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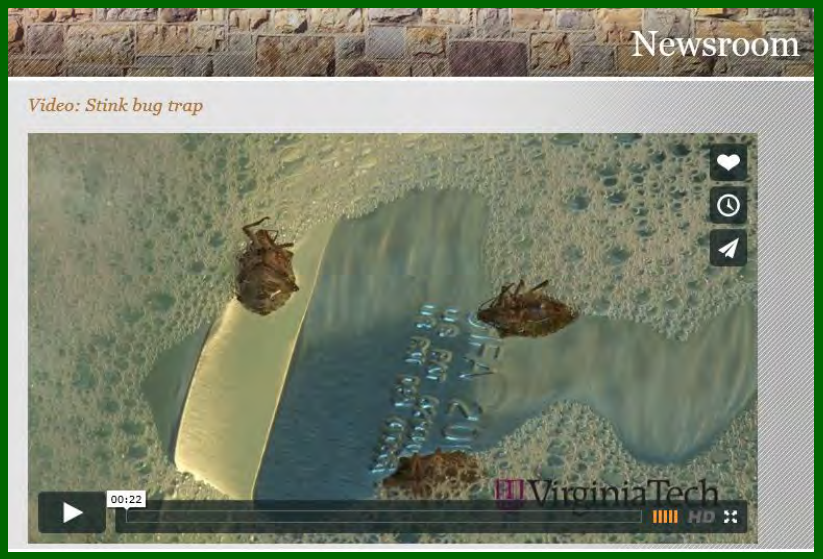
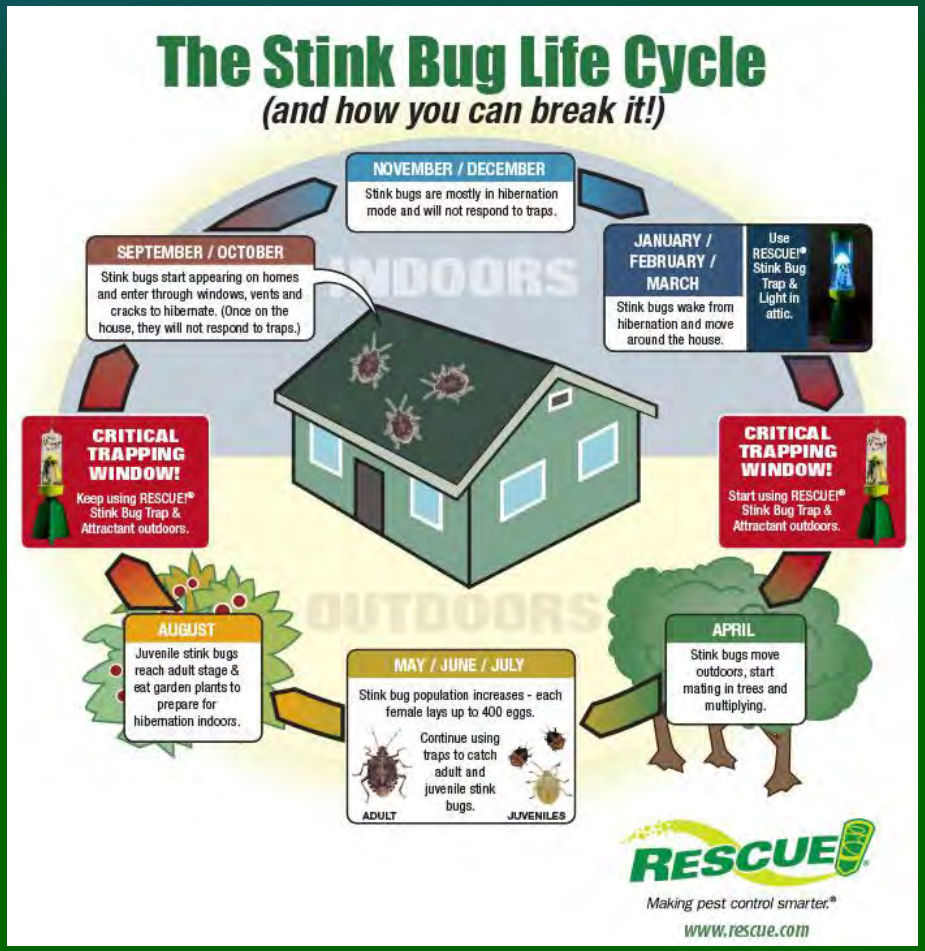
From bubble baths to baking bugs: A potpourri of our urban pest control research endeavors on BMSB in Virginia

