Zootaxa 4358 (2): 385–392
http://www.mapress.com/j/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.4358.2.11
http://zoobank.org/urn:lsid:zoobank.org:pub:EC00185E-FA79-427C-BE98-C7C26B18BA3E

A new species of *Macrosaccus* (Lepidoptera: Gracillariidae: Lithocolletinae) from Arizona, USA

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Abstract

A sixth species of *Macrosaccus* (Gracillariidae), *M. coursetiae* **sp. nov.**, is described. The larvae are leafminers of *Coursetia glandulosa* (Fabaceae). The parasitoid *Chrysocharis walleyi* (Eulophidae) has been reared from the leaf mines; a table summarizing the host records for this wasp is presented.

Key words: *Chrysocharis walleyi*, *Coursetia glandulosa*, Eulophidae, Fabaceae, leafminer

Introduction

Macrosaccus Davis & De Prins (Lepidoptera: Gracillariidae: Lithocolletinae) is a New World genus of moths whose larvae form tentiform leaf mines on legumes (Fabaceae). Four species are known from North America—one of which, *M. robiniella* (Clemens), is now an invasive species that has been introduced into Europe—and one from Central America and the Caribbean (Davis & De Prins 2011). Here we describe a new species from Arizona, which (in addition to *M. neomexicanus* Davis) is the second species in the genus reported from this state.

Materials and methods

The leaf mines of the new species were found by CSE and J. Blyth in Tucson, Arizona during a search for leafminers throughout the central and western United States from September to November 2012. Mined leaves were collected in plastic vials, which were checked daily for emerging adults. Adult moths were pinned, spread, and double mounted, then deposited in the National Museum of Natural History, Smithsonian Institution, Washington, DC, USA (USNM). The parasitoid was preserved in 95% ethanol and deposited in the Natural History Museum, London, UK.

Results

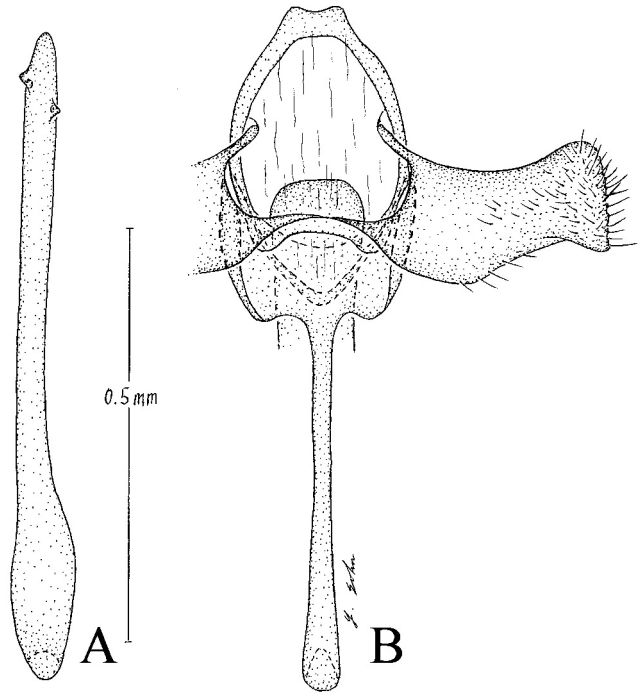
***Macrosaccus coursetiae*, sp. nov.**
Figs. 1–7

