, Mexico on a climbing plant identified as *Serjania recemosa* Schumach, a new host plant. To obtain the adults, larvae, and pupae of *Caloptilia stigmatella*, collections of leaves with signs of damage due to mining caused by the larvae were made, which were placed in an incubation chamber with controlled temperature and humidity. This gracilarid was originally described in England and is currently distributed throughout Europe, Asia, Canada, and the United States of America feeding on several species of the Salicaceae family, mainly the *Salix* spp. and *Populus* spp. genera. Although reports indicate that *Caloptilia stigmatella* shows a Holarctic distribution, there may be a migration trend towards the Neotropical zone, and despite its preference for feeding on plants of the Salicaceae family, here we find it feeding on a species of Sapindaceae.

PALABRAS CLAVE: Lepidoptera, Gracillariidae, *Caloptilia*, *Serjania racemosa*, new record.

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RESUMEN

Se registra por primera vez a *Caloptilia stigmatella* (Fabricius) como parte de la entomofauna de microlepidópteros minadores de la flora en la Rivera de Chapala en Jalisco, México, sobre una planta trepadora identificada como *Serjania racemosa* Schumach, nueva planta hospedera. Para la obtención de los adultos, larvas y pupas de *Caloptilia stigmatella*, se realizaron colectas de hojas con señales de daños por minaduras causadas por las larvas, las cuales fueron colocadas en una cámara de incubación con temperatura y humedad controladas. Este gracilárido fue originalmente descrito en Inglaterra y actualmente se distribuye por toda Europa, Asia, Canadá y en los Estados Unidos de Norteamérica, alimentándose en varias especies de la familia Salicaceae, principalmente en los géneros *Salix* spp. y *Populus* spp. Aunque los reportes indican que *Caloptilia stigmatella* muestra una distribución Holártica, es posible que exista una tendencia de migración hacia la zona Neotropical y a pesar de su preferencia de alimentación por plantas de la familia Salicaceae, aquí la encontramos alimentándose de una especie de Sapindaceae.

PALABRAS CLAVE: Lepidoptera, Gracillariidae, *Caloptilia*, *Serjania racemosa*, registro nuevo.

Introduction

The Chapala lake, around which the collections were performed, is home to many endemic species, being the largest lake in Mexico with a surface area of 114,659 ha, is located at coordinates 20°13'N and 103°03'W and is considered a Ramsar site since February 2009 with assignment number 1973 (Ramsar Sites Information Service, 2022).

The geographic location of Mexico often presents a rich mixture of Nearctic and Neotropical arthropod faunas (Davis, 2000); however, the study of lepidopteran leafminers in Mexico has been scarce, as there are a large number of undescribed species, particularly among the smaller micro-moths such as leafminers (Heppner, 2004). Lopez-Muraira *et al.* (2020) report *Antispastis xylophragma* (Meyrick, 1926) as a leaf miner of *Solanum umbellatum* (Solanaceae) and also records *Rifseria fuscotaeniaella* (Chambers, 1878) mining the leaves of *Montanoa tomentosa* (Asteraceae) (Lopez-Muraira *et al.*, 2022). To these contributions is added *Phyllocnistis psittacanthusella* (Heppner & Lopez-Muraira, 2020), a gracillariid that mines the leaves of *Psittacanthus calyculatus*, a parasitic plant of the Loranthaceae family.

The Gracillariidae family has 2,016 species recognized worldwide and despite the wide diversity of habitats in our country, only 14 species have been recorded to date for Mexico and it is estimated that there are close to 450 species yet to be discovered (Heppner, 2004; Heppner & López-Muraira, 2020).

Of the genus *Caloptilia*, 322 species have been reported worldwide (De Prins & De Prins, 2006-2022), but there are only 20 species known for the Neotropical Region and only two species reported for Mexico, *C. burserella* (Busck) and *C. perseae* (Busck), both as avocado leafminers (De Prins *et al.*, 2016; De Prins *et al.*, 2019). *Caloptilia perseae* is considered a minor pest of avocados in Florida (Glenn *et al.*, 2003).

