Chemical Control/New Products

In-orchard management of the consperse stink bug, *Euschistus conspersus,* and associated non-target effects

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Abstract: The consperse stink bug, *Euschistus conspersus*, has emerged as an important pest of pome fruit production in north-central Washington in the past decade. Growers have struggled to manage this pest, with limited effective chemical control options near harvest. Application of the synthetic pyrethroid, fenpropathrin (Danitol®), resulted in high mortality in laboratory tests in both Potter tower and leaf disc bioassays. Assessment of the field efficacy of Danitol® revealed significant suppression of stink bug damage. However, we found a significant increase in the populations of pest mite species in Danitol®-treated areas relative to controls, with a concurrent depression in populations of beneficial mite species.

Materials and Methods

Potter tower assay. Adult stink bugs were anesthetized using CO_2 gas and placed ventral side up upon a Petri dish. The dish was then placed in the Potter tower and sprayed with a 2-mL solution of the chosen treatment. Water was sprayed on bugs and designated as control. After exposure, bugs were removed from the dish and maintained in 16-oz. plastic cups with green beans as a food source. Bugs were monitored for 72 hours post-treatment and corrected mortality was recorded for each treatment. A total of 26 adult *E. conspersus* was used in each treatment (13 males, 13 females).

Leaf disc assay. Insecticides were mixed at label rates with 2 gallons of water in a standard garden pump-type sprayer. Mullein (*Verbascum thapsus*) plants growing in the field were sprayed to drip with each chemical, with a water spray serving as a control. Mullein was used since this is a primary host plant of *E. conspersus* both within and outside orchards. Plants were allowed to dry and residues aged in the field on leaves for 24, 48, 72, and 120 h. Leaves were removed from the plants and 1/2" leaf discs were removed from each leaf. Five discs were placed in a Petri dish with 6 adult stink bugs. Mortality was recorded after 7 days and compared with untreated (water) controls to determine corrected mortality.

Danitol—In-orchard efficacy. Danitol sprays were applied on August 13, 2001, to all orchards in the study (n=7). This date was chosen because the second, or summer, generation of stink bugs had reached adulthood and the onset of fruit damage had been noted. Damage assessment was conducted in these orchards at harvest time, with 20 apples counted/tree and 30 trees assessed/row.

Danitol—Mite counts. Block sizes used in this study were approximately 2 acres, with standard conventional orchard management conducted throughout this study. Blocks were

divided in half, with half of each block receiving two late summer (August 20 and 27, 2001) applications of Danitol® at the label rate of 19 fl. oz/acre. Mite counts were conducted prior to the initial Danitol® application on August 18, 2001, and at 24-h, 8 weeks, and 10, 11 and 12 months post-spray. Three samples of 25 leaves were taken at each sample date/site (i.e., 75 leaves/site). No more than 5 leaves were taken from any one tree. Leaves were placed in coolers and taken to the lab where they were brushed and numbers of the following mite species/leaf were recorded: two-spotted spider mite (*Tetranychus urticae*), European red mite (*Panonychus ulmi*), rust mites (*Aculus schlechtendali*), and the predatory mites *Galendromus occidentalis* and *Zetzellia mali*.

Results and Discussion

Potter tower and leaf disc bioassay. Carzol®, Danitol®, Thiodan® and Warrior T® showed good efficacy in Potter tower tests (Table 1). These compounds were then assayed in the leaf disc assay to determine residual activity. The pyrethroid insecticide Danitol® was the most effective, followed by Thiodan®. Warrior T® performed well in acute toxicity tests but had little residual effectiveness. Carzol® and Thiodan® are currently the recommended in-orchard treatments for stink bug control; however, Thiodan® has a long PHI and restrictions on the number of applications per year, and Carzol® can be applied only once after bloom and then under prescription use regulations. Both of these products may be phased out in the future due to FQPA action, and Danitol® may provide a short-term solution for growers with stink bug pressure.

Danitol—In-orchard efficacy. Damage assessment data are summarized in Fig. 1 and show a reduction in damage within Danitol®-treated blocks by over 80% on average (72-90%). It should be noted that these are extremely high-pressure orchards—in many cases 100% of the fruit on the border row were damaged. The reduction in fruit damage was achieved with only a single Danitol® application, and the timing of this spray likely could have been improved (i.e., earlier in season). It is also important to note that the sprays were applied at, or shortly after, dusk, the period of highest stink bug activity.

Danitol—Mite counts. Applications of Danitol® in 2001 had a marked negative effect upon mite populations. The short-term effects are a reduction in all populations of mites (Table 3). The long-term effects of Danitol® applications were more serious with high levels of pest mite species, with few or no predator mites present (Table 4). These orchards were sprayed with miticide on July 31, 2002, to prevent economic loss due to these heavy mite infestations. This disruption of integrated mite control is a serious downfall of Danitol® as an in-orchard stink bug control and has led us to evaluate alternative methods of employing this compound as a management tool.