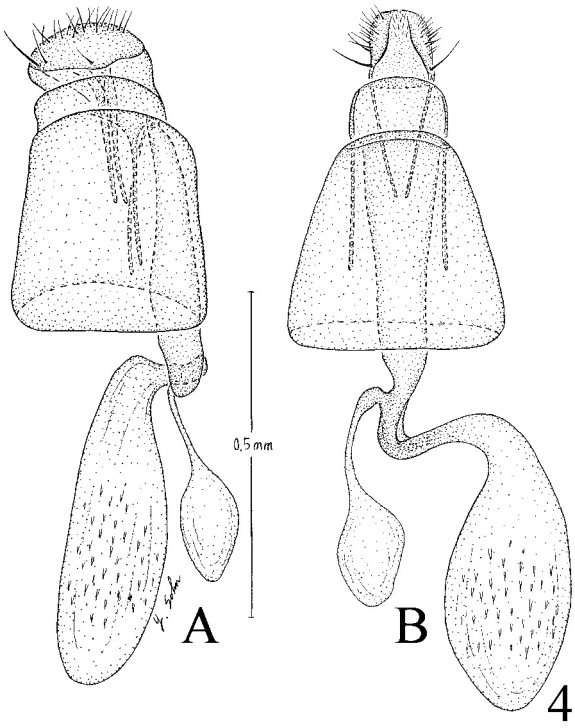
Adult (Figs. 1, 2). Forewing length 2.5–3.0 mm. *Head:* Frons white, smoothly scaled. Vertex rough, with scattered, erect, brownish piliform scales intermixed with white piliform scales; occipital area also rough, covered with mostly white, piliform scales. Labial palpus mostly black dorsally and laterally, white ventrally, and brown toward base. Antennal segments dusky with pale bases.

Accepted by J. De Prins: 18 Oct. 2017; published: 29 Nov. 2017

FIGURES 1–2. *Macrosaccus coursetiae* adults. 1, Live specimen in resting position. 2, Holotype male.

Thorax: Gray-brown above; white with black markings below. Forewing with ground of dusky-tipped white scales; patches of pure white scales forming more or less distinct oblique dorsal and costal streaks and an apical spot; dusky-tipped orange-brown scales forming several patches, mostly in the costal half; a basal streak of mostly pure orange-brown scales near the costal margin, these being the only orange-brown scales in the basal quarter of the wing; several small patches of black or black-tipped scales, these absent from the dorsal margin; fringe pale brown with a black subapical band. Hindwing (including fringe) gray-brown. Legs banded black and white, with patches of brown scales.





FIGURES 3–6. *Macrosaccus coursetiae*. 3, Male genitalia: A, Phallus; B, Genital capsule. 4, Female genitalia: A, Lateral view; B, Ventral view. 5. Larval mine in leaflet of *Coursetia glandulosa*. 6, Abandoned leaf mine with pupal exuviae protruding from base of leaflet.

FIGURES 7–9. *Coursetia glandulosa*. 7, Basal portion of leaf with two mines of *Macrosaccus coursetiae* (abaxial surface). 8, Whole leaf (adaxial surface). 9, Detail of stipules and twig.

Abdomen: Grayish brown dorsally, with dark brown spots laterally (~ one per segment); venter mostly white, with midventer pale brown.

Male genitalia (Figs. 3A–B): Valva relatively simple, of uniform width and slightly curved throughout its length; apex truncate, with ventral margin of cucullus moderately produced and subacute; saccus a slender, elongate rod ~ 1.7× the length of valva. Phallus long (~ 3× the length of valva) and slender, with basal end slightly swollen and 2 minute spines present near apex.