Thomas Kuhar & John Aigner



Stink bug frenzy – Circa. 2010



Evaluating Indoor Light Traps

- 2012-13 we studied commercial and homemade light traps in homes in several counties in Virginia
- Traps were counted weekly using citizen scientists who volunteered their houses for the project

What did we find?

- The most efficacious trap tested was the water pan trap
  - Caught up to 144 BMSB adults in a single week
  - Up to 14 times more effective than other traps tested
  - Cheap

- http://www.cals.vt.edu/news/multimedia/stink-bug-trap.html

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Research In Brief

Using Citizen Scientists to Evaluate Light Traps for Catching Brown Marmorated Stink Bugs in Homes in Virginia

Abstract

More and more, citizen scientists are playing an integral role in research studies. This has been particularly evident as entomologists unravel the biology, spread, and management of the brown marmorated stink bug, which has plagued many homeowners in the mid-Atlantic U.S. in recent years. We used citizen scientists to evaluate different indoor light traps for catching the bugs in houses. Throughout the late winter and early spring months, these traps were tested inside homes and enabled us to determine that the most efficacious trap was an aluminum foil water pan trap, developed by—you guessed it—a citizen scientist.

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Insecticide field efficacy trials on peppers, tomatoes, sweet corn and beans in VA, 2011 -13

- Tested over 50 different insecticide treatments
- RCBD small-plot experiments (4 reps)
- Plot = one row (20 ft)
- CO_2 backpack sprayer w/ 3-nozzle drop down boom

Performance of insecticides on BMSB

Product	Rate oz/Acre	% mortality in bean dip bioassays*		% control in pepper field tests**		Avg. % control from all four experiments
		Nymphs	Adults	2011	2012	
Scorpion 3.24	7.7	76.7	90.0	85.4	67.0	79.8
Permethrin 3.2EC	8	97.5	98.8	60.6	58.4	78.8
Baythroid XL	2.8	92.5	88.2	52.8	67.8	75.3
Endigo ZC	4.5	75.0	98.7	49.2	78.3	75.3
Bifenture 10DF	12.8	100.0	81.9	56.3	60.3	74.6
Belay	4	75.0	67.5	66.7	78.3	71.9
Lannate LV	40	66.7	75.3	79.8	62.2	71.0
Leverage 360	2.8	97.3	74.5	49.9	60.2	70.5
Hero EC	10.3	91.7	50.0	72.8	66.6	70.3
Brigadier	9.85	76.7	70.0	69.9	62.8	69.9
Venom 70	4	100.0	80.0	46.0	52.8	69.7
MustangMAX	4	100.0	35.0	72.8	69.2	69.2
Acephate 97UP	16	100.0	51.8	70.4	52.8	68.7
Vydate L	48	85.0	47.0	79.7	47.1	64.7
Assail 30 G	4	90.0	32.8	70.4	NA	64.4
Warrior II	2.5	100.0	72.8	38.0	42.5	63.3
Danitol	16	93.3	42.5	60.3	55.6	62.9
Actara 50 WG	5.5	66.7	81.0	60.3	42.5	62.6
Lambda-cy	3.84	86.0	32.3	62.0	NA	60.1
Asana XL	9	35.0	27.5	76.4	NA	46.3
Beleaf 50SG	2.8	28.5	17.5	27.2	71.8	36.3

Table 6.3 - Recommended Use (cont.)

Pests	Prevention	Pesticide	Application
Brown marmorated stink bugs (BMSB)	Sting bugs begin aggregating on structures soon after the first cool day in September. Prior to September plug openings in windows and vents that provide entry to these bugs.	**Perimeter applications made during the first week of September:** Fipronil (Termidor)[1] Imidacloprid (Premise)[1] Indoxacarb (Arilon)[1]	**Indoors:** Vacuum up individual insects, but be aware stink bugs will make the vacuum smell strongly of their odor. **Outdoor:** Well timed perimeter applications may help to reduce bugs indoors but cannot eliminated entry in most cases.

