UC Davis

UC Davis Previously Published Works

Title

Evaluation of Spider Venom Toxin—Based Insecticide to Control House Flies, 2018

Permalink

https://escholarship.org/uc/item/731581fg

Journal

Arthropod Management Tests, 44(1)

ISSN

0276-3656

Authors

Hubbard, Caleb B
Gerry, Alec C

Publication Date

2019

DOI

10.1093/amt/tsz006

OXFORD

CATTLE: *Bos Taurus* L.

Evaluation of Spider Venom Toxin–Based Insecticide to Control House Flies, 2018

Caleb B. Hubbard[1,3] and Alec C. Gerry[2,]

[1]Department of Entomology, University of California, Riverside, CA 92521, Phone: 951-827-5741 (caleb.hubbard@email.ucr.edu), [2]Department of Entomology, University of California, Riverside, CA 92521, Phone: 951-827-7054 (alec.gerry@ucr.edu), and [3]Corresponding author, e-mail: caleb.hubbard@email.ucr.edu

Subject Editor: Jonathan Babcock

Cattle | *Bos Taurus* L.

House Fly (HF) | *Musca domestica* L.

The objective of this study was to evaluate the efficacy of a novel commercial insecticide (VST-006340LC) for the control of house flies (HF) when applied as a fog/mist. The treatments were 1) Water (negative check), 2) Silwet L-77 0.1% (surfactant), 3) VST 2.5 parts per thousand (ppt), 4) VST 2.5 ppt + Silwett L-77 0.1%, 5) VST 5 ppt, 6) VST 5 ppt + Silwet L-77 0.1%, and 7) Permectrin II (permethrin) (positive check) (Table 1). An insectary-maintained colony of house flies collected from the field in 2015 was utilized for this experiment. Flies were removed from colony fly cages by vacuum, chilled and counted into groups of 50 mixed sex flies, and then placed into mesh ring cages (4 cm wide × 15.5 cm dia. cardboard rings covered with mesh; Multi Packaging Solutions Paper Tube & Can. Chicago, IL) for 16–18 h prior to treatment application. Flies were provided a 20% sucrose solution by filling 4-ml clear glass vial and then capping with a dental wick plug. The vial was inserted through, and held in place by, the cardboard ring until treatment application. The vial was removed during treatment to avoid contamination of the sugar source by the treatment. Pretreatment mortality was recorded immediately before a treatment was applied. For each treatment, five mesh ring cages containing flies were suspended from rebar support poles at a height of approximately 1 m off of the ground and placed in a line with 3 m separating each mesh ring cage. Trials were conducted in an outdoor environment at the University of California at Riverside Agricultural Operations facility, with the five mesh ring cages. Insecticide treatments were applied using a hand-held cold fogger with a droplet size of 15–20 microns (Longray ULV Cold Fogger Model 2680A, San Francisco, CA) at an application rate indicated in Table 1. After each treatment, the cold fogger was cleaned with soap and water followed by a water-only rinse prior to application of the next treatment. Treatment order was randomly assigned through the use of a random number generator, with all treatments applied on the same day and using the same population of laboratory-reared flies. After each treatment application, mesh cages were again provisioned with 20% sucrose placed into holding containers held at room temperature (24.5°C). Mortality was assessed at 1, 4, 24, 72, and 120 h post-treatment. After the 120-h count, containers were frozen and fly sex was determined by cage. Each treatment application was replicated across three dates: 18 Sep, 26 Sep, and 10 Oct 2018.

Statistics

Kaplan–Meier survival analysis was utilized to determine if there was a difference in mortality rate among treatments, with differences in overall mortality between treatments analyzed by log-rank test. Proportional fly mortality in each mesh ring cage at each time interval sampled was transformed using arcsine-square root to normalize the data prior to analysis. For differences in mortality among treatments at each time point, ANOVA was utilized with Tukey's post hoc test ($\alpha = 0.05$) to separate differences of means. All statistics performed using R Statistical package v. 3.5.1. Kaplan–Meir survival analysis figure created using Prism version 8.0.1 for Mac OS X (GraphPad Software, La Jolla, CA).

