Proceedings V World Avocado Congress (Actas V Congreso Mundial del Aguacate) 2003. pp. 503-508.

LEPIDOPTEROUS PESTS OF FLORIDA AVOCADO: BIODYNAMICS, MORTALITY FACTORS AND CONTROL

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SUMMARY

The omnivorous loopers, *Epimeces detexta* (Walker), *E. matronaria* (Guenée), *Anacamptodes matronaria* (Guenée) and *Oxydia vesulia transponens* (Walker)

feed on the foliage of avocado and at times on fruits whereas the leafroller, *Caloptilia perseae* (Buck) causes minor damage to young foliage. Larval development of *E. detexta* and its consumption of foliage were determined. The *E. detexta* life cycle is as follows: egg (5 days), larva (17-20 days), prepupa (2 days) and pupa (10 days).

Three orchards were used to determine the population dynamics of the loopers . A larval parasitoid, *Parapanteles* sp., as well as a pupal parasitoid, *Trichospilus diatreae* were collected from specimens held under laboratory conditions. Efficacy of different insecticides was determined on the avocado leaf roller.

Key Words: avocado loopers, dynamics, biology, parasitoids

INTRODUCTION

Species within the families, Geometridae, Tortricidae and Gracillariidae are widely represented as avocado pests around the world. The tortricid, *Amorbia cuneana* Walsingham, the western avocado leafroller, the avocado loopers *Anacamptodes defectaria* (Guenée), *Epimeces detexta* (Walker), *Epimeces matronaria* (Guenée), *Oxydia vesulia transponens* (Walker) and *Sabulodes aegrotata* (Guenée), the gracillariid *Gracillaria perseae* Busk and *Phyllocnistis* sp, are seasonal pests that eventually cause economic damage to avocado in different regions of the world (Wysoki et al., 2002; Bailey and Hoffman, 1979)

Epimeces detexta (Walker) is one of the most common loopers affecting avocado in Florida and gained pest status since 1985. Damage by *E. detexta* normally affects flower panicles, fruit and leaves of avocado, but it can be found feeding on foliage of other fruit species, such as *Annona* spp. Heavy infestations can cause severe defoliation, the weakening of trees and yield reductions (Glenn, pers. obs).

The objectives of this research were to: 1. Study larval development and leaf area consumption, followed by studies of the pest dynamics and identification of its natural enemies. 2. Determine effectiveness of insecticides on the avocado leafroller.

MATERIALS AND METHODS

Larval development, leaf consumption and life cycle of E. detexta. Newly eclosed larvae (n = 518) were individually placed in 50 x 9 mm petri dishes lined with filter paper and provided one or several 5.07cm^2 cv. 'Peterson' leaf portions, depending on larval size and held at approximately 27°C, 80% RH. Larvae were checked daily to determine moulting and head capsules measured under a microscope. Specimens with head capsules measuring 15-80 μm were measured at x50 magnification while larger specimens were measured at x25 or x12 as required. When small larvae stopped leaf consumption, the leaf discs were removed and consumed area was measured. Pupal and adult stages were then held under the same conditions. Eggs (n = 7804) deposited by females (n = 7) were held until eclosion.

Seasonality of Geometridae in avocado orchards.. Three commercial avocado groves were used as study sites. The groves were examined weekly from 21 May 1986 to 26 May 1987. Number of larvae recorded during a 30 min. inspection of branches. Larvae were collected and head capsule widths recorded. Larvae were held under laboratory conditions in order to determine the presence of natural enemies.

Leaf Roller Control on Avocado, 2001. The trial was conducted in a commercial orchard located 6 miles northwest of Homestead. The trees were 7 to 8 feet tall. Eight treatments (Table 3) were replicated 10 times in a RCB design. Each replicate consisted of an individual tree. Treatments were applied with a hand-gun sprayer operating at 350 psi and delivering 100 gpa of finished spray (~1 gal/tree). The insecticides were compared for efficacy against the avocado leafroller, *Caloptilia perseae*, which feeds on the underside of the leaves. The insecticides were applied on October 17, and October 24, 2000. Samples consisted of 3 leaf flushes (ca. with 3-4 leaves) from the periphery of each tree (ca. 15 leaves per tree), collected 2 days before treatment (DBT) and 5, 12 [5 days after second treatment], and 20 days after treatment (DAT)[13 days after second treatment]. Samples were brought to the laboratory where the number of live and dead larvae were recorded per flush. We also recorded the number of larvae that were parasitized by an unknown Braconidae. The data was analyzed using PROC GLM and

Means separated by using Waller Duncan test.

