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FIRST RECORD OF *ASPHONDYLIA WEBSTERI* (DIPTERA: CECIDOMYIIDAE) INFESTING HASS AVOCADOS

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Asphondylia websteri Felt (Diptera: Cecidomyiidae) is a polyphagous galling midge that attacks immature fruiting bodies of native and exotic crop plants in the southwestern U.S.A. (Barnes 1946; Gagné 1989, 1994; Gagné & Wuensche 1986; Gagné & Woods 1988.) There are over 250 described species of *Asphondylia*, with many additional known species that are undescribed (Gagné 2004; Gagné & Waring 1990). *Asphondylia* is cosmopolitan in distribution and the majority of species appear to be mono- or stenophagous (Barnes 1939; Gagné 2004). Some *Asphondylia* spp. exhibit sufficiently high host fidelity that they have been considered as classical biological control agents for invasive weed species (Cruickwell-McFadyen & Bennett 1995). Other species of *Asphondylia*, like *A. websteri* and *A. gennadii*, are polyphagous, and in some instances, can be important pests on non-native crops (Gagné & Orphanides 1992; Gagné & Wuensche 1986; Rogers 1972).

The exact home range of *A. websteri* is uncertain, but southwestern U.S.A. and northern Mexico are thought to be areas constituting the natural range in North America (Gagné & Orphanides 1992; Gagné & Woods 1988; Rogers 1972). *Asphondylia websteri* may be an invasive pest in the Dominican Republic that was accidentally introduced from the U.S.A. with a commercial legume, guar (*Cyamopsis tetragonoloba* [Fabaceae]) (Gagné & Wuensche 1986). At the time the work reported here was conducted in Guatemala, the range of *A. websteri* was not known to have extended into Central America (R. Gagné, pers. comm. 2008).

During surveys over the periods Nov 13, 2007 to Dec 21, 2007 and Mar 13 to Apr 30, 2008 for avocado (*Persea americana* Miller [Lauraceae]) fruit feeding insects in Guatemala, small deformed fruit of the cultivar 'Hass' were observed in several commercial Hass avocado orchards. At an orchard in Sumpango, Sacatepéquez (N14°40.292; W90°43.195; elevation 1,825 m), the orchard owner and manager indicated that this was a common occurrence for Hass fruit that was set during the off-bloom period that occurs over the period Aug through Sep each year. Despite regular broad-spectrum pesticide applications during flowering over the off bloom period, it was estimated that at least 80% of small fruit (<2 cm) set were deformed (i.e., elongate and slightly curved) in this orchard in Sumpango and distorted fruit were dropping prematurely from trees. Dissection of misshapen fruit hanging on trees revealed the presence of internally feeding larvae. On Dec 1, 2007, approxi-

mately 150 small deformed fruit <2.0 cm in length were collected from the Sumpango orchard and held in ventilated plastic containers for insect emergence over a 2-week period at 22.56°C ± 0.19 and RH 71.33% ± 4.89 (temperature and humidity measured with a Hobo data logger, Onset Corp., Bourne, MA, at 60-min intervals).

Off bloom in 2 additional commercial Hass orchards under intensive broad spectrum insecticide treatments were examined for deformed fruit in Dec 2007. The first of these 2 orchards was in Parramos, Sacatepéquez, Guatemala (N14°37.174; W90°47.421; elevation 1925 m), and the second was in Antigua, Sactepéquez, Guatemala (N14°34.441; W90°43.284; elevation 1932 m). Infestation levels for both orchards was estimated at 70-85% from examination for misshapen fruit developing from the off bloom set. Deformed off bloom fruit were not collected from either of these 2 sites for rearing of insects.

In Guatemala, the principal bloom for Hass avocados occurs during Dec through Feb and fruit set from this flowering period is the major crop that is harvested. On Mar 14, 2008, Hass fruit setting from principal bloom were examined at the Sumpango orchard (deformed off bloom fruit had been collected at this site in Dec 2007) for deformed fruit. No distorted fruit were found. On Mar 25, 2008, fruit setting from principal bloom at the Parramos and Antigua Hass avocado orchards were examined for misshapen fruit. Infestation levels at both of these orchards was very low and estimated to be <5%. Around 60 deformed fruit <2 cm in length set during the principal bloom were collected from both orchards, and held in labeled ventilated plastic containers for emergence of insects in the laboratory under similar conditions as described previously.

