

# ***Archytas californiae* (Diptera: Tachinidae) Reported as Natural Enemy of the Fall Armyworm (Lepidoptera: Noctuidae) in Nayarit, Mexico<sup>1</sup>**

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In Mexico, an area of 7,366,967 ha of corn (maize) (*Zea mays* L.) is planted annually, of which the state of Nayarit represents 0.41% of that total area (Servicio de Información Agroalimentaria y Pesquera, 2017, <http://www.siap.gob.mx>, 23 July 2017). However, its productivity is reduced by insects including the lepidopterans *Helicoverpa* spp., *Diatrea saccharalis* (Borer), and *Spodoptera frugiperda* (J.E. Smith) (Salas et al. 2018, J. Entomol. Sci. 53: 569–571). *Spodoptera frugiperda*, commonly known as the fall armyworm, causes yield reductions ranging from 10% to 100% depending on the level of infestation (Hernández et al. 2008, J. Trop. Insect Sci. 28: 126–129).

Biological control is a sustainable component of pest management and can be achieved by the use of natural enemies such as parasitoids, predators, and entomopathogens (Williams et al. 2013, Annu. Rev. Entomol. 58: 119–140). According to Bahena et al. (2002, Entomol. Mex. 1: 260–265), more than 100 species of parasitoids have been recorded attacking lepidopterans, of which 40 have been reported from Mexico. Our objective in this study was to survey and identify naturally occurring parasitoids of *S. frugiperda* attacking corn in Xalisco, Nayarit, Mexico.

In November 2018, 104 first, second, and third instar *S. frugiperda* were collected at random from corn plots established in an experimental field of the

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**Fig. 1. Dorsal and lateral view of adults of *Archytas californiae*.**

Academic Unit of Agriculture (UAA) of the Autonomous University of Nayarit (UAN), Mexico (N 21°25'45'', W 104°53'29'', 965 m above sea level) located in Xalisco, Nayarit. Chemical insecticides had not been applied to these plots. Larvae were placed individually in 30-ml clear plastic cups (Envases Cuevas SA de CV, Mexico) containing a synthetic lepidopteran diet (Southland Products Inc., Lake Village, AR, USA) and transported to the Parasitology Laboratory of UAA, where they were maintained at  $25 \pm 2^\circ\text{C}$  and 60% relative humidity on a 12:12-h L:D photo phase. Larvae were checked daily for 28 d to until death or adult emergence. If parasitoids emerged from cadavers, those were preserved in 70% ethanol and taxonomically identified using the keys of Townes and Townes (1966, Mem. Am. Entomol. Inst. 8: 1–367) and Zetina et al. (2018, Trans. Am. Entomol. Soc. 144: 1–89). Parasitoids also were identified by molecular characters by extracting genomic DNA (gDNA) using the Pure Link Genomic DNA Mini Kit (Invitrogen, Carlsbad, CA, USA) following the manufacturer's protocol. The gDNA was visualized by electrophoresis on a 1% agarose gel and subsequently used to amplify the cytochrome C oxidase (COI) subunit gene using the following pairs of initiators, LCO (5'-GGTCAACAAATCATAAAGATATTGG-3') and HCO (5'-TAAACTTCAGGGT-GACCAAAAAATCA-3') (Folmer et al. 1994, Mol. Mar. Biol. Biotechnol. 3: 294–299). The PCR products were sequenced by MacroGen USA (Rockville, MD, USA). The sequences obtained were deposited in GenBank.

Of the 104 *S. frugiperda* larvae collected, 12 (11.5%) were parasitized. Of the parasitoids, *Archytas californiae* (Walker) (Diptera: Tachinidae) accounted for 7.6% of the total mortality while *Chelonus insularis* (Cresson) (Hymenoptera: Braconidae) caused 3.8% mortality. Of the 92 remaining larvae, 18 died from unknown causes (17.3%) and 74 (71.1%) reached adulthood.

*Chelonus insularis* has been previously reported in the states of Coahuila, Durango, Sonora, Sinaloa, Nayarit, Michoacán, and Chiapas in Mexico (Cortez et al. 2012, Southwest. Entomol. 35: 199–203; Estrada et al. 2013, Southwest. Entomol. 38: 339–344; González et al. 2014, Vedalia 15: 47–53; Molina et al. 2004, Florida Entomol. 87: 461–472; Rios et al. 2011, Florida Entomol. 94: 723–726; Ruiz et al. 2007, J. Agric. Entomol. 24: 35–42). This, however, represents the first report of *A. californiae* parasitizing *S. frugiperda* in the state of Nayarit and in Mexico (Fig. 1). *Archytas marmoratus* (Townsend) reportedly caused parasitism levels of 8% of parasitism in Coahuila, Mexico (Rios et al. 2011, Acta Zoo. Mex. 27: 577–582),

0.07% in Nayarit (Estrada et al. 2013), and 1.6% in Chiapas (Ruiz et al. 2007). *Archytas* spp. also have been reported parasitizing *S. frugiperda* in many areas of Latin America (Rios et al. 2011) and in Southeast Argentina (2.1% to 10.5%) (Murúa et al. 2006, Florida Entomol. 89: 175–182). Pair et al. (1986, Environ. Entomol. 15: 342–348) reported *A. marmoratus* as the main parasitoid that attacks *S. frugiperda* in the southeastern United States. Tachinids are considered as the most important dipteran parasitoids, attacking a variety of insect species of the orders Coleoptera, Orthoptera, Hemiptera, and Lepidoptera (Gutiérrez et al. 2015, Southwest Entomol. 40: 555–564).