Within the mining microlepidoptera, the genus *Caloptilia* contains the largest moth species of Gracillariidae (Núñez & Barro, 2011) for example, the species *C. hemidactylella* (Denis & Schiffermüller), *C. theivora* (Walsingham), and *C. stigmatella* (Fabricius) can reach up to 14 mm in wing spread (Corver *et al.*, 2011; Park & Han, 1986; Shin *et al.*, 2015). This genus has been reported worldwide feeding on a great diversity of plant species, including members of the families Sapindaceae, Betulaceae, Anacardiaceae, Lauraceae, Fabaceae, and Euphorbiaceae; The *Caloptilia stigmatella* (Fabricius) larva has been found feeding on several species of the Salicaceae family, especially the genera *Salix* and *Populus*, although it has also been reported on several species of the Fabaceae and Myricaceae families (De Prins & De Prins, 2006-2022). In this study, the presence of this gracilarid species for the first time in Mexico, and although other species of *Caloptilia*, were reported, whose larvae have been reported feeding on plants of the Sapindaceae family, this is the first report on *Serjania racemosa*.

Material and Methods

During the period from November 7th, 2021 to January 16th, 2022, eight foliage collections were made to search for the larvae of microlepidopteran leafminers of the climbing species known as bejuco or bejuco three-in-one, identified as *Serjania racemosa* (Figure 1) using the taxonomic key of Rzedowski & Rzedowski (2006). Plant samples were collected near Mezcala town (20°19'58 "N 103°03'10 "W) in the municipality of Poncitlán, Jalisco, Mexico. The plant material, consisting of leaves and branches, was placed in plastic containers of 9.5 cm diameter by 14.25 cm high with a 30 mesh lid and placed in an incubation chamber with a controlled temperature of 25°C and 55 % relative humidity for three weeks and with daily inspections to obtain the adults of the leafminer microlepidopteran species.



Figure 1. *Serjania racemosa* plant

Serjania racemosa reported as a medicinal plant (Andrade-Cetto & Heinrich, 2005; Casanova-Pérez *et al.*, 2022) is characterized as a climbing plant of the Sapindaceae family. They are shrubs that present petioles 6 cm long, biternate leaves 17 cm long and 23 cm wide; sub-rhombic leaflets up to 7 cm long and 5 cm wide; serrate margin; thyrses up to 14 cm long and 2.5 cm in diameter; white or yellow flowers (Figure 2) with 4 petaloid sepals, the outer ones 2 mm and the inner ones 2.3 to 3.5 mm long, petals up to 3.5 mm long; fruit up to 3 cm long (Figure 3). In the study area, it remains green all year round and therefore represents a nutritional source for many insects.



Figure 2. *Serjania racemosa* flowers

A total of four adult male specimens of the species determined as *Caloptilia stigmatella* (Fabricius) were obtained, using for their identification the external morphological descriptions and male genitalia published by Park & Han (1986) and Shin *et al.* (2015). The insects were deposited in the entomological collection located within the CREG Herbarium of the Instituto Tecnológico de Tlajomulco in Jalisco, Mexico. Previous records of Gracillariidae in Mexico were consulted using as a basis the publication of Davis & Miller (1984), showing no previous record of *Caloptilia stigmatella* (Fabricius) in Mexico, finally the classification scheme of Kawahara *et al.* (2017) and De Prins *et al.* (2019), were used.



Figure 3. *Serjania racemosa* fruits

Results and discussion

Family: Gracillariidae. Stainton, 1854

Subfamily: Gracillariinae Stainton, 1854

Caloptilia stigmatella (Fabricius, 1781).

Tinea stigmatella Fabricius, 1781:295-296

Type locality: England

Examined material

Mexico, Mezcala, Jalisco. 4 males deposited in the entomological collection located in the CREG Herbarium of the Instituto Tecnológico de Tlajomulco in Jalisco. Cat.: ITTJ071121M1, ITTJ071121M2, ITTJ160122M3 and ITTJ091022M4. H.R. Iruegas leg, new record for Mexico.

Caloptilia stigmatella has a worldwide distribution, mainly in the Holarctic Region, and although originally described for England, it is found throughout Europe and Asia, Canada, and on the Atlantic slope in the United States of America, including Florida and Texas (De Prins & De Prins, 2006-2022).