We asked one top urban/structural pest control company in Virginia what insecticide they spray for stink bugs

- Answer: Fenvastar Plus (Rockwell Labs)

  active ingredient: esfenvalerate

Not a good choice for BMSB control based on trials in agriculture

BMSB like to hang out on window screens

Evaluating Dip Treated Window Screen for Activity and Residual Field Efficacy

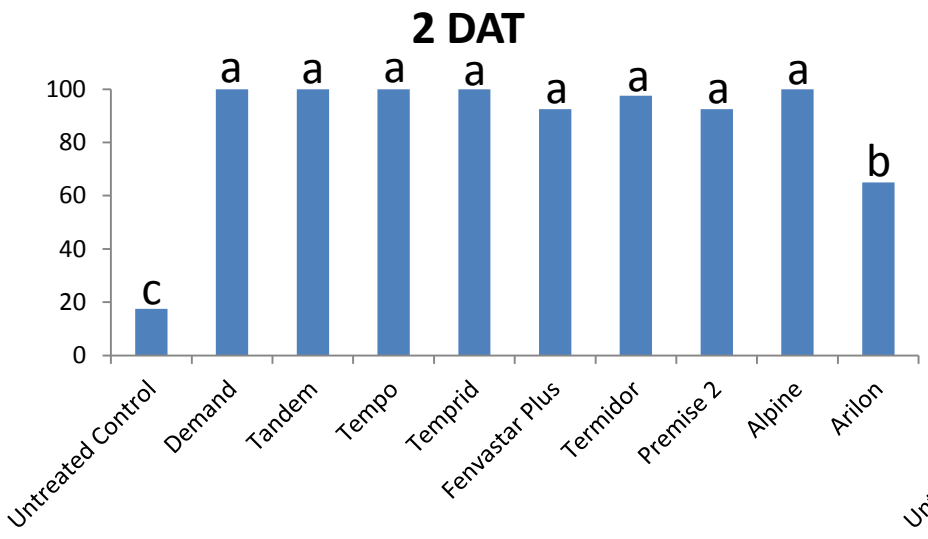
Treatment	Trade Name	Manufacturer	A.I.	Concentration	Rate to Mix
1	Untreated Control	n/a	n/a	0.00%	n/a
2	Demand	Syngenta	lambda cyhalothrin	9.70%	24mL/gal
3	Tandem	Syngenta	thiamethoxam + lambda cyhalothrin	11.6% + 3.5%	32mL/gal
4	Tempo	Bayer	betacyfluthrin	20%	16mL/gal
5	Temprid	Bayer	imidacloprid + cyfluthrin	21% + 10.5%	16mL/gal
6	Fenvastar Plus	Rockwell Labs	esfenvalerate	8.40%	24.5mL/gal
7	Termidor	BASF	fipronil	9.10%	47.3mL/gal
8	Premise 2	Bayer	imidacloprid	75%	17.7mL/gal
9	Alpine	BASF	dinotefuran	40%	30g/gal
10	Arilon	DuPont	Indoxacarb	20%	18.71g/gal

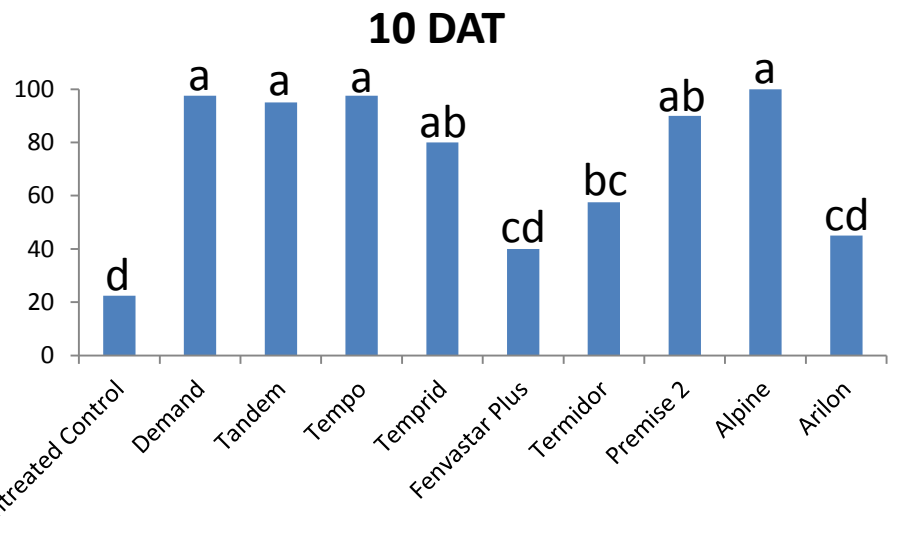
Evaluating Dip Treated Window Screen for Activity and Residual Field Efficacy

