

New Records of *Eiphosoma* sp. and *Pristomerus vulnerator* (Hymenoptera: Ichneumonidae) as Natural Enemies of the Fall Armyworm (Lepidoptera: Noctuidae) on Cultivated Maize in Chiapas, Mexico¹

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Maize, *Zea mays* L., is the most important agricultural crop in Mexico. In 2016, 8,368,615 ha was planted in maize, with 684,462 ha planted in the state of Chiapas (Servicio de Información Agroalimentaria y Pesquera, 2017, accessed 13 December 2017, www.siap.gob.mx). Maize production in Mexico is affected by a number of lepidopteran pests, including *Helicoverpa* spp., *Diatrea saccharalis* (Borer), and *Spodoptera frugiperda* (J.E. Smith), commonly known as the fall armyworm. This noctuid is considered the most important pest of maize in Mexico, causing the crop losses in very severe infestations (Hernández et al. 2017, Southwest. Entomol. 42: 915–917). In the central region of the state of Chiapas, *S. frugiperda* control is based on applications of chemical insecticides, which may affect environmental and human health (Cortez et al. 2010, Southwest. Entomol. 35: 199–203). Faced with this situation, growers in this region are looking for control alternatives with one being biological control by conservation or augmentation of native natural enemies. While several braconids, ichneumonids, and tachinids have been reported as larval parasitoids of *S. frugiperda* (Cortez et al. 2012, Southwest. Entomol. 37: 423–428; Hernández et al. 2017), few studies have been conducted to characterize the diversity of parasitoids that attack *S. frugiperda* in cultivated corn in

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Table 1. Similarity percentage of base pairs between *Chelonus insularis*, *Chelonus* sp., *Pristomerus vulnerator*, and *Lespesia postica* from Chiapas, Mexico, compared with other sequences using the GenBank database.

Species	GenBank Accession	Base Pairs	Origin	% Similarity
<i>Chelonus insularis</i>		619	Chiapas	84
CiCHIS	GQ252935.1	368	Mexico	84
<i>Chelonus</i> sp.		655	Chiapas	92
<i>Chelonus</i> CHIS	KR892323.1	658	Canada	92
<i>Lespesia postica</i>	EF181908.1	644	Chiapas	97
LpCHIS		657	Costa Rica	97
<i>Pristomerus vulnerator</i>		649	Chiapas	88
PvCHIS	KP072585.1	658	France	88

Mexico. Our objective in this study was to identify the parasitoids of the fall armyworm in maize in the central region of Chiapas.

Spodoptera frugiperda larvae were collected in two production cycles (autumn–winter 2016; spring–summer 2017) in the same plot of maize located in Julián Grajales, Chiapa de Corzo, Chiapas, Mexico (N 16°48'55.56", W 92°96'77.78"; 460 m above sea level). In both cycles, the crop was treated with Spinoteram™ (Dow AgroSciences, Indianapolis, IN) insecticide 15 d after crop emergence. Parasitoid sampling began 50 d after crop emergence and was done using two methods. One was by sweep net over the plants so that adults were collected and preserved in 70% ethanol. The second involved collection of *S. frugiperda* 3rd and 4th instars which were placed individually in 50-ml plastic cups (Solo, Lake Forest, IL) where they were fed maize foliage and maintained at 28 ± 2°C, 70 ± 5% relative humidity, and on a photoperiod of 12 h light until larvae pupated or adult parasitoid emergence. Collections were continued weekly until the maize reached the R3 (grain filling) phenological stage. All samples were sorted, labeled according to morphological characteristics, and sent to the Biopesticides Laboratory (IPN. CINVESTAV, Irapuato) in Guanajuato, Mexico. The cytochrome *c* oxidase I marker gene was used for molecular identification (Folmer et al. 1994, Mol. Mar. Biol. Biotechnol. 3: 294–299), and the sequences obtained were compared against the GenBank database. For the identification of the genus *Eiphosoma* sp., the taxonomic key of Townes and Townes (1966, Mem. Amer. Entomol. Inst. 8: 371) was used.

From these collections, we identified five parasitoids associated with this maize field and fall armyworm larvae attacking the crop therein. These represented two taxonomic orders and three families: *Chelonus insularis* (Cresson), *Chelonus* sp. (Hymenoptera: Braconidae); *Eiphosoma* sp., *Pristomerus vulnerator* (Panzer) (Hymenoptera: Ichneumonidae); and *Lespesia postica* (Walker) (Diptera: Tachinidae) (Table 1). This represents the first report of *P. vulnerator* parasitizing *S.*

frugiperda in the state of Chiapas and in Mexico (Table 1). *Pristomerus spinator* F. had been previously reported from the states of Coahuila, Colima, Jalisco, Michoacán, Nayarit, and Quintana Roo (Carrillo 1980, Folia Entomol. Mex. 45: 111–112; Estrada et al. 2013, Southwest. Entomol. 38: 339–344; García et al. 2013, Rev. Colomb. Entomol. 39: 211–215; Molina et al. 2004, Fla. Entomol. 87: 461–472; Ríos et al. 2011, Fla. Entomol. 94: 723–726).

Eiphosoma sp. collected in our study also was a first report of this ichneumonid parasitizing fall armyworm in the state of Chiapas. *Eiphosoma vitticole* Cresson had been reported from the states of Colima, Michoacán, Tamaulipas, and Nayarit by Molina et al. (2003, Fla. Entomol. 86: 254–289).

We also collected *Chelonus* sp. and *C. insularis* in our study. Both are widely distributed in North America, Central America, and South America (Molina et al. 2003). In Mexico, they have been reported in Nayarit, Colima, Jalisco, Michoacán, Sinaloa, Veracruz, Coahuila, Chiapas, and in the Frailesca region (Estrada et al. 2013, Molina et al. 2004, Ríos et al. 2011; Ruiz et al. 2007, J. Agric. Entomol. 24: 35–42). *Chelonus insularis* is considered an important natural enemy of the fall armyworm in both Mexico and the United States (Molina et al. 2003, 2004).

Lespesia postica was only recently reported in the state of Chiapas (Hernández et al. 2017). Representatives of the genus *Lespesia* have been reported parasitizing *S. frugiperda* in Campeche, Oaxaca, Chihuahua, State of Mexico, Guanajuato, Guerrero, Jalisco, Morelos, Nayarit, and Chiapas. Cortez et al. (2010) and Ruiz et al. (2007) have reported *L. archippivora* (Riley) in Chiapas.

In conclusion, this survey identified five species of parasitoids naturally occurring in fall armyworm larvae in maize grown in the central region of Chiapas. Strategies should be developed that might conserve these natural enemies and/or augment natural populations to provide increased levels of biological control of this important pest of maize.