Description

Adult males (Figure 4) have an average wing spread of 11.875 mm (± 0.479 mm) and are easily distinguished given that the forewings are dark brown in color and have a light yellow sub-triangular spot extending from the costa of the wing at its widest part and narrowing posteriorly; there is also a small yellow spot at the base of the anal area of the wing. Hindwings are narrow and uniformly light brown, with long tufts of piliform silks of the same color. The male genitalia (Figure 5) has a narrow, triangular vinculum, dilated apically and 1.2 times shorter than the valves, the latter are covered with piliform silks that become longer apically. The aedeagus (Figure 6) is pointed at the apex and has a membranous covering. The larvae produce an almost rectangular-shaped lesion that undermines the leaves forming an interveinal spot (Figure 7), subsequently rolling the leaf to prepare to form the pupa (Figure 8).



Figure 4. *Caloptilia stigmatella* adult

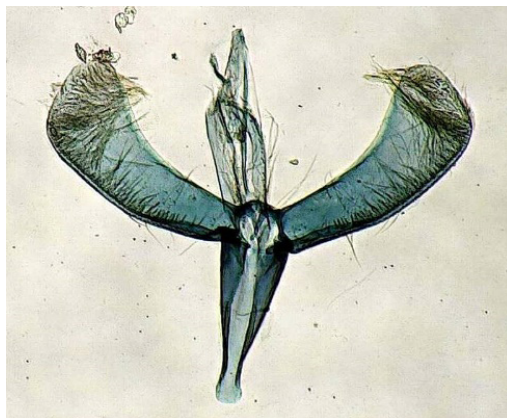


Figure 5. Male genitalia of *Caloptilia stigmatella*

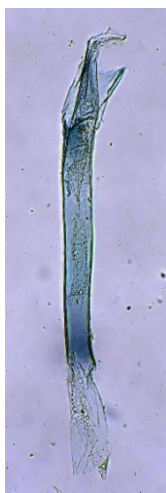


Figure 6. Aedeagus of *Caloptilia stigmatella*



Figure 7. *Caloptilia stigmatella*, blister-shaped mine.



Figure 8. *Caloptilia stigmatella* miner & roller leaf.

Discussion

The analysis of this study indicates that *Caloptilia stigmatella* stands out for its worldwide distribution, especially in cold regions. Halffter & Morrone (2017), reported that insect migration from the Nearctic Region is mainly through the Mexican Transition Zone comprising the Sierra Madre Occidental, Sierra Madre Oriental, Sierra Madre del Sur, and the Trans-Mexican Volcanic Belt. The presence of this species in Mexico suggests the use of these geographic corridors. The various bibliographic consultations did not record any report on a Neotropical distribution of *Caloptilia stigmatella*, so it is likely that due to its dispersal capacity, it could be distributed towards southern Mexico, this is possible since this species is found in most of the territory of the United States of North America, including the border states of California and Texas (Moth Photographers Group, 2019). Likewise, Halffter & Morrone (2017), mention that the genera *Onthophagus* and *Copris* (Scarabaeidae), as well as *Bombus* (Hymenoptera:Apidae), which present a Paleoamerican distributional behavioral pattern, are an example of this phenomenon

since they have species that arrived to North America from Eurasia and present taxa in the Mexican Transition Zone.

Conclusions

To date and including the present study, only 15 species of gracilarids have been reported for Mexico, which represents 0.75 % of the total number of species recorded worldwide, which indicates that this group is scarcely studied in our country. This publication is part of the effort to identify the present species of this group of leafminers and to define their host plants in the State of Jalisco. The *Caloptilia* genus maintains feeding preferences on plants of the Salicaceae family, including *C. stigmatella*; however, in the present study, *Serjania racemosa* (Sapindaceae) is added as another host species for Mexico, and the geographic distribution of *C. stigmatella*, which in America was only known for Canada and the United States of America, is extended.

Authors contributions

Conceptualization, I.G. López-Muraira, H.R. Iruegas-Buentello; development of the methodology, H.R. Iruegas-Buentello; photographs, I.G. López-Muraira, H.R. Iruegas-Buentello; writing and preparation of the manuscript, I.G. López-Muraira, H.R. Iruegas-Buentello; drafting, revising and editing, H. Flores-Martínez, J.F. Gómez-Leyva. All authors of this manuscript have read and accepted the published version of the manuscript.

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Conflict of interest

The authors declare no conflicts of interest.

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