N O T E

Caliothrips phaseoli (Thysanoptera: Thripidae) Occurrence on *Moringa oleifera* (Brassicales: Moringaceae) and Its Predation of *Tetranychus merganser* (Acari: Tetranychidae)[1]

Claudia Molina-Arjona[2], Julio César Chacón-Hernández[3], Agustín Hernández-Juárez[4], Julia Cecilia Anguiano-Cabello[4], Roberto Arredondo-Valdés[4], and Elan Iñaky Laredo-Alcalá[4]

Instituto de Ecología Aplicada, Universidad Autónoma de Tamaulipas, División del Golfo No. 356, Col. Libertad. C.P. 87019. Ciudad Victoria, Tamaulipas, Mexico

J. Entomol. Sci. 53(1): 89–92 (January 2018)

Key Words facultative predator, biological control, feeding behavior

The tree *Moringa oleifera* Lamarck is of agricultural importance in Mexico and other parts of the tropical Americas (Olson and Fahey 2011, Rev. Mex. Biodiver. 82: 1071–1082). Fruits, seeds, and roots are consumed by humans, stems are used for livestock feed, and oils extracted from seeds are used in lubricants, cosmetics, and biofuels (Da Silva et al. 2010, Biomass Bioenerg, 34: 1527–1530; Pérez et al. 2010, *Moringa oleifera*, una Alternativa Forrajera para Sinaloa. Fundación Produce, Sinaloa AC. Mexico).

A number of insects and related arthropods have been reported on *M. oleifera* including ants (Hymenptera: Formicidae), *Helicoverpa zea* Boddie (Lepidoptera: Noctuidae), *Estigmene acrea* Drury (Lepidoptera: Erebidae), *Trichoplusia ni* Hübner (Lepidoptera: Noctuidae), *Diatraea* sp. (Lepidoptera: Crambidae), *Bemisia* sp. (Hemiptera: Aleyrodidae), *Oligonychus punicae* Hirts (Acari: Tetranychidae), and *Tetranychus merganser* Boudreaux (Acari: Tetranychidae) (Monjarás-Barrera et al. 2015, Southwest. Entomol. 40: 847–849; Pérez et al. 2010). Herein, we report the first reported occurrence of *Caliothrips phaseoli* Hood (Thysanoptera: Thripidae) larvae on *M. oleifera* under greenhouse conditions and its predation of eggs and adult females of *T. merganser* under laboratory conditions.

Thrips larvae were collected from *M. oleifera* leaves growing in greenhouse conditions (36 $\pm$ 4°C; 80 $\pm$ 10% relative humidity [RH]) in Ciudad Victoria,

[1]Received 22 June 2017; accepted for publication 10 October 2017.
[2]Unidad Académica Multidisciplinaria de Ciencias, Educación y Humanidades, Universidad Autónoma de Tamaulipas, Centro Universitario Adolfo López Mateos. C.P. 87149. Ciudad Victoria, Tamaulipas, Mexico.
[3]Corresponding author (email: jchacon@uat.edu.mx).
[4]Departamento de Parasitología, Universidad Autónoma Agraria Antonio Narro. Calzada Antonio Narro 1923, CP, 25315, Buenavista, Saltillo, Coahuila, Mexico.

Tamaulipas, Mexico (N 23°27′40″, W 99°56′42″; 308.4 m above sea level). Forty leaves with thrips larvae were collected and transported to the laboratory where the larvae were transferred onto bean leaves (*Phaseolus vulgaris* L.) and maintained at 26 ± 2°C and 60 ± 10% RH. Once the larvae reached the adult stage, they were identified using the taxonomic keys of Stannard (1968, Bull. Illinois Nat. Hist. Surv. 29: 213–552), Mound and Marullo (1996, Mem. Entomol. Int. 6: 1–487), Johnson and Triplehorn (2005, Borror and DeLong's Introduction to the Study of Insects, 7th ed., Thomson Brooks/Cole, Belmont, CA), and Hoddle et al. (2012, Thrips of California, CBIT Publishing, Queensland, Australia, http://keys.lucidcentral.org/keys/v3/thrips_of_california/Thrips_of_California.html, accessed 28 February 2017).

A colony of *T. merganser* was initiated from mites collected from *M. oleifera* trees growing in the greenhouse. These specimens were placed on *P. vulgaris* and maintained at 36 ± 4°C and 80 ± 10% RH.

Studies of the predation of *C. phaseoli* larvae on eggs and females of *T. merganser* were conducted at the Institute of Applied Ecology, Autonomous University of Tamaulipas. Egg predation was studied by first transferring five male and five female *T. merganser* from the laboratory colony, using a camel-hair brush (000), to a either a 2.5-cm diameter (area = 4.9 cm^2) bean disc or a 4.8-cm^2 *M. oleifera* leaflet on moistened filter paper in a 5.5-cm diameter petri dish. These adults remained on the discs for 24 h to mate and oviposit, at which time they were removed, leaving 10 eggs on each disc. Either one Stage I or one Stage II *C. phaseoli* larva was then transferred from the laboratory colony to each leaf disc.

Adult predation was studied by transferring 10 *T. merganser* adult females from the colony to either a bean leaf disc or a *M. oleifera* disc in the petri dish arenas. Either one Stage I or one Stage II *C. phaseoli* larva was then transferred to each leaf disc. The arenas were maintained at 36 ± 4 °C and 80 ± 10% RH. Treatments were arranged in a completely randomized experimental design with five replicates. Daily counts of eggs and females were made using a dissecting microscope. Predation data were subjected to analysis of variance (ANOVA) with mean comparisons using Tukey's HSD test (SAS 2002, SAS Institute, Cary, NC).