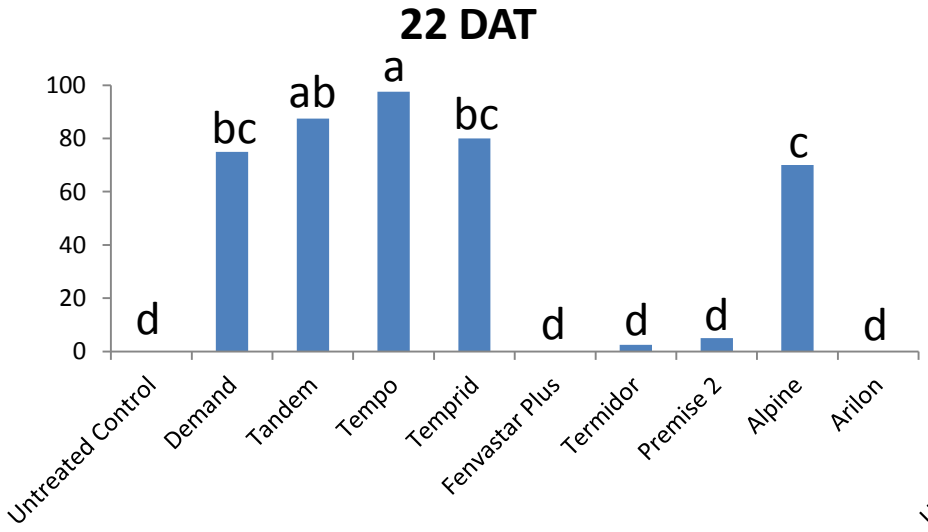
- 9 Insecticides labeled for pest management professionals (PMP's) to apply
- Each screen 20.32 cm x 40.64 cm
- Completely randomized design
- Exposed to ambient conditions from 0 DAT (Sept 24, 2014)
- Mortality assessed after 48h of continuous exposure

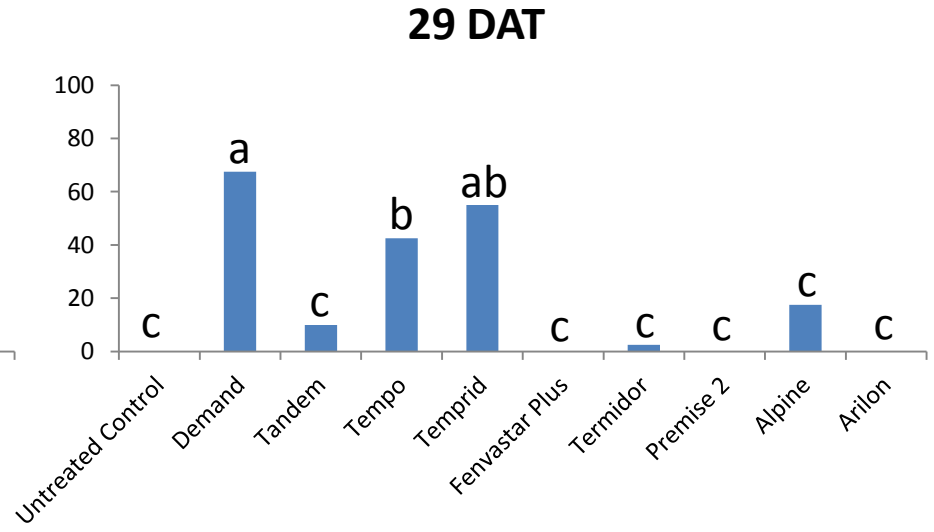
Evaluating Dip Treated Window Screen for Activity and Residual Field Efficacy

