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FIRST REPORT OF A PREDACEOUS WASP ATTACKING NYMPHS OF *DIAPHORINACITRI* (HEMIPTERA: PSYLLIDAE), VECTOR OF HLB

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Since 2008, a wasp species has been observed to predate nymphs of *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae) (Fig. 1), the Asian citrus psyllid, one of the vectors of the bacterial pathogen *Candidatus Liberibacter asiaticus*, causal agent of the deadly citrus greening disease (Xuet al. 1998; Garnier & Bové 2000). The wasp species was identified as the Mexican honey wasp, *Brachygastra mellifica* (Say 1837) (Vespidae: Polistinae) by M. Buck. This wasp was first observed attacking *D. citri* nymphs in 2008 in sweet orange, *Citrus × sinensis* (L.) Osbeck (Rutaceae),

and lemon, *Citrus × limon* (L.) Burm. f. (Rutaceae), groves, planted 3 to 5 yr ago in Río Bravo, Tamaulipas, México (25°56'39.12"N, 98°07'3.9"W, 28. 2 elev.). We have been observing *B. mellifica* since 2008 at Río Bravo, and have found that its predatory activity is greatest during Jul through Sep when a high population of *D. citri* nymphs is present on new flush.

B. mellifica are small ocial wasps (body length 7-9 mm), and are one of the few insect species, other than honey bees, that produce and store honey (Sugden & McAllen 1994). The species con-



Fig. 1. Adult of *Brachygastra mellifica* preying on nymphs of *Diaphorina citri* in Río Bravo, Tamaulipas, México. Aug 2008.

structs paper nests of 40-50 cm in diam when mature. The 10 or more horizontal cell combs are surrounded by an outer envelope. Nests are placed in the mid-canopy of a tree or shrub 1 to 9 m above ground level (Sugden & McAllen 1994). The nests of *B. mellifica* are populous and can house from 3,500 to 18,700 wasps (Hastings et al. 1998).

The genus *Brachygastra* occurs from the southern U.S. (Texas, possibly Arizona) to northern Argentina and includes a total of 16 species (Richards 1978). Three species are known from Mexico: *B. mellifica*, *B. azteca* (Saussure 1857) and *B. smithii* (Saussure 1853). *B. mellifica* ranges from Texas into Nicaragua. It appears to be the only species of the genus in northeastern Mexico, whereas *B. azteca* has a more southern and western distribution, and *B. smithii* is known from Chiapas only (Richards, 1978). *Brachygastra* is a fairly distinctive genus of social wasps that is unlikely to be confused with other wasps except for certain species of the solitary genus *Pachodynerus* (Vespidae: Eumeninae), which possess a much larger first metasomal segment.

In the nearby Lower Rio Grande Valley of Texas, wasps gather nectar from wild or exotic flowers including sunflower (*Helianthus annuus* L., Asteraceae) and mesquite (*Prosopis glandulosa* Torr., Fabaceae) (Sugden & McAllen 1994). The wasps have also proven to be efficient pollinators of avocado (*Persea americana* Mill., Lauraceae) (Castañeda-Vildozola et al. 1999; Ish-Am et al. 1999). Besides nectar, they gather honey dew excreted by aphids (Aphididae) and psyllids (Psyllidae) (Sugden & McAllen 1994).

Reports on predacious activity of *Brachygastra* are scarce and refer mostly to boring or plant tissue mining of prey species. In the U.S., *B. mellifica* was reported to prey on the flower-mining larvae of the weevil *Anthonomus aeneolus* Dietz (Curculionidae), and on a many-plumed moth (Alucitidae) (Sugden & McAllen 1994). In Brazil, the closely related species *B. lecheguana* was observed hunting cotton boll weevil larvae, *Anthonomus grandis* Boheman (Soares & Lara 1994) and white coffee leaf miner larvae, *Perileucoptera coffeella* Guérin-Meneville (Lyonetiidae) (Parra et al. 1977; Gravena 1983).

We observed that *B. mellifica* generally attacks *D. citri* nymphs on the new flushes of citrus (Fig. 1). They appear to be efficient predators because they explore the new flushes rapidly and move much more quickly from one twig to another than other predators of *D. citri* nymphs, such as the Asian lady beetle, *Harmonia axyridis* (Pallas), and the lady beetle, *Cyclonedasanguinea* (L.) (Coleoptera: Coccinellidae).

In 2008 the distance between the wasp nest and the foraging place was approximately 30 m.

On the other hand, in 2009 we observed that the wasps had built a nest inside a grove in an orange tree; it lasted for about 2 yr, but was abandoned early in 2011. During 2008 and 2011, we have observed psyllid nymphs being predated by *B. mellifica* in absence of any nests in the vicinity. During the summer time, when the population of *D. citri* nymphs increases, the predation by *B. mellifica* was observed all day, but predation was most intense from 800-1200 h and from 1600-1900 h.

To determine the amount of nymphs consumed by *B. mellifica*, a video was filmed by a Canon® Power Shot S3IS de 6.0 Megapixeles. The numbers of nymphs consumed were registered by analyzing the video in a personal computer. This was accomplished by selecting flushes from 5 to 10 cm long infested by 4th to 5th instar *D. citri* nymphs. These leaves were removed, and those with nymphs were then exposed to *B. mellifica* at its foraging time.

The period of time that *B. mellifica* was foraging on new flushes infested by *D. citri* nymphs varied from less than 1 min up to 16 min approximately, depending on the size of the nymph population. The average consumption of *B. mellifica* was one 4th or 5th instar nymph every 30 seconds ($n = 50$). The maximum number of nymphs consumed at one time was 31 nymphs in 16 min. Evidence of the such predatory activity of *B. mellifica* was documented on the video: <http://www.inifapcirne.gob.mx/Videos.htm>.

Based on our field observations in Río Bravo, Mexico, we believe that *B. mellifica* has the potential to be a suitable biological control agent against *D. citri*. Further studies should focus on the efficiency of *B. mellifica* as a predator, development of a protocol for the relocation of wild colonies to citrus groves, and possibly mass rearing this species.

SUMMARY

Since 2008, in México, a new natural enemy of *Diaphorinacitri* has been observed predated on nymphs of this psyllid vector of citrus greening disease. This wasp was identified as *Brachygastra mellifica* (Say 1837), the Mexican honey wasp. This wasp was observed attacking all *D. citri* nymph instars, and it appears to have the potential to serve as a tool in integrated biological control programs.

RESUMEN

Desde 2008, en México, se detectó un nuevo enemigo de *Diaphorina citri*. Fue identificado como *Brachygastra mellifica*, la avispa mexicana de la miel. Este insecto se observó atacando a todos los instares ninfales de *D. citri*. Su uso en programas de control biológico podría ser importante.

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