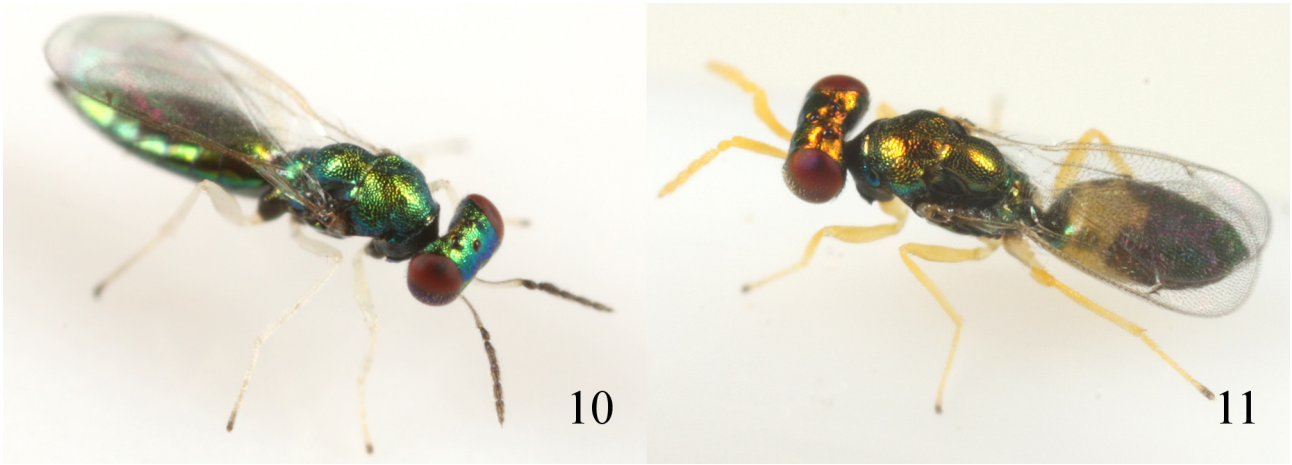
Female genitalia (Figs. 4A–B): Ostium broadly truncate. Ductus bursae broadest near caudal end, gradually narrowing anteriorly, and approximately equal in length to corpus bursae. Corpus bursae moderately broad and elliptical in shape, with 8–10 longitudinal rows of minute, acute spicules concentrated over anterior half of corpus; a relatively small accessory bursa arising from anterior third of ductus bursae and joined by an elongate, slender duct.

Leaf mine (Figs. 5–7). The larva forms a white blotch on the lower leaflet surface. Based on the two aborted mines examined, which measure 1 mm and 3 mm across, there is not an initial linear track as is sometimes present in gracillariid blotch mines. Ultimately the blotch occupies most of the lower leaflet surface and becomes tentiform, with numerous fine longitudinal folds, causing the lateral leaflet margins to curl downward. The upper leaflet surface becomes finely speckled with white as the larva consumes minute patches of palisade parenchyma. Upon emergence of the adult, the pupa is thrust through the lower epidermis at the base of the leaflet.

Type material. *Holotype:* ♂, UNITED STATES: Arizona: Pima Co.: Tucson, 10 Nov. 2012, em. 18 Nov. – 5 Dec. 2012, C. S. Eiseman & J. A. Blyth, ex *Coursetia glandulosa*, #CSE148, digital image captured (USNM 00913184).

Paratypes: Same collection data as holotype: 9♂, slides USNM 34623♂, 34759♂; 7♀, slide 34760♀; wing venation slide USNM 34774♀, (USNM).

Distribution. The entire type series was collected from a single shrub growing in a wash on the west side of Tucson, Arizona, USA.



FIGURES 10–11. *Chrysocharis walleyi*. 1, Female. 2, Male.

Etymology. The specific name is derived from the generic name of the host plant, *Coursetia* DC. The species-group name of the moth is a latinized noun in genitive singular, gender feminine. It is combined with the generic name *Macrosaccus* of which the gender is masculine. Since the species-group name *coursetiae* is a noun in apposition its ending does not need to agree in gender with the generic name with which it is combined and must not be changed to agree in gender with the generic name (ICZN Art. 34.2.1).

Diagnosis. The speckled appearance of the forewings, produced by the dark-tipped white scales, is unique among the known species of *Macrosaccus*. All other species have a ground color of solid pale orange-brown, and possess more well-defined costal (and often dorsal) strigulae. The male genitalia of *M. coursetiae* differ from those of all other *Macrosaccus* in possessing a truncate cucullus, with the distal-ventral margin of the cucullus subacute and not rounded. The wing venation of *M. coursetiae* agrees with that of *M. robiniella* (Davis & De Prins 2011) in all respects including the presence of 8 veins in the forewing and 5 veins in the hindwing. The general morphology of the female bursa, particularly the signa, associates *M. coursetiae* most closely with *M. morrisella* (Fitch).

TABLE 1. Hosts of *Chrysocharis walleyi*.