2014 Results







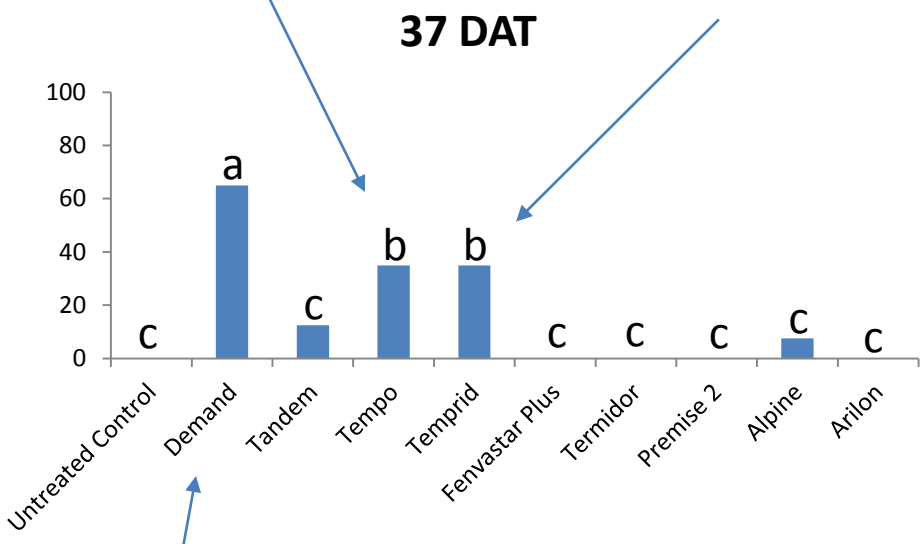


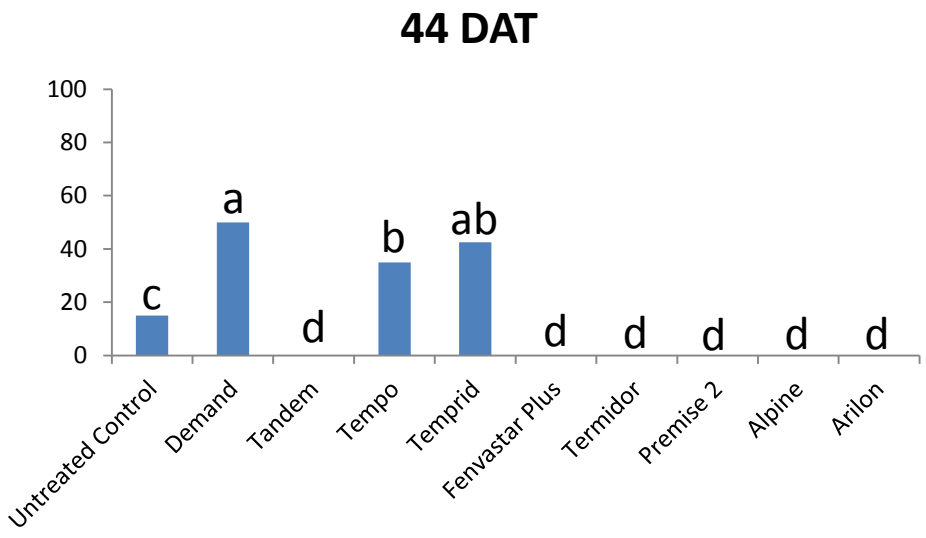
2014 Results

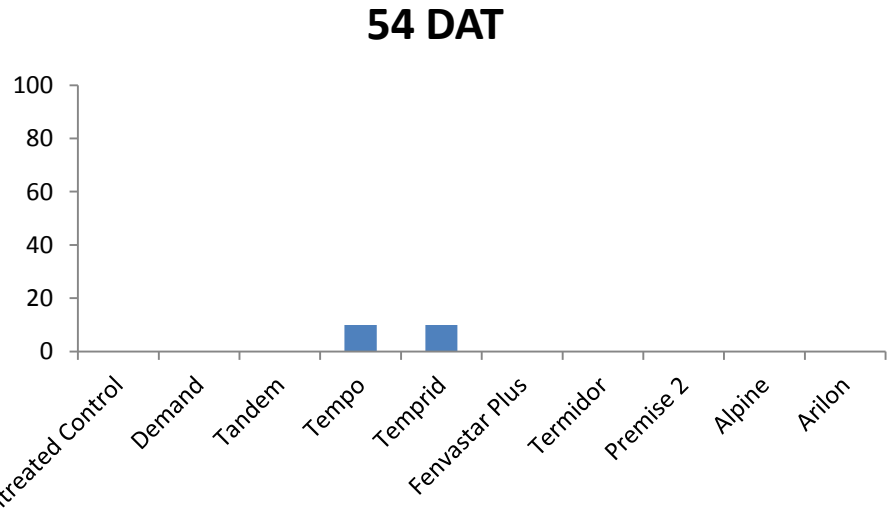
Beta cyfluthrin

Imidacloprid + cyfluthrin

Lambda-cyhalothrin





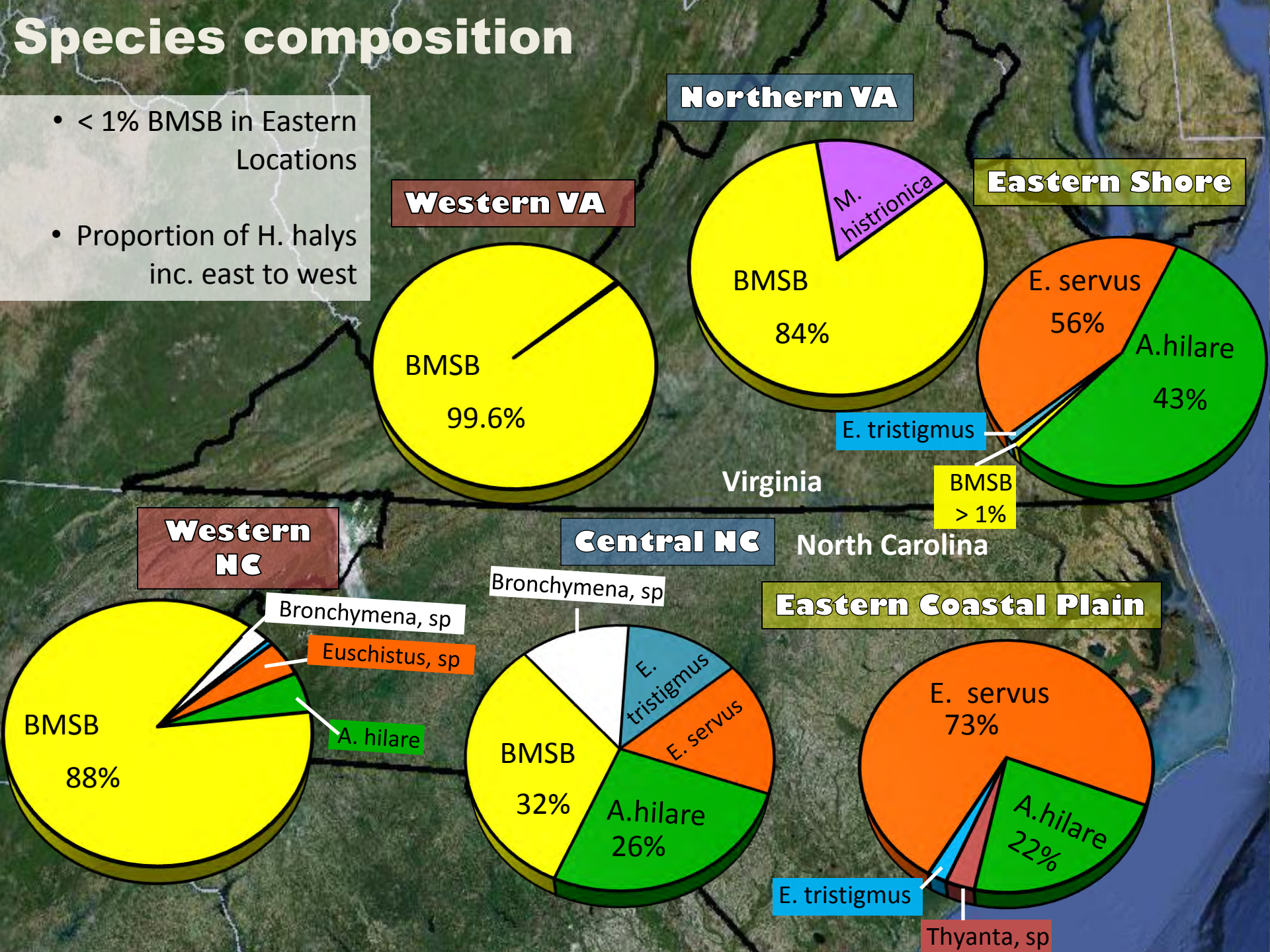


Summary

