NOTE

Laboratory Toxicity of Chlorfenapyr to *Keiferia lycopersicella* (Lepidoptera: Gelechiidae)[1]

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The tomato pinworm, *Keiferia lycopersicella* (Walsingham), is an important pest of tomato in the southern United States, Mexico and the Caribbean (Poe, 1973, Florida Dept. Agric. & Cons. Serv., Div. Plant Industry, Entomol. Circ. No. 131). Eggs are deposited on the lower surfaces of leaves. Neonates mine leaves while older larvae form leafrolls or bore into fruit, primarily under the calyx. Thus, larvae are protected from direct exposure to insecticides during much of their lives. The insect has developed resistance to many of the insecticides applied for its control including fenvalerate (Brewer et al., 1993, Trop. Agric. 70: 179-184) and methomyl (Schuster et al., 1996, Crop Protection 15: 283-287). Recently, chlorfenapyr (AC 303, 630, American Cyanamid Co., Princeton, NJ) was found to be effective against the tomato pinworm (Schuster, 1996, Arthropod Management Tests 21: 186-187) on tomato. In order to monitor and manage potential resistance in the tomato pinworm to this new insecticide, the baseline toxicity of chlorfenapyr to tomato pinworm larvae was determined for populations collected within Florida before the insecticide became available to growers.

Foliage infested with tomato pinworm larvae was collected from tomato at Vero Beach, Parrish, and the Gulf Coast Research and Education Center (GCREC), Bradenton, and from eggplant at Immokalee in 1994, and from tomato at the Tropical Research and Education Center (TREC), Homestead, in 1995. Larvae were maintained in the laboratory on untreated tomato foliage until pupation. If sufficient eggs were obtained from emergent adults, hatching larvae (F_1 generation) were used in the bioassay. Otherwise, the populations were maintained on tomato foliage in the laboratory for one (F_2) to five (F_6) additional generations until sufficient larvae were obtained.

To conduct the bioassays, excised leaflets of tomato seedlings grown in a greenhouse were placed individually in 118-ml plastic specimen cups on a filter paper disc moistened with water. Each leaflet was infested with five neonates and each cup was sealed with a lid with an organdy-covered hole for ventilation. After 24 h, the leaflets

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Table 1. AC 303, 630 bioassay of *Keiferia lycopersicella* (Walsingham) from laboratory colonies and from collections from selected sites in Florida

Site/host*	Date (mo/yr)	n**	% Control mortality	Slope ± SE†	LC_{50}‡ (95% FL)§	$RR_{50}$$	LC_{90}‡ (95% FL)§	$RR_{90}$$	P¶
GCREC, tomato lab	Apr/94	646	0.0	1.20 ± 0.11	0.71 (0.56-0.88)	—	8.31 (5.83-13.5)	—	0.72
GCREC, tomato F_6 gen	Apr/94	629	1.0	2.12 ± 0.02	1.35 (1.18-1.54)	1.9	5.44 (4.44-6.99)	0.7	0.38
TREC, tomato F_4 gen	Aug/95	144	0.0	2.71 ± 0.43	0.54 (0.41-0.69)	0.8	1.60 (1.19-2.62)	0.2	0.32
IMM, eggplant F_1 gen	Apr/94	434	1.4	2.09 ± 0.27	1.20 (0.83-1.72)	1.7	4.92 (3.08-11.7)	0.6	0.06
Parrish, tomato F_3 gen	July/94	723	0.0	1.42 ± 0.11	1.20 (1.02-1.42)	1.7	9.64 (7.12-14.3)	1.2	0.16
Vero Beach F_2 gen	Oct/94	206	0.0	1.73 ± 0.30	1.13 (0.61-2.06)	1.6	6.22 (3.08-34.7)	0.8	0.09

* GCREC = Gulf Coast Research & Education Center, Bradenton; TREC = Tropical Research & Education Center, Homestead; IMM = Imokalee; lab = reference laboratory colony; F_1-F_6 = generations removed from the field.

** n, total number of insects tested excluding the control.

† Slope (SE), slope of the probit line and the standard error of the estimate.

‡ LC_x, lethality estimates based on ppm surface treated bioassays.

§ 95% FL, fiducial limits for the preceeding lethality estimate.

$ Resistance ratio to the laboratory colony.

¶ P, probability of the X^2 associated with testing the null hypothesis that the data were adequately described by the probit model.

were dipped in water or in aqueous preparations of six concentrations of chlorfenapyr (AC 303, 630 2SC). After drying, the leaflets were returned to the cups, which were resealed, and mortality was determined 24 h later. Each concentration was replicated 5 to 20 times depending upon availability of larvae and goodness of fit of data. Data for each dose were combined for replicates and were subjected to standard probit analyses using PROC PROBIT (SAS Institute, 1990, SAS/STAT User's Guide, Version 6, Fourth Edition, Vol 2, pp. 1325-1350). Resistance ratios were calculated for LC_{50} and LC_{90} values by comparing the field populations to a laboratory colony that had been maintained continuously on tomato foliage since 1978 at GCREC (Schuster and Burton, 1982, J. Econ. Entomol. 75: 1164-1165).

Resistance ratios indicated that LC_{50} values of the field populations generally were similar to that of the reference laboratory colony and ranged from 0.8 to 1.9 (Table 1). Because slopes for field populations tended to be steeper than the slope for the laboratory colony, the resistance ratios for LC_{90} values tended to be near to or less than unity with the reference colony. Thus, all field populations were susceptible to chlorfenapyr whether they were evaluated at the F_1 or F_6 generation. The populations from GCREC, TREC, and Vero Beach were collected from insecticide research plots that had been sprayed with a number of primarily experimental compounds. The populations from Parrish and Immokalee were collected from commercial vegetable farms that had been sprayed with registered insecticides, particularly methomyl. Therefore, susceptibility to chlorfenapyr appeared to be independent of exposure to insecticides of different chemistries. The bioassay method and data reported here can be used to monitor changes in susceptibility of the tomato pinworm to chlorfenapyr in the future and to document resistance easily should it occur.

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