Host insect	Host plant	Leaf mine type	Location	Reference
Phytomyza ilicis Curtis (Agromyzidae)	*Ilex aquifolium* L. (Aquifoliaceae)	upper surface blotch	Canada: British Columbia	Yoshimoto 1973
Cremastobombycia sp. (Gracillariidae)	*Artemisia douglasiana* Besser (Asteraceae)	underside tentiform	USA: California	C. Eiseman (unpublished)
"*Lithocolletis*" sp. (Gracillariidae)	*Betula* L. (Betulaceae)	*Lithocolletis* may indicate *Cameraria* (upper surface blotch) or *Phyllonorycter* (underside tentiform)	Canada: Nova Scotia	Yoshimoto 1973
"*Lithocolletis*" sp. (Gracillariidae)	*Ostrya virginiana* (Mill.) K. Koch (Betulaceae)	see above	Canada: Quebec	Yoshimoto 1973
"*Lithocolletis* sp." (Gracillariidae)	*Ulmus* L. (Ulmaceae)	see above	Canada: Nova Scotia	Yoshimoto 1973
"*Lithocolletis*" sp. (Gracillariidae)	not recorded	see above	Canada: Ontario	Yoshimoto 1973
Macrosaccus coursetiae Eiseman & Davis (Gracillariidae)	*Coursetia glandulosa* A. Gray (Fabaceae)	underside tentiform	USA: Arizona	this study
Phyllocnistis sp. (Gracillariidae)	*Prunus ilicifolia* (Nutt. ex Hook. & Arn.) D. Dietr. (Rosaceae)	upper or lower surface serpentine	USA: California	Gates *et al*. 2002
?Phyllocnistis sp. (Gracillariidae)	*Vitis californica* Benth. (Vitaceae)	upper surface serpentine	USA: California	Gates *et al*. 2002
Phyllonorycter elmaella Doğanlar & Mutuura 1980	*Malus pumila* Mill. (Rosaceae)	underside tentiform	Canada: British Columbia	Doğanlar & Beirne 1980
Phyllonorycter mespilella (Hübner) (Gracillariidae)	*Cotoneaster* Medik. (Rosaceae)	underside tentiform	USA: California	Gates *et al*. 2002
Phyllonorycter platani (Staudinger) (Gracillariidae)	*Platanus racemosa* Nutt. (Platanaceae)	underside tentiform	USA: California	Gates *et al*. 2002
Phyllonorycter salicifoliella (Chambers) (Gracillariidae)	*Populus* L. (Salicaceae)	underside tentiform	Canada: Ontario	Yoshimoto 1973
Phyllonorycter salicifoliella (Chambers) (Gracillariidae)	not recorded	underside tentiform	Canada: Ontario (multiple records)	Yoshimoto 1973
Phyllonorycter salicifoliella (Chambers) (Gracillariidae)	*Populus* L. (Salicaceae)	underside tentiform	USA: Maine	Hansson 1987
Phyllonorycter sp. (Gracillariidae)	*Malus* Mill. (Rosaceae)	underside tentiform	Canada: Ontario	Yoshimoto 1973
Phyllonorycter sp. (Gracillariidae)	*Populus tremuloides* Michx. (Salicaceae)	underside tentiform	Canada: Ontario	Hansson 1987
Phyllonorycter sp. (Gracillariidae)	*Salix* L. (Salicaceae)	underside tentiform	USA: California	C. Eiseman (unpublished)
Phyllonorycter sp. (Gracillariidae)	not recorded	underside tentiform	Canada: Ontario	Hansson 1987

.....continued on the next page

TABLE 1. (Continued)