RESULTS AND DISCUSSION

Field Observations. E. detexta eggs are deposited in clusters of 60 to 1100, primarily in the upper canopy of avocado trees. Females appear to prefer egg deposition on long and thin surfaces, such as needles of Australia pine (*Casuarina* sp.), remaining midvein of an avocado leaf, larval webs, golden orb spider webs. The adult *E. detexta* is short-lived and mates and oviposits soon after emergence from the pupa.

Life cycle, larval development and leaf consumption. Each female deposits an average of 1114 eggs; eggs hatch within 4.69 days, average larval development was 28.07 d, pupae, 9.95 d and adults live approximately 6.33 d. Total life cycle was approximately 49.04 d (Table 1). Young larvae, up to 0.64 cm in length are usually grey to greyish black, but when approach 3.81 or more in length are regularly brownish to greenish yellow. Larvae consumed an average 137.74 cm^2 leaf tissue of which 77.5% was consumed during the 7^{th} instar. Females consumed 26.2% more foliage (153.7 cm^2) than males (121.8 cm^2); female pupae were 24% heavier (0.31 g) than male pupae (0.25 g). No significant differences were observed on head capsule width between males and females (Table 2). Under field conditions, all larvae feed on new flush; First and 2^{nd} instar larvae cause leaf notching, while mature larvae consume almost the whole leaf.

Seasonality Four species of Geometridae were collected during this study. *E. detexta* (Walker), *E. matronaria* (Guenée), *Anacamptodes defectaria* (Melanies) and *Oxydia vesulia trasnponens* (Walker). For the first two groves, the highest peaks were observed for *E. detexta*; the remaining species were observed sporadically throughout the year.

For the third grove, *E. matronaria* had similar or higher peaks than *E. detexta*. Peaks of

E. matronaria were observed during fall and winter whereas *E. detexta* increased throughout the year (Fig 1).

Mortality Factors. A larval parasitoid, *Parapanteles* sp., and a pupal parasitoid, *Trichospilus diatraeae* Cherian and Margabandhul were collected from the specimens hed under laboratory conditions. The predators *Calleida decora* (Fabricious) and *Podisus maculiventris* (Say) were observed feeding on *E. detexta* larvae. A unidentified granulosis virus was observed causing mortality to late larval instars.

Two exotic parasitoids, *Telenomus alsophilae* Viereck and *Trichogramma platneri* Nagarkati were released in *E.detexta* infested groves, none were recovered.

Chemical Control Caloptilia perseae. Pest pressure was considered high through the season, with an average number of 1.68 to 2.07 larvae per leaf flush before application of insecticides. Five to 20 days after treatment, the treatments Danitol, Provado, and Calypso had less larvae alive than on the untreated control or on the Proclaim, Proclaim + oil and Spintor treated trees. However, the actual number of larvae killed by either insecticide was not significantly different from the control 20 days after the first treatment and 13 days after the second treatment. More larvae were parasitized on the untreated control trees than on trees treated with either of the insecticides. No phytotoxicity was observed after any of the spray treatments.

CONCLUSIONS

Epimeces detexta, E. matronaria, O. vesulia transponens feed in avocado leaves in Florida and occasionally damage young fruit. Looper infestations appear to be somewhat seasonal and more severe in spring and summer, generally becoming less of a problem in autumm and winter. The adult E. detexta is short lived, and mates and oviposits soon after emergence from the pupa. Native natural enemies of E. detexta include the predators *Calleida decora* and *Podisus maculiventris*. *Parapanteles* sp., and *Trichospilus diatreae* are natural enemies of *E. matronaria, A. defectaria* and *O. vesulia transponens.*

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Table 1. Life Cycle of *Epimeces detexta*

Egg	Larvae	Pupae	Adult	Total Life Cycle
Days ± SE	Days ± SE	Days ± SE	Days ± SE	Days ± SE
4.69 ± 0.13	28.07± 4.83	9.95 ± 0.76	6.33 ± 1.20	49.04 ± 6.92

Table 2. Larval development, Head capsule of *E. detexta* reared on mature and young foliage under laboratory conditions.