Caliothrips phaseoli larvae were observed feeding on the abaxial surface of primary leaves of the newly emerged leaves of *M. oleifera*. The thrips larvae were observed feeding on leaves, flowers, and petioles of more mature plants.

Caliothrips phaseoli larvae also preyed upon eggs and adult females of *T. merganser*. Significantly ($F = 8.10$; df = 1, 8; $P = 0.0216$) fewer eggs were consumed by first-instar *C. phaseoli* larvae on *M. oleifera* than on *P. vulgaris* leaf discs, while no significant differences ($F = 2.67$; df = 1, 8; $P = 0.1411$) were observed in numbers of adult females consumed by first instars on the different plant (Table 1). A significantly greater number of eggs ($F = 6.40$; df = 1, 8; $P = 0.0353$) and adult females ($F = 8.33$; df = 1, 8; $P = 0.0203$) were preyed upon by second-instar larvae on *P. vulgaris* leaf discs than on the *M. oleifera* leaflets. And, overall, second-instar larvae consumed significantly more eggs ($F = 21.51$; df = 1, 18; $P = 0.0002$) and adult females ($F = 11.22$; df = 1, 18; $P = 0.0036$) than were consumed by first instars.

The phytophagous and predatory feeding habits of *C. phaseoli* larvae we observed have been previously reported with other thrips species habits (Kirk 1997, Pp. 119–174 *in* Thrips as a Crop Pest, CAB International, Wallingford, U.K.;

Table 1. Predation of first- and second-instar *Caliothrips phaseoli* larvae on eggs and adult females of *Tetranychus merganser* in laboratory assays using different sources of leaf.*

	***T. merganser* Eggs**		***T. merganser* Adult Females**	
Host Plant	**First Instar**	**Second Instar**	**First Instar**	**Second Instar**
Moringa oleifera	1.80 b ± 0.83	4.60 b ± 1.14	0.00 a ± 0.00	0.60 b ± 0.55
Phaseolus vulgaris	3.60 a ± 1.14	6.20 a ± 0.83	0.40 a ± 0.55	1.60 a ± 0.54
Overall means**	2.70 B ± 1.33	5.40 A ± 1.26	0.20 Y ± 0.42	1.10 Z ± 0.73

* Means (±SE) within a column and followed by different lowercase letters are significantly different (Tukey's HSD, $P < 0.05$).
** Means (±SE) within a row and within a prey group that are followed by different uppercase letters are significantly different (Tukey's HSD, $P < 0.05$).

Cambero-Campos et al. 2011, Acta Zool. Mex. (n.s.) 27: 115–121). But the predatory activity has been largely ignored because of the economic damage to crops caused by phytophagous feeding habits. It is further postulated that the predatory activity meets certain nutritional needs, or allows for competitive exclusion in establishing ecological niches on the plant, or both (Lacasa and Llorens 1998, Trips y su Control Biológico, Pisa Ediciones, Alicante, Spain).

Our observation that greater numbers of eggs were consumed than adult female mites might be attributed to larger size and the mobility of the adult mites, but nutritional considerations (Albajes and Alomar 2008, Pp. 1400–1405 *in* Encyclopedia of Entomology, Springer Science Business Media B.V., Dordrecht, The Netherlands) and morphology and feeding strategies of the predator (Cobben 1978, Evolutionary Trends in Heteroptera. Part II. Mouthpart-Structures and Feeding Strategies, Mededelingen Landbouwhogeschool, Wageningen, The Netherlands; Eubanks et al. 2003, Ecology 84: 2549–2556; Torres and Boyd 2009, Braz. Arch. Biol. Technol. 52: 1199–1208) should not be ignored. The greater consumption of prey by second-instar than first-instar larvae we observed was also reported for *Frankliniella schultzei* Trybom, *Thrips tabaci* Lindeman, and *Thrips imagini* Bagnall by Wilson et al. (1996, Bull. Entomol. Res. 86: 297–305). Size of prey in relation to predator size, mobility of the prey in relation to that of the predator, and dietary demands are likely factors involved (García et al. 2007, Corpoica Cienc. Tecnol Agropec. 8: 17–21). And, differences in predation that occurred on the *M. oleifera* versus the *P. vulgaris* leaf discs might result from differences in semiochemical composition. Torres-Castillo et al. (2013, Phyton-Int. J. Exp. Bot. 82: 193–202) report that metabolites in the leaves, stems, and roots of *M. oleifera* aid in protecting foliage from abiotic and biotic stresses. Alkaloids and polyphenols accumulating in the foliage are related to restrictive and potentially toxic effects on herbivores, including insects and other arthropods (Coley 1988, Oecologia 74: 531–536; Macel et al. 2005, J. Chem. Ecol. 31: 1493–1508). Such metabolites might impact *C.*

phaseoli, especially if the larvae are feeding upon the plant as well as preying upon mite eggs and adults.

Caliothrips phaseoli is an important pest of several crops, and we now report its occurrence on the economically important *M. oleifera*. Larvae developing from eggs oviposited on the plant are omnivorous, feeding on plant exudates as well as *T. merganser*, another pest of the tree. This facultative feeding behavior and the potential impact of its predatory activity should be further investigated and assessed.

Acknowledgments. We are grateful for economic support from the research project with number approved UAT-PTC-176 (PRODEP).