N O T E

Effect of Selected Insecticides on the Leaffooted Bug (Hemiptera: Coreidae)[1]

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In the U.S., the tachinid fly *Trichopoda pennipes* (F.) is one of the most successful parasitoids of the southern green stink bug, *Nezara viridula* (L.) (Jones 1988, Ann. Entomol. Soc. Am. 81: 262-273). The leaffooted bug, *Leptoglossus phyllopus* (L.), (Hemiptera: Coreidae) is an alternative host of this parasitoid in various crops including corn, cotton, peanuts, sorghum, millet, and vegetables (Buschman and Whitcomb 1980, Florida Entomol. 63: 154-162; Tillman, unpubl. data). Disruptions of populations of these alternative hosts could have a negative impact on parasitoid populations. Therefore, the objective of this study was to determine the effect of acetamiprid, dicrotophos, oxamyl, and thiamethoxam on *L. phyllopus* 2nd and 4th instars and adults in both residual and oral toxicity tests.

Doses of each insecticide used in these experiments simulated the concentrations of field-use rates based on applications at a total volume of 93.5 L/ha. The test included the following four treatments and rates: (1) acetamiprid (Assail 70™ [577 μg/ml], Cerexagri, Inc., King of Prussia, PA), (2) dicrotophos (Bidrin 8™ [3,806 μg/ml], Amvac, Los Angeles, CA), (3) oxamyl (Vydate 2™ [2883 μg/ml], DuPont Agricultural Products, Wilmington, DE), and (4) thiamethoxam (Centric 25™ [715 μg/ml], Syngenta, Greensboro, NC).

Residual toxicity experiments were conducted to determine the effect on leaffooted bugs when walking on residues of the insecticides. In these tests, an insecticide treatment was sprayed on the top and bottom of a Petri dish (100 by 15 mm) using a Preval™ sprayer (Precision Valve Corp., Yonkers, NY). Water was used as the control. After the compounds were allowed to dry for 1 h, *L. phyllopus* 2nd instars were placed singly in Petri dishes. A randomized complete block design was used with 10 insects per block (day) for 4 blocks (40 insects per treatment). Insects were not fed during the exposure period to avoid the possibility of the insects feeding on contaminated food. After 24 h, insects were moved to clean Petri dishes and provided food

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and water. The whole procedure was repeated for *L. phyllopus* 4th instars and adults. If insects were unable to right themselves when turned on their backs, they were considered to be dead. Mortality was recorded 4 d after exposure to insecticide residues.

Oral toxicity experiments were conducted to determine the effect on leaffooted bugs when feeding on food contaminated with insecticide residues. Before the test, food (pole beans) was dipped and held in an insecticide treatment of 30 sec and placed on a wire screen for 1 h to allow the chemical to dry. Water was used as the control. After the materials dried, treated food was wrapped in Parafilm™ (American National Can, Menasha, WI) to eliminate the possibility of the insects being exposed to residues of the compound when feeding. Then, *L. phyllopus* 2nd instars were placed singly in the Petri dishes with treated food. A randomized complete block design was used with 5 insects per block (day) for a total of 3 blocks (15 insects per treatment). The same procedure was repeated for *L. phyllopus* 4th instars. The procedure was similar for *L. phyllopus* adults except only 2 blocks were established. If insects were unable to right themselves when turned on their backs, they were considered to be dead. Mortality was recorded 4 d after feeding on food contaminated with residues of the insecticides.

Residual and oral toxicity data were analyzed for developmental stages using PROC MIXED (SAS Institute 1999, SAS/STAT user's guide, version 8. SAS Institute, Cary, NC). The fixed effect was insecticide. Random effects were block, block by insecticide, and residual error. Least squares means were separated by least significant difference (LSD) (SAS Institute 1999) where appropriate.