Table 1. Corrected percent mortality of stink bugs exposed to insecticides applied in Potter tower bioassay

Treatment	Rate (ppm)	Rate (Form./100 gal)	Corrected % mortality 24 h.	48 h.	96 h.	1 week
Assail 70WP	60	1 oz.	4	4	4	46
Avaunt 30WDG	34	1.5 oz.	0	0	0	0
Carzol 92SP	413	6 oz.	12	35	63	74
Danitol 2.4 EC	106	4.8 fl. oz.	98	98	98	98
Thiodan 50WP	149	1 lb.	12	42	59	91
Warrior T 1SC	7	1 oz.	64	96	96	96

Table 2. Corrected percent mortality of stink bugs exposed to insecticides applied to mullein leaf discs

Treatment	Rate (ppm)	Rate (Form./100 gal)	Corrected % mortality 24 h.	48 h.	72 h.	120 h.
Carzol 92SP	413	6 oz.	12	12.5	16	16
Danitol 2.4 EC	106	4.8 fl. oz.	76	84	89	92
Thiodan 50WP	149	1 lb.	84	84	100	100
Warrior T 1SC	7	1 oz.	16	21	21	23

Table 3. Counts of pest and beneficial mites in orchards up to 8-wk post-Danitol treatment (# of mites/50 leaves)

Date	Spider mites* Egg	Motile	Beneficials* Egg	Motile	Ratio Pest/Beneficials
Pre-count - 8/13/01					
Treated	12.1[a]	2.3[a]	0.28[a]	0.96[a]	2.75:1[a]
Check	18.5[a]	2.7[a]	0.64[a]	1.24[a]	1.84:1[a]
24-h post - 8/21/01					
Treated	6.1[a]	0.5[a]	0.02[a]	0.04[a]	9:1[a]
Check	13.6[a]	8.8[b]	0.04[a]	0.36[b]	18:1[b]
8-wk post - 10/11/01					
Treated	2.2[a]	0.8[a]	0	0[a]	N/A
Check	10.8[a]	5.9[b]	0	0.92[b]	5.17:1

*Counts of spider mites represent totals of European red mite and twospotted spider mites; counts of beneficials represent totals of *Galendromus* + *Zetzellia* spp., as the dominant species varied by locations.

Table 4. Counts of pest and beneficial mites in orchards pre- and 1 year post-Danitol® treatment (# of mites/50 leaves)

	Spider mites*		Beneficials*		Ratio
Date	Egg	Motile	Egg	Motile	Pest/Beneficials
Pre-count - 8/13/01					
Treated	12.1[a]	2.3[a]	0.28[a]	0.96[a]	2.75:1[a]
Check	18.5[a]	2.7[a]	0.64[a]	1.24[a]	1.84:1[a]
1 yr. post - 7/30/02					
Treated	52.6[a]	13.8[a]	0.1[a]	0.16[a]	86:1[a]
Check	19.4[b]	7.8[b]	0.3[a]	2.43[b]	3.3:1[b]

*Counts of spider mites represent totals of European red mite and twospotted spider mites; counts of beneficials represent totals of *Galendromus* + *Zetzellia* spp., as the dominant species varied by locations.

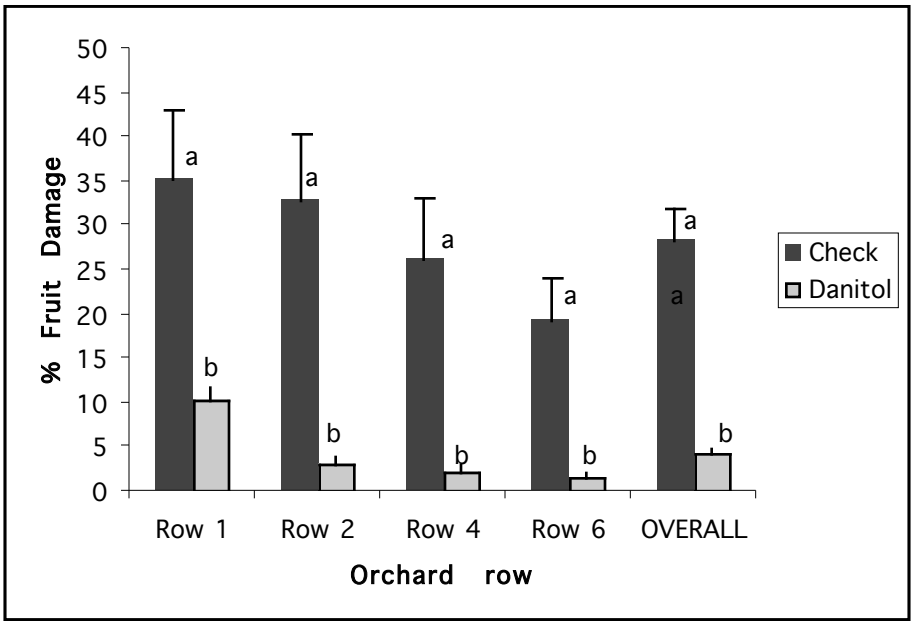

Figure 1. Stink bug fruit damage at harvest following a single in-orchard application of Danitol® at label rate (20 fl. oz/acre) on August 13, 2001 (n=7 orchards). Bars with same letter superscript in each category are not significantly different ($P<0.05$).