- Screen application seems to be an effective delivery method
- Residual Activity
  - Lambda cyhalothrin (Demand)
    - >50%>44 days
  - Imidacloprid + cyfluthrin (Temprid)
    - >50%~29 days
  - Beta-cyfluthrin (Tempo)
    - ~44 days residual, but low activity past 22 days
- Update Virginia Recommendations Guide

Species composition

- < 1% BMSB in Eastern Locations
- Proportion of H. halys inc. east to west

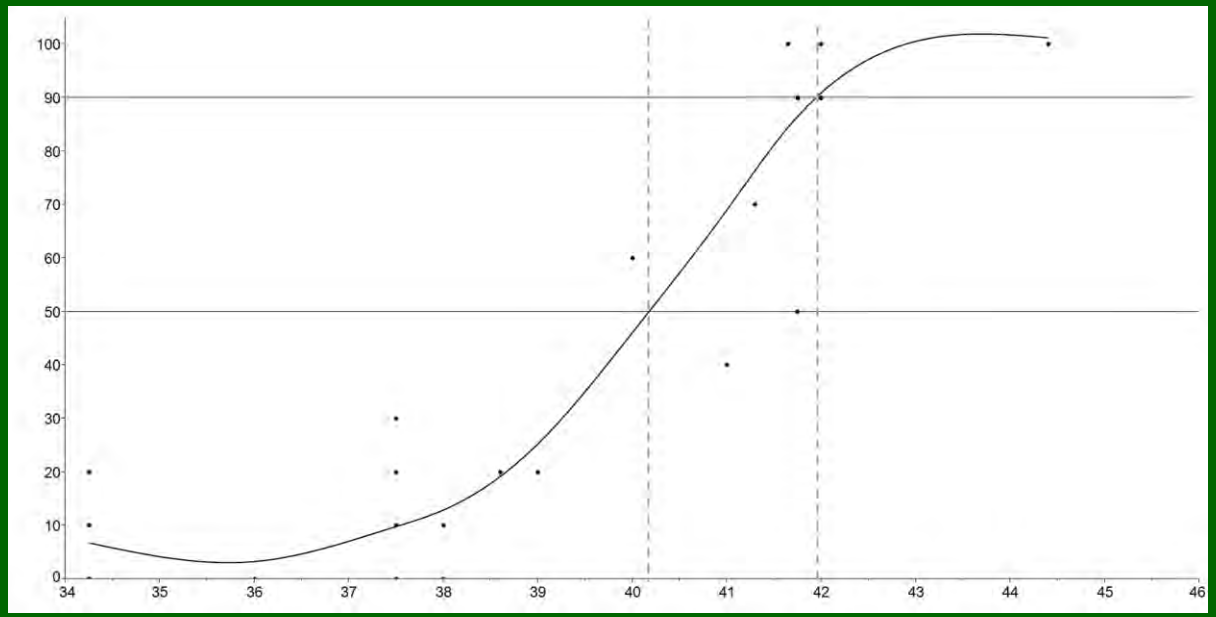


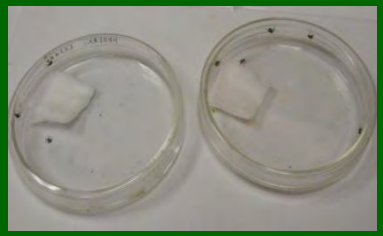
Heavy mortality of BMSB bagged on cotton in southeast VA

- Temps. Exceeded 100F after bagging bugs on cotton bolls

Can BMSB take the heat?