Discussion/Results

The mortality rate was not different for house flies treated with VST-006340LC at 2.5 ppt or 5 ppt, with or without Silwett L-77 0.1% (a surfactant), relative to the negative check (Water) (Table 2). The mortality rate was greater for flies treated with permethrin (Permectrin II) relative to all other treatments, including the water check, VST, Silwet, and VST + Silwet treatments. Proportional fly mortality at each time point similarly did not vary statistically among the VST, Silwet, VST + Silwet, and water check treatments, whereas the permethrin treatment produced significantly greater mortality at all time points evaluated relative to other treatments (Table 2). This experiment concludes that at the concentrations tested, the VST-006340LC product was not effective for control of house flies when applied alone or in combination with Silwet L-77 as a fog at the application rates indicated.

Table 1.

Treatment	Application rate and method	Treatment composition
Water (negative check)	1 L per 1,000 ft^2 Mist/Fog	H$_2$O
Silwett L-77 0.1%	1 L per 1,000 ft^2 Mist/Fog	99.5-Polyalkyleneoxide modified hetamethyltrisioloxane
VST-006340LC 2.5 ppt	1 L per 1,000 ft^2 Mist/Fog	GS-omega/kappa-Kxtx-Hv1a, 1,2-benzisonthiazolin-3-one
VST-006340LC 2.5 ppt + Silwett L-77	1 L per 1,000 ft^2 Mist/Fog	GS-omega/kappa-Kxtx-Hv1a,2-benzisonthiazolin-3-one + 99.5-polyalkyleneoxide modified hetamethyltrisioloxane
VST-006340LC 5 ppt	1 L per 1,000 ft^2 Mist/Fog	GS-omega/kappa-Kxtx-Hv1a,2-benzisonthiazolin-3-one
VST 5-006340LC ppt + Silwet L-77 0.1%	1 L per 1,000 ft^2 Mist/Fog	GS-omega/kappa-Kxtx-Hv1a,2-benzisonthiazolin-3-one +99.5-polyalkyleneoxide modified hetamethyltrisioloxane
Permectrin II 1 ppt	1 L per 1,000 ft^2 Mist/Fog	10-Permethrin, 90- other ingredients (contains petroleum distillates)

Table 2.

Time (h)	Water (negative check) Mean ± SE	Silwett L-77 0.1% Mean ± SE	VST 2.5 ppt Mean ± SE	VST 2.5 ppt + Silwett L-77 Mean ± SE	VST 5 ppt Mean ± SE	VST 5 ppt + Silwet L-77 Mean ± SE	Permectrin II (positive check) Mean ± SE
1	0.005 ± 0.005 a	0.014 ± 0.006 a	0.010 ± 0.006 a	0.010 ± 0.005 a	0.034 ± 0.015 a	0.022 ± 0.006 a	0.642 ± 0.079 b
4	0.016 ± 0.007 a	0.036 ± 0.011 a	0.027 ± 0.008 a	0.026 ± 0.008 a	0.060 ± 0.019 a	0.034 ± 0.008 a	0.663 ± 0.067 b
24	0.057 ± 0.014 a	0.046 ± 0.018 a	0.062 ± 0.013 a	0.062 ± 0.014 a	0.092 ± 0.021 a	0.073 ± 0.016 a	0.674 ± 0.052 b
72	0.109 ± 0.021 a	0.076 ± 0.030 a	0.090 ± 0.018 a	0.093 ± 0.020 a	0.149 ± 0.029 a	0.166 ± 0.015 a	0.750 ± 0.046 b
120	0.135 ± 0.019 a	0.120 ± 0.025 a	0.190 ± 0.024 a	0.126 ± 0.020 a	0.241 ± 0.037 a	0.252 ± 0.020 a	0.781 ± 0.046 b

Arcsine-square root transformed data used for analysis, but raw data are shown in table. Letters indicate significant difference ($P \leq 0.05$) among treatments by time (rows).