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February 2019

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BLACKBERRY: *Rubus* subgenus *rubus*, ‘Ouachita’Effects of an Unregistered Insecticide on Adult Spotted Wing *Drosophila* Mortality and Field Infestation Rates, 2015Katharine A. Swoboda-Bhattarai^{1,2} and Hannah Burrack^{3,4}

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Subject Editor: John Wise

Blackberry; raspberry | *Rubus* spp.Spotted wing drosophila (SWD) | *Drosophila suzukii* (Matsumura)

The effectiveness of an unregistered material at reducing *Drosophila suzukii* (SWD) infestation rates in blackberry field plots and its toxicity to adult SWD in laboratory bioassays was tested during the 2015 growing season. Field trials were conducted at the Sandhills Research Station near Jackson Springs, NC, in a 0.11-acre planting consisting of two rows of ‘Ouachita’ blackberries. Six treatments, including an untreated check (UTC), were applied to 5-plant plots and were arranged in an RCB design with four replicates per treatment, blocked by row, with two blocks per row. Delegate was the standard material. Some of the treatments were combined with an adjuvant, Syntact, at a concentration recommended by the manufacturer (Table 1).

Applications were made twice, on 11 and 30 Jun. Treatments were applied to both sides of each row to fully cover plants using a CO₂-pressurized backpack sprayer fitted with three flat fan nozzles at 45 psi pressure and 50 gal/acre spray volume. The desired application frequency for these materials is 7 days; however, additional applications could not be made due to unseasonably hot weather. Ten to 20 ripe berries, depending on availability, were collected from the middle three plants in each plot pre-treatment and 7 days after treatment (DAT) to measure infestation in the field. Fruit were held in plastic containers vented with fine mesh on the bottom to allow fruit to drain at 20°C, 65% RH, and 12:12 (L:D) h conditions. After 7 days, larvae and pupae were counted to determine infestation rates per berry.

Plant material for bioassays was collected immediately after treatment (0 DAT) and 7 DAT. A small branch with several leaves and three ripe berries were collected in each plot and immediately placed into an individual bioassay arena. Arenas were constructed from 32-oz plastic deli cups fitted with a floral water pick into which the cut stem was placed. Arenas were transported back to the laboratory and provisioned with food and water, whereas berries were placed in a 1-oz portion cup within each arena. Five male and five female reproductively mature SWD adults (≥5 days old) were then placed in each arena. Flies were obtained from a laboratory colony maintained for over 50 generations. Arenas were

observed 1 and 3 days after infestation (DAI), and the number of dead SWD was counted and the flies sexed. Infestation rates in berries were obtained by counting larvae and pupae. Data were analyzed via mixed model ANOVA with replicate considered a random variable. Mean separations were obtained using Fisher’s least significant difference ($\alpha = 5\%$).

Treatment did not have a significant effect on SWD infestation rates in field collected fruit for the first three sample dates, but on 7 Jul, when field infestation rates were highest, all insecticide-treated plots had significantly lower infestation rates than the UTC (Treatment*date: $F = 3.53$; $df = 15,69$; $P = 0.0002$; Table 1).

There was not a significant interaction between treatment and date on fly mortality in bioassays conducted with samples collected 0 DAT, so data for both applications were combined (Treatment*date: $F = 0.48$; $df = 5,36$; $P = 0.79$). Data (proportion dead flies) were arcsine square root transformed prior to analysis to meet the assumptions of ANOVA; nontransformed means are presented. Female mortality was highest in samples treated with Delegate at 1 DAI. Both female and male mortality were higher in all insecticide treatments than in the UTC at 3 DAI. Infestation rates at 3 DAI were lower in berries treated with Delegate and the two highest concentrations of HGW86 10 SE than in untreated berries (Table 2). Bioassays for samples collected 7 DAT were only conducted for the 11 Jun application because fruit was overripe and degraded following the 30 Jun application. Female mortality differed among treatments at both 1 and 3 DAI, and female mortality was higher in all insecticide treatments than in the UTC at 3 DAI. Male mortality did not differ among treatments at 1 or 3 DAI. Treatment did not significantly affect infestation rates in berries collected 7 DAT (Table 3).

The 2015 growing season was unseasonably warm and dry in North Carolina, which may have affected fruit quality and the efficacy and residual activity of the materials tested.

This research was supported by industry gifts of product and research funding.

Table 1.

Treatment/formulation	Rate amt product/acre	Immature SWD per berry			
		11 Jun (0 DAT)	18 Jun (7 DAT)	30 Jun (0 DAT)	7 Jul (7 DAT)
UTC	–	0.00a	0.00a	0.88a	9.34a
HGW86 10 SE	13.5 fl oz	0.15a	0.05a	1.26a	1.82b
HGW86 10 SE + Syntact	13.5 fl oz + 0.25% v/v	0.08a	0.05a	0.38a	2.42b
HGW86 10 SE + Syntact	16.9 fl oz + 0.25% v/v	0.03a	0.00a	1.38a	2.52b
HGW86 10 SE + Syntact	20.5 fl oz + 0.25% v/v	0.03a	0.00a	0.84a	1.26b
Delegate + Syntact	6 oz + 0.25% v/v	0.00a	0.00a	0.94a	1.99b

Values within a column that share a letter are not significantly different ($\alpha = 0.05$).

Table 2.

Treatment/formulation	Rate amt product/acre	0 DAT bioassays				
		Proportion dead SWD				Fruit infestation
		1 DAI		3 DAI		3 DAI
		Male	Female	Male	Female	Total offspring (larvae + pupae per fruit)
UTC	–	0.16a	0.00b	0.15b	0.05c	18.13a
HGW86 10 SE	13.5 fl oz	0.24a	0.15b	0.51a	0.50ab	12.13ab
HGW86 10 SE + Syntact	13.5 fl oz + 0.25% v/v	0.32a	0.08b	0.65a	0.43b	10.38ab
HGW86 10 SE + Syntact	16.9 fl oz + 0.25% v/v	0.30a	0.08b	0.58a	0.55ab	5.88bc
HGW86 10 SE + Syntact	20.5 fl oz + 0.25% v/v	0.26a	0.14b	0.60a	0.53ab	8.63bc
Delegate + Syntact	6 oz + 0.25% v/v	0.40a	0.42a	0.78a	0.78a	3.13c
P values		0.51	0.0006	0.0033	0.0002	0.0083

Values within a column that share a letter are not significantly different ($\alpha = 0.05$).

Table 3.

Treatment/formulation	Rate amt product/acre	7 DAT bioassays				
		Proportion dead SWD				Fruit infestation
		1 DAI		3 DAI		3 DAI
		Male	Female	Male	Female	Total offspring (larvae + pupae per fruit)
UTC	–	0.00a	0.05bc	0.20a	0.10b	10.50a
HGW86 10 SE	13.5 fl oz	0.35a	0.20ab	0.50a	0.65a	16.17a
HGW86 10 SE + Syntact	13.5 fl oz + 0.25% v/v	0.35a	0.45a	0.65a	0.55a	1.25a
HGW86 10 SE + Syntact	16.9 fl oz + 0.25% v/v	0.30a	0.00c	0.75a	0.75a	12.75a
HGW86 10 SE + Syntact	20.5 fl oz + 0.25% v/v	0.15a	0.10bc	0.65a	0.65a	4.75a
Delegate + Syntact	6 oz + 0.25% v/v	0.00a	0.05bc	0.85a	0.85a	9.50a
P values		0.053	0.0044	0.13	0.0188	0.10

Values within columns that share a letter are not statistically different ($\alpha = 0.05$).