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OBSERVATIONS ON *ASPHONDYLIA WEBSTERI* (DIPTERA: CECIDOMYIIDAE) INFESTING HASS AVOCADOS IN GUATEMALA

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Asphondylia websteri Felt (Diptera: Cecidomyiidae), has been recorded attacking immature avocados *Persea americana* Miller (Lauraceae) in Guatemala, and internally feeding larvae cause deformation and abortion of immature avocados (Hoddle 2008). In Guatemala, Hass avocados have 2 flowering periods, minor off bloom over Aug through Sep, and principal flowering over Dec through Feb. Limited surveys of Hass fruit in Guatemala over 2 separate periods spanning Nov 2007 to Apr 2008 indicated that ~85% of small Hass fruit set from off bloom exhibited deformation consistent with *A. websteri* infestation. Attack rates on immature Hass fruit set from principal bloom were estimated at ≤5% (Hoddle 2008). The activity of *A. websteri* was examined again in an expanded survey of 4 commercial Hass avocado orchards in Guatemala during off bloom over the period 17 Nov 2008 through 14 Jan 2009. These orchards were being used as part of a larger study on pest Lepidoptera. The results of surveys for *A. websteri* are presented here.

The locations and orchard details of the 4 study sites were: (1) Sumpango, Sacatepéquez (N14°40.292; W90°43.195; elevation 1,825 m), with 1,100 trees ~8-10 years of age (~5 m in height); (2) Santa Ana, Sacatepéquez (N14°32.980; W90°43.203; 1583 m), 720 trees ~5 years old (~4-5 m). (3) Antigua, Sacatepéquez (N14°34.271; W90°43.179; 1771 m), ~170 trees ranging 18 months (~2 m) to ~8 years of age (~6-8 m), and (4) Antigua Sacatepéquez (N14°35.233; W90°42.557; 1881 m), ~300 trees ~ 5 years of age (~4 m).

At sites 2 and 3, the percentages of deformed fruit and normal fruit were estimated by randomly selecting 5 trees in each orchard and classifying every off bloom fruit on the tree as either being "normal" or "deformed." At site 2, 38% of trees in the orchard exhibited off bloom, and of 431 inspected fruit, 21% (n = 89) exhibited deformity due to *A. websteri* infestation. At site 3, 53% of trees had off bloom fruit and 100% of trees with off bloom had damaged fruit. Of 606 randomly inspected fruit across 5 trees at site 3, 54% (n = 326) of fruit displayed abnormalities consistent with *A. websteri* attack. At site 3, the effect of *A. websteri* infestation on fruit growth was compared to comparably aged fruit that were not infested. On each of 5 randomly selected trees with off bloom fruit, the lengths of 9-35 (exact number measured depended on fruit abundance) randomly selected deformed (n = 129) or normal fruit (n = 137) were measured per tree for a total of 266 measured fruit. The average fruit length for deformed fruit was 5.75 ± 0.02 mm. Undamaged fruit were 4.11 times longer with a mean length of 23.64 ± 0.05 mm.