Leaf Type	Sex	Variable	1st Instar	2nd Instar	3rd Instar	4th Instar	5th Instar	6th Instar	7th Instar
Mature	m	Days	4.22±0.83	2.44±0.53	2.44±0.53	2.56±0.73	2.67±0.5	3.56±0.73	4.56±0.53
		HCW*	0.30±0.03	0.48±0.02	0.74±0.37	1.06±0.06	1.55±0.05	2.24±0.09	3.15±0.12
		LAC**	–***	—	0.86±0.17	1.31±0.29	4.68±0.84	20.95±3.89	95.01±17.99
	f	Days	3.14±0.38	2.86±0.69	2.57±0.53	2.00±0.00	3.14±0.90	3.86±0.69	5.71±0.76
		HCW	0.30±0.01	0.48±0.02	0.76±0.33	1.11±0.06	1.63±0.06	2.39±0.54	3.35±0.10
		LAC	—	—	0.94±0.23	1.43±0.23	6.83±0.84	25.62±3.98	118.86±20.08
	m	Days	3.30±0.70	1.87±0.46	1.96±0.47	2.14±0.71	3.00±0.87	4.41±1.01	4.60±0.55
		HCW	0.30±0.06	0.50±0.01	0.82±0.02	1.25±0.07	1.92±0.15	2.89±0.23	3.25±0.13
	f	Days	4.00±0.97	1.89±0.58	2.22±0.94	2.44±0.63	2.88±0.96	4.12±1.79	5.09±1.37
		HCW	0.30±0.01	0.50±0.02	0.80±0.06	1.24±0.07	1.82±0.20	2.63±0.36	3.38±0.15

* HCW = Head capsule width m= male

** LAC = Leaf area consumed (cms) f= female

***** Leaf consumption was not recorded.**

Table 3. Insecticides tested for control of *Caloptilia perseae*

Insecticide	Dose/Acre
Danitol 2.4EC	16 oz
Provado 1.6	5.30 oz
Proclaim	4.8 oz
Spintor 2SC	10 oz
Calypso	80 g
Petroleum Oil 435-66	1%
Untreated Control	—

Table 4. Average *Caloptilia* larvae alive before]Day 0] and after application of insecticides

Treatment	Day 0	Day 5	Day 12 = 5 d after second spray	Day 20 = 13 d after second spray
Control	2.12 a	2.10 a	1.39 a	2.77 a
Danitol 2.4EC	1.89 a	0.46 c	0.00 c	0.00 d
Provado 1.6	1.78 a	0.80 bc	0.04 c	0.29 cd
Proclaim	1.99 a	1.41 ab	0.42 b	2.32 ab
Proclaim + oil	2.73 a	1.17 bc	0.01 c	1.21 bcd
Spintor2SC	1.90 a	1.58 ab	0.15 bc	1.55 abc
Calypso	1.71 a	0.49 c	0.01 c	0.52 cd
p<	0.1952	0.0021	0.0001	0.0001

Table 5. Average *Caloptilia* larvae dead before]Day 0] and after application of insecticides

	Day 0	Day 5	Day 12 = 5 d after second spray	Day 20 = 13 d after second spray
Control	0.031	0.078 b	0.064 a	0.048 b
Danitol	0.042	0.696 a	0.000 a	0.000 b
Provado	0.009	0.649 a	0.094 a	0.017 b
Proclaim	0.000	0.423 ab	0.102 a	0.222 a
Proclaim + oil	0.000	0.544 ab	0.100 a	0.073 b
Spintor	0.020	0.582 ab	0.174 a	0.033 b
Calypso	0.034	0.362 ab	0.000 a	0.000 b
p<	0.6754	0.0828	0.1816	0.0087

Table 6. - Average *Caloptilia* larvae parasitized before]Day 0] and after application of insecticides

	Day 0	Day 5	Day 12 = 5 d after second spray	Day 20 = 13 d after second spray
Control	–	0.059	0.416 a	0.461 a
Danitol	–	0.000	0.000 b	0.000 b
Provado	–	0.090	0.058 b	0.022 b
Proclaim	–	0.036	0.027 b	0.000 b
Proclaim + oil	–	0.022	0.025 b	0.000 b
Spintor	–	0.065	0.000 b	0.033 b
Calypso	–	0.070	0.000 b	0.026 b
p<	–	0.5864	0.0001	0.0001

Fig 1 Population dynamics of avocado loopers in avocado orchards A, B, C, Homestead, Florida, USA