A cecidomyiid fly, *A. websteri*, was reared from harvested deformed Hass avocado fruit that were set during off bloom and principal bloom in Guatemala. This is the first record of this midge infesting avocados and the first documented collection of this cecidomyiid from Central America. It is unknown if this finding represents part of the natural range of *A. websteri*, or whether this cecidomyiid has been accidentally introduced into Guatemala from North America. From these extremely limited surveys of Hass avocados, it would appear that the severity of *A. websteri* infestations vary in intensity between the off and principal blooms, with the off bloom crop potentially being more heavily attacked. However, much more work over several consecutive bloom-

ing periods would be needed to verify this suggestion for Hass avocados in Guatemala. Further, no infestation information was collected for the extremely abundant but unmanaged non-Hass avocados growing in Guatemala and surveys for *A. websteri* attacking these potential hosts also would be warranted.

Specimens of *A. websteri* adults and pupal cases reared from Hass avocados in Guatemala have been deposited in the University of California at Riverside Entomology Museum (ascension numbers are UCRCENT 169685-7) and with the Systematic Entomology Laboratory, USDA-ARS, in Washington DC, U.S.A. Larvae of this galling midge were heavily parasitized by 5 species of hymenopteran parasitoids in 4 families. The parasitoid species reared from *A. websteri* in Guatemala were *Lyrcus* sp. (Pteromalidae) (UCRCENT 169552-3; 23900), *Paragaleopsomyia* sp. (Eulophidae) (UCRCENT 169535-6; 023896), *Rileyia* sp. (Eurytomidae) (UCRCENT 169537; 023890), *Torymus* sp. A (Torymidae) (UCRCENT 169541-3; 023891; 023893; 023898; 023899), and *Torymus* sp. B (UCRCENT 169538-40; 023888; 023889; 023892; 023895; 023894; 023897). In descending order, the frequency of reared parasitoid species was *Torymus* sp. B (constituted 45% of reared material), *Torymus* sp. A (20%), *Lyrcus* sp. (18%), *Paragaleopsomyia* sp. (13%), and *Rileyia* sp. (5%). Vouchered parasitoids and *A. websteri* have been point-mounted and others have been preserved for DNA analysis in the University of California Riverside Entomology Museum. In addition to parasites attacking larvae of *A. websteri*, *Epipona guerini* Saussure (Hymenoptera: Vespidae: Polistinae) (UCRCENT 137020) was observed in the Sumpango orchard on Dec 1, 2007 systematically inspecting deformed fruit. The vespid chewed circular holes in infested fruit, extracted larvae, and ate them. Photographs of deformed avocado fruit, *A. websteri* emergence holes in fruit with protruding pupal cases, adult *A. websteri*, and *E. guerini* opening deformed fruit and consuming midge larvae are available on the web (Hoddle 2008).

Asphondylia websteri is the second galling midge now known to attack young avocado fruit. *Bruggmanniella perseae* Gagné (Diptera: Cecidomyiidae) has been recorded causing very similar damage in Costa Rica and Colombia where it is considered a severe pest (Gagné et al. 2004). Part of the native range of *A. websteri* encompasses southern California (Gagné & Woods 1988) which puts populations of this midge in sympatry with the largest Hass avocado growing areas in the U.S.A. (~26,500 Ha, CAC 2008). Curiously, this midge has not been recorded attacking young Hass fruit or other avocado cultivars in southern California. There are 4 possible reasons for this. First, *A. websteri* does attack developing fruit over the single fruit set period Apr-Jun each year in southern California. Damaged fruit could have gone un-

noticed because infestations are inconsequential, possibly due to natural enemy activity, and attacks do not adversely affect expected crop yields. Second, significant damage does occur but has simply gone unrecognized because deformed fruit are aborted and this has been considered a normal developmental occurrence for Hass fruit during fruit set. Third, the phenology of early Hass fruit development does not coincide with reproductively active populations of *A. websteri* so this insect has never emerged as a serious avocado pest in southern California. Fourth, avocados are not attacked in southern California because they are not a preferred host when more highly favored native plants are present when avocados are setting fruit that would be vulnerable to attack. The possible association of *A. websteri* with avocados, in particular the commercially important Hass cultivar, in southern California warrants future research.

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