At each site, immature fruit exhibiting characteristic *A. websteri* deformation (see Hoddle 2009 for photos of damaged fruit) were picked from at least 10-15 randomly selected trees, isolated individually in labeled, ventilated, plastic 0.6-mL micro-centrifuge vials, and maintained in the laboratory at 17°C ± 0.03, %RH 52% ± 1.67 under ambient light (L:D ~12:12). The identity, sex, and numbers of *A. websteri* and parasitoids that emerged per fruit by orchard and collecting date were recorded. Fruit were kept until desiccation at which time they were discarded. Altogether, 928 fruit were picked from 4 orchards. Specifically, 46 distorted fruit were collected from site 1 on 22 Nov 2008; 88 fruit were picked from site 2 on 27 Nov 2008. Two collections were made from site 3; 321 fruit were collected 21 Nov 2008, and on 24 Nov 2008 an additional 253 fruit were picked for a total of 574 fruit. On 16 Dec 2008, 220 deformed fruit were collected from site 4. *A. websteri* emerged from 6% of individually isolated fruit (n = 57). Only 1 *A. websteri* emerged per fruit, of which 60% were female, and 74% of emergence holes were in the top third of the fruit near the pedicel, 7% of flies each emerged from the middle and bottom thirds of fruit, and in 12% of fruit an unambiguous emergence hole was not detected. Parasitoid emergence was recorded from 27% of fruit (n = 248), and nothing emerged from 67% of deformed fruit (n = 623). The low emergence of flies and parasitoids from deformed fruit was unexpected. To better understand the relationship between deformed fruit and infestation with *A. websteri*, an additional 291 deformed fruit were collected from site 4 on 16 Dec 2008. Fruit were opened longitudinally with a razor blade, and contents examined with a 20× hand lens. Of these dissected fruit, 18% (n = 52) had live larvae supporting the observation of low rates of larval presence at time of sampling. Dissection results suggested that either *A. websteri* larvae were too small to be seen, or that oviposition by *A. websteri* caused fruit deformation regardless of whether eggs were laid or larvae hatched, or that adult flies and associated parasitoids had emerged prior to dissection and deformed fruit without ob-

TABLE 1. SPECIES IDENTITIES, NUMBER REARED, SEX RATIO, AND VOUCHER SPECIMEN ASCENSION NUMBERS OF PARASITOIDS THAT EMERGED FROM HASS AVOCADO FRUIT EXHIBITING *ASPHONDYLIA WEBSTERI* DAMAGE IN GUATEMALA.

Species identity*	Total number reared	Proportion of females	Ascension number
Eulophidae			
Paragaleopsomyia sp.	212	0.65	UCRC ENT: 172355, 172356, 172364, 172366,
Galeopsomyia sp. 1	47	0.53	UCRC ENT: 172369, 172374
Galeopsomyia sp. 2	56	0.46	UCRC ENT: 91483, 91484
Galeopsomyia sp. 3	2	0	UCRC ENT: 91490
Aprostocetus sp.	1	1	UCRC ENT: 91487
Torymidae			
Torymus solidaginis	25	0.48	UCRC ENT: 91486, 172383
Torymus bedeguaris species group	17	0.47	UCRC ENT: 172380, 91488
Torymus sp.	8	1	UCRC ENT: 91489
Pteromalidae			
Lyrcus sp.	2	1	UCRC ENT: 91491
Eurytomidae			
Rileya sp.	14	0.79	UCRC ENT: 172377, 91485

*Automontage photos of all identified parasitoids are available (Hoddle 2009).

vious emergence holes had not been aborted. It is possible that other insects, such as flower thrips (e.g., *Frankliniella* spp.), may have caused fruit deformation similar to that associated with *A. websteri* infestation.

A total of 384 parasitoids were reared from fruit exhibiting *A. websteri* deformation. Parasitoids represented 10 species from 4 families and representative voucher specimens with ascension numbers have been deposited in the Entomology Museum at the University of California, Riverside (Table 1). The number of individual parasitoids emerging from fruit ranged from 1 to 7. A single parasitoid emerged from 71% of fruit, and 2, 3, ≥4 individuals were reared from 15%, 7%, and 7% of fruit, respectively. A single parasitoid species was reared from 94% of fruit. Six percent of fruit produced 2-3 different parasitoid species suggesting hyperparasitism may be occurring in this system. The parasitoid genera reared in this study have been previously recorded (Hoddle 2008). However, the parasitoid species composition reported here was significantly different with 6 additional species being reared and *Paragaleopsomyia* sp. dominating at 55% of reared material. These important faunal differences could be related to intensity of sampling, and the addition of extra study sites not previously surveyed. The timing of this study overlapped with previous sampling efforts (Hoddle 2008) suggesting that large year to year variation in the parasitoid fauna attacking *A. websteri* larvae may occur.

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