In residual toxicity tests with *L. phyllopus*, a significant insecticide effect was detected for percentage mortality data 4 d after treatment of 2nd instars ($F = 308.85$; df = 4, 15; $P = 0.0001$), 4th instars ($F = 74.1$; df = 4, 1; $P = 0.0001$), and adults ($F = 15.49$; df = 4, 12; $P = 0.0001$). Residues of all the insecticides were highly toxic to *L. phyllopus* 2nd instars (Table 1). Residues of acetamiprid, dicrotophos, and oxamyl were highly toxic to 4th instars, but thiamethoxam was only slightly toxic to these immature leaffooted bugs. For adult leaffooted bugs, residues of dicrotophos were more toxic than residues of the other three insecticides. Acetamiprid was moderately

Table 1. Least squares means for percentage mortality 4 d after treatment for *L. phyllopus* 2nd instars, 4th instars, and adults walking on residues of acetamiprid, dicrotophos, oxamyl, and thiamethoxam

Insecticide	μg/ml	2nd instars	4th instars	Adults
Acetamiprid	577	100.0a	95.0a	50.0ab
Dicrotophos	3806	100.0a	100.0a	70.0a
Oxamyl	2883	97.5a	92.5a	30.0bc
Thiamethoxam	715	95.0a	32.5b	12.5c
Control		0b	2.5c	0c

Least squares means within a column followed by the same lowercase letter are not significantly different between insecticides for 2nd instars (PROC MIXED, LSD, $P > 0.05$, n = 40, SE = 3.5, df = 15), 4th instars (PROC MIXED, LSD, $P > 0.05$, n = 40, SE = 7.3, df = 12), and adults (PROC MIXED, LSD, $P > 0.05$, n = 40, SE = 10.1, df = 12).

Table 2. Least squares means for percentage mortality 4 d after treatment for *L. phyllopus* 2nd instars, 4th instars, and adults feeding on food contaminated with residues of acetamiprid, dicrotophos, oxamyl, and thiamethoxam

Insecticide	μg/ml	2nd instars	4th instars	Adults
Acetamiprid	577	53.3a	6.7b	10.0bc
Dicrotophos	3806	53.3a	53.3a	70.0a
Oxamyl	2883	6.7b	6.7b	10.0bc
Thiamethoxam	715	45.7a	40.0a	40.0ab
Control		0b	0b	0c

Least squares means within a column followed by the same lowercase letter are not significantly different between insecticides for 2nd instars (PROC MIXED, LSD, $P > 0.05$, n = 15, SE = 14.2, df = 68), 4th instars (PROC MIXED, LSD, $P > 0.05$, n = 15, SE = 13.2, df = 70), and adults (PROC MIXED, LSD, $P > 0.05$, n = 10, SE = 16.7, df = 45).

toxic, oxamyl was slightly toxic, and thiamethoxam was almost nontoxic to adults in residual toxicity tests. Tarsal contact with residues of dicrotophos and oxamyl also resulted in very high mortality for nymphs of the brown stink bug, *Euschistus servus* (Say), and the predator *Podisus maculiventris* (Say) (Tillman and Mullinix 2004, J. Econ. Entomol. 97:800-806). However, residues of these insecticides were less toxic to *L. phyllopus* adults than to brown stink bug and *P. maculiventris* adults. Also, exposure to thiamethoxam residues resulted in lower mortality for leaffooted adults compared with that for brown stink bug and *P. maculiventris* adults. In contrast, acetamiprid residues were more toxic to leaffooted bugs than to brown stink bugs and *P. maculiventris*.

For the oral toxicity tests, a significant insecticide effect was detected for percentage mortality data 4 d after treatment of 2nd instars ($F = 5.64$; df = 4, 68; $P = 0.0006$), 4th instars ($F = 5.33$; df = 4, 70; $P = 0.0008$), and adults ($F = 5.93$; df = 4, 45; $P = 0.0006$). Oxamyl was not very toxic to all developmental stages of *L. phyllopus* feeding on insecticide-treated pole beans (Table 2). The other three insecticides were moderately toxic to *L. phyllopus* 2nd instars feeding on food covered with insecticide residues. Dicrotophos was very toxic to adults feeding on insecticide-treated food. Thiamethoxam was moderately toxic whereas acetamiprid was nontoxic to *L. phyllopus* 4th instars and adults. Similar to the results for *L. phyllopus* adults, only dicrotophos exhibited significant mortality for *P. maculiventris* adults (Tillman and Mullinix 2004). However, toxicity of this insecticide was much lower for brown stink bug adults than for leaffooted bug and *P. maculiventris* adults. Over both tests, dicrotophos was the most toxic of the three insecticides to the three developmental stages of *L. phyllopus*. Also, the insecticides were more toxic to the insects when walking on residues of the insecticides compared with feeding on food contaminated with residues of the insecticides.

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