- Exposure for 4 hrs to temps. >41˚C (104˚F) resulted in significant mortality to all life stages of BMSB





Lohr, A., T. P. Kuhar, J. D. Aigner, and C. Philips. 2012. Maximum Lethal Temperature and its Potential Use in Predicting the Distribution of the Brown Marmorated Stink Bug (*Halyomorpha halys*) in the United States. Eastern Branch ESA Meeting Poster

Determination of lethal high temperatures of BMSB

- BMSB adults were collected from manmade structures in the fall and winter of each year.
- Bugs were placed in groups of 10 in glass Petri dishes (Pyrex Co.) and placed in an incubator (Fisher Scientific Thermo Incubator 537D, Fisher Scientific, Waltham, MA)
- Held at different temperature intervals starting with 35°C through 50°C and exposed for time intervals of 15 min, 1 hr, and 4 hr .

Average mortality of *H. halys* adults* following exposure for different times and temperatures in an incubator located at Virginia Tech, Blacksburg, VA (USA).

% mortality (Mean ± SE)			
Temp. °C	15 min exposure	1 hr exposure	4 hr exposure
35	-	-	5.0 ± 1.4
38	-	-	11.7 ± 1.9
40	0.0 ± 0.0	0.0 ± 0.0	38.3 ± 3.7
42	-	-	91.3 ± 2.2
45	22.5 ± 19.3	100.0 ± 0.0	100.0 ± 0.0
50	100.0 ± 0.0	100.0 ± 0.0	-

*at least four replicates, total >50 bugs per temperature time treatment.

Australian and New Zealand Government Mandate March 2015

Brown Marmorated Stink Bug: emergency measures for break bulk and containerised vehicles, machinery, automotive parts and tyres.

- Fumigated with methyl bromide
- Fumigated with sulfuryl fluoride
- Maintained at 60°C for 30 min

Field evaluation of heat treatments for control of live *H. halys* adults in export cargo

- In 2015, a heat treatment facility at the Port of Savannah, GA, USA was constructed by Willenius Wilhelmsen Logistics, Lysaker, Norway (WWL) to create a usable heated space approximately 6.1 × 12.2 × 3 m.

- 500,000 BTU propane heaters (PEST-HEAT, Aston, PA) that allowed the heat to move throughout the space.

Heat treatment facility at the
Port of Savannah, GA
Willenius Wilhelmsen Logistics

Targeted temperatures, actual measured temperatures, and observed mortality of *H. halys* adults after 15 min exposures to heat treatments applied to a vehicles at the Port of Georgia, Savannah, GA, USA in 2015.

Target Temp. °C	Actual Measured Temp. (Mean °C ± SE)		% Mortality (Mean ± SE)*	
	Under Driver's Seat	Engine Compartment	Under Driver's Seat	Engine Compartment
40	39.1 ± 0.2	42.2 ± 0.3	2.5 ± 2.5	17.5 ± 17.5
50	50.9 ± 0.1	54.2 ± 0.1	100.0 ± 0.0	100.0 ± 0.0
60	65.0 ± 0.7	67.1 ± 0.8	100.0 ± 0.0	100.0 ± 0.0

Results

- Temperatures recorded from under the driver's seat were about 2 to 3°C cooler than those recorded in the engine compartment, but both were at least at the minimal targeted temperature generated from the heat treatment.
- Targeted heat treatment exposures for 15 min at either 50 or 60°C resulted in 100% mortality of the *H. halys* adults tested, regardless of location in the vehicle.
- Heat treatments at 40°C resulted in very low mortality of *H. halys* adults.
- Utilizing heat is an IPM friendly tactic in pest management for treating vehicles and other equipment
  - Timing/temperature are critical
  - More environmentally friendly than other current treatments (toxic fumigants)