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Two new records of egg parasitoids for *Dalbulus maidis* (Hemiptera: Cicadellidae): *Ufens niger* (Hymenoptera: Trichogrammatidae) and *Anagrus nigriventris* (Hymenoptera: Mymaridae)

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The corn leafhopper, *Dalbulus maidis* (DeLong) (Hemiptera: Cicadellidae), is one of the most important pests of maize (*Zea mays* ssp. *mays* L. [Poaceae]) in the Americas because it is an efficient vector of the corn stunt spiroplasma, *Spiroplasma kunkelii* Whitcomb (Spiroplasmataceae); maize bushy stunt phytoplasma, *Candidatus* Phytoplasma *asteris*; and maize rayado fino virus (Nault 1980). The corn leafhopper is broadly distributed in the Americas from the southern USA to Argentina (Triplehorn & Nault 1985). *Dalbulus maidis* feeds and reproduces on maize (Nault 1990), where females insert eggs into the plant tissue, with most eggs being laid in clusters on the midrib of the leaf (Heady et al. 1985). In Mexico, eggs of *D. maidis* on maize are parasitized by *Anagrus breviphragma* Soyka (Hymenoptera: Mymaridae), which was recently synonymized under *A. incarnatus* Haliday (Triapitsyn 2015), *A. columbi* Perkins, and *Polynema saga* (Girault) (all Hymenoptera: Mymaridae), and also by *Aphelinoidea semifuscipennis* Girault, *Oligosita clarimaculosa* (Girault), *Oligosita desantisi* Viggiani, *Oligosita* sp., *Paracentrobia tapajosae* Viggiani, and *Pseudoligosita longifrangiata* (Viggiani) (all Hymenoptera: Trichogrammatidae) (Virla et al. 2009; Moya-Raygoza et al. 2012, 2014; Moya-Raygoza & Becerra-Chiron 2014); however, identification of the two last species needs verification. Mexico is considered to be the center of origin of the genus *Dalbulus* DeLong (Nault 1990). Therefore, diversity of the natural enemies of the corn leafhopper is presumed to be high in Mexico. The objective of this study was to conduct surveys to find egg parasitoids that could be used as potential biological control agents to improve control of *D. maidis* populations in corn fields.

Egg parasitoids were surveyed in 2 sites where maize is cultivated in the State of Jalisco in central Mexico. The first site was Zapopan, located at 20.7333 °N, 103.5000 °W, 1,662 m above sea level, and this survey was conducted Apr to May of 2013. The second site was El Grullo, located at 19.8166 °N, 104.2333 °W, 888 m above sea level, and this survey was conducted Aug to Sep of 2016. Two-week-old *D. maidis* females that were reared in the laboratory were allowed to oviposit in the potted ancho-pozolero maize plants at a 3 to 6 leaf stage. For the oviposition period, 5 to 10 females were confined in a single leaf cage containing a leaf of a live maize plant for 72 h. During this period maize plants and insects were maintained in a rearing room at 25 ± 2 °C, 50% relative humidity, and a photoperiod of 12:12 h L:D. After the oviposition period, the pots containing maize leaves with sentinel eggs were transported immediately to the maize fields. The pots with the sentinel maize plants remained in the field for 5 d to allow exposure to egg parasitoids. After 5 d, the sentinel maize plants were transported to the laboratory, where the leaves with the exposed eggs were cut from each maize plant and transferred to a Petri dish with wet tissue paper. The dishes were covered with plastic food wrap to avoid desiccation and prevent escape of the emerged wasps. Parasitized egg masses were maintained in the rearing room and checked every other day for 35 d to collect the emerging parasitoid adults, which were preserved in 95% ethanol. Adult parasitoids that were considered to be possible new records were slide-mounted in Canada balsam or in Faure liquid, and deposited in the entomological collection of the University of Guadalajara, Jalisco, Mexico (CAJAPE), or the Entomology Research Museum, University of California at Riverside, California, USA (UCRC). Identification of the new records was made using the keys in Triapitsyn (1997, 2002) for *Anagrus* spp. and Owen (2011) for *Ufens* sp. (Trichogrammatidae).