Host insect	Host plant	Leaf mine type	Location	Reference
Porphyrosela desmodiella (Clemens) (Gracillariidae)	*Desmodium* Desv. (Fabaceae)	underside tentiform	USA: Arizona	Eiseman *et al*. 2017
?Stigmella sp. (Nepticulidae)	*Frangula californica* (Eschsch.) A. Gray (Rhamnaceae)	upper surface serpentine	USA: California	Gates *et al*. 2002
"*Tischeria* sp." (Tischeriidae)	*Quercus rubra* L. (Fagaceae)	not recorded (tischeriids form trumpet or blotch mines, some strongly wrinkled)	USA: Connecticut	Hansson 1987
"*Tischeria* sp." (Tischeriidae)	not recorded	see above	Canada: Ontario	Hansson 1987
"*Tischeria*" sp. (Tischeriidae)	not recorded	see above	Canada: Quebec	Yoshimoto 1973
Lepidopteran leafminer	*Ageratina adenophora* (Spreng.) R.M. King & H. Rob. (Asteraceae)	not recorded	Mexico: Morelos	Hansson 1987

Host Plant (Figs. 7–9). Adults were reared from *Coursetia glandulosa* A. Gray (Fabaceae), the distribution of which is limited to southern Arizona in the USA, continuing through western and southern Mexico to Oaxaca. The genus *Coursetia* also occurs from the southern tip of Texas south to northern Argentina (Lavin 1988). Although no flowers or fruit were present at the time of collection, the leaf shape, stipules, and twig color and shape were sufficient to distinguish the host plant from similar fabaceous shrubs found in the same habitat and locality (L. Crumbacher, *in litt.*).

Parasitoids. A single adult of *Chrysocharis walleyi* Yoshimoto (Eulophidae) was reared along with the type series of *Macrosaccus coursetiae*.

Discussion

In several *Macrosaccus* species, mines of different larvae have been observed to coalesce, forming a single large mine in which multiple individuals are able to complete development (Davis & De Prins 2011). Each of the viable mines of *M. coursetiae* we collected produced a single adult, and given that the leaflets were almost entirely mined out, it is doubtful that two larvae could have completed development in a single leaflet. (One preserved leaflet does contain two small mines that were initiated about 5 mm apart, but both were aborted while still separated by 4 mm.) However, whereas the leaflets we collected were at most 25 mm long by 9 mm wide, *Coursetia glandulosa* leaflets can measure up to 50 mm by 22 mm (Lavin 1988). Thus, it is conceivable that *C. glandulosa* plants with larger leaves could accommodate multiple larvae per leaflet.

Davis & De Prins (2011) stated that the pupa of *Macrosaccus* is characterized by an accessory cremaster on abdominal sternum 7, consisting of a raised transverse ridge bearing ~ 18–21 mostly longitudinally oblique rows of short blunt spines. The pupa of *M. coursetiae* we examined did not possess an accessory cremaster. Since only the pupa of *M. robiniella* has been thoroughly examined previously, it is not known how consistent this feature is for the genus.

Although numerous parasitoid species have been reared from *Macrosaccus* (Davis & De Prins 2011), ours is the first recorded rearing of *Chrysocharis walleyi* from this genus. As shown in Table 1, all host records for this wasp are from leaf-mining moths, with the exception of one agromyzid fly, a record considered questionable by Hansson (1987). These records suggest a possible preference for hosts forming underside tentiform mines.

Acknowledgments

Julia Blyth (Northfield, MA) assisted in collecting the leaf mines and mounted the adult specimens. The host plant identification was suggested by David Ferguson (Rio Grande Botanic Garden, Albuquerque, NM) and Michael Wilson (Prescott, AZ), and confirmed by Laura Crumbacher (University of Arizona Herbarium, Tucson, AZ), who compared CSE's photographs with herbarium specimens. Christer Hansson (Department of Zoology, Lund University, Sweden) identified the eulophids (including CSE's unpublished data cited in Table 1). We also wish to thank Young Sohn for the genitalic illustrations, Donald Harvey for graphic assistance, Karolyn Darrow for preparing the spread adult photo for publication, and Mignon Davis for preparing labels and general curation; all are personnel associated with the Department of Entomology, Smithsonian Institution. Finally, we thank two anonymous reviewers for feedback on an earlier version of the manuscript.

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