We are reporting for the first time *Ufens niger* (Ashmead) (Hymenoptera: Trichogrammatidae) as an egg parasitoid of the corn leafhopper. At El Grullo site, 3 females and 1 male of this species emerged on 11 Sep 2016, and 2 females and 1 male emerged on 15 Sep 2016. In the revision by Owen (2011), the leafhoppers reported as hosts of *U. niger* are *Colladanus geminatus* (Van Duzee); *Cuerna costalis* (F.); *Draeculacephala mollipes* (Say); *Homalodisca* sp.; and *Keonella confluens* (Uhler) (all Hemiptera: Cicadellidae). *Ufens niger*, however, is not a new record for Mexico as it was previously reported by Owen (2011) from the states of Nuevo León and Veracruz.

Moreover, herein we are reporting for first time *Anagrus nigriventris* Girault (Hymenoptera: Mymaridae) as an egg parasitoid of *D. maidis* in Mexico. One male emerged on 20 Apr and 1 female on 27 May, both in 2013, in Zapopan, Jalisco. Previously this species was reported attacking eggs of the corn leafhopper in Argentina (Luft Albarracin et al. 2006). In addition, *A. nigriventris* has other leafhopper hosts such as *Aceratagallia* sp.; *Neoaliturus* (*Circulifer*) *tenellus* (Baker); *Empoasca* sp.; *Erythroneura comes* (Say); and *Scaphytopius nitridus* (DeLong) (all Hempitera: Cicadellidae) (Triapitsyn & Moratorio 1998). With the 2 new records reported in this study for Mexico, the total number of

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egg parasitoids is increased to 11, thus supporting the hypothesis that Mexico is very likely to be the country with the highest richness of egg parasitoids that attack *D. maidis* egg in maize habitats. Clearly, both species should be evaluated as biological control agents against *D. maidis* in future studies.

Voucher specimens of *U. niger* were deposited in the Entomology Research Museum, University of California at Riverside, California, USA (UCRC) and the entomological collection of the University of Guadalajara, Jalisco, Mexico (CAJAPE); those of *A. nigriventris* were deposited in CAJAPE. We thank Vladimir V. Berezovskiy (UCRC) for mounting parasitoids in Canada balsam. Field work was sponsored in part by the program PROSNI (Universidad de Guadalajara), given to G. Moya-Raygoza.

Summary

Ufens niger (Ashmead) (Hymenoptera: Trichogrammatidae) is reported for the first time as an egg parasitoid of the corn leafhopper, *Dalbulus maidis* (DeLong) (Hemiptera: Cicadellidae), which is one of the most important pests of maize in the Americas. In addition, eggs of *D. maidis* were found to be parasitized also by *Anagrus nigriventris* Girault (Hymenoptera: Mymaridae) for the first time in Mexico. *Ufens niger* was found in 2016 in El Grullo and *A. nigriventris* was found in 2013 in Zapopan; both sites are in Jalisco State in central Mexico.

Key Words: maize, biological control

Sumario

Por primera vez se reporta a *Ufens niger* (Ashmead) (Hymenoptera: Trichogrammatidae) atacando los huevos de la chicharrita del maíz *Dalbulus maidis* (DeLong) (Hemiptera: Cicadellidae), quien es una de las plagas más importantes del maíz en el continente Americano. Además, se reporta por primera vez a *Anagrus nigriventris* Girault (Hymenoptera: Mymaridae) atacando los huevos de *D. maidis* en México. *Ufens niger* se encontró en 2016 en el Grullo y *A. nigriventris* se encontró en 2013 en Zapopan, ambos sitios están en el Estado de Jalisco, México.

Palabras Clave: maíz, control biológico

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