

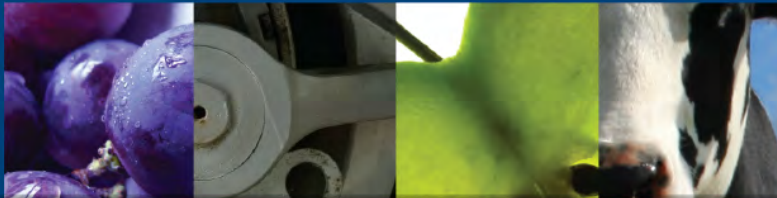
# BROWN MARMORATED STINK BUG IN PENNSYLVANIA FRUIT ORCHARDS

*RESULTS OF BMSB ADULTS DIRECT CONTACT LABORATORY BIOASSAYS  
AND 2011 PA FIELD EXPERIENCE UPDATE*

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and United States Department of Agriculture*



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## Direct contact topical bioassays

### *Brief description of methods*

#### Subject

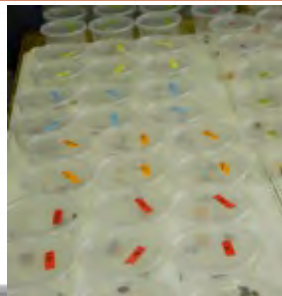
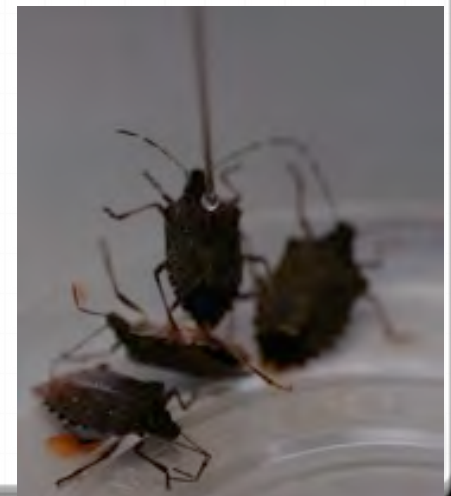
- BMSB adults from overwintering colony;
- Male and female adults (30 from each gender) tested separately.

#### Test

- Commercial grade insecticide solutions at field rate, surfactant added;
- Each individual bug treated dorsally with 2  $\mu$ l of solution.

#### Results

- Mortality assessed at 4, 24, 48, 72, 96 and 120 hours after treatment;
- Surviving individuals kept for further observation.



# BMSB mortality based on direct contact bioassays – organophosphates, IRAC 1B

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE tested	FRUIT REGISTRATION*	% DIRECT MORTALITY**			RESIDUAL: LETHALITY INDEX <sup>1</sup>
				24 h	72 h	120 h	
<b>Acephate 97UP</b>	acephate	4 oz	Nonbearing/border	<b>13</b>	<b>42</b>	<b>63</b>	88
<b>Acephate 97UP</b>	acephate	1 lb	Nonbearing/border	<b>10</b>	<b>45</b>	<b>73</b>	88
<b>Diazinon 50W</b>	diazinon	3 lb	PF, SF	<b>0</b>	<b>3</b>	<b>7</b>	20
<b>Guthion</b>	azinphos-methyl	2 lb	PF	<b>3</b>	<b>13</b>	<b>27</b>	71
<b>Imidan</b>	phosmet	4 lb	PF, SF	<b>2</b>	<b>20</b>	<b>35</b>	20
<b>Lorsban Adv.</b>	chlorpyrifos	3 pt	Before bloom	<b>42</b>	<b>73</b>	<b>82</b>	89
<b>Penncap-M</b>	methyl parathion	6 pt	Not registered	<b>65</b>	<b>82</b>	<b>87</b>	93
<b>Thionex 50W</b>	endosulfan***	2 lb	PF, SF	<b>52</b>	<b>98</b>	<b>100</b>	90
<b>Thionex 50W</b>	endosulfan***	4 lb	PF, SF	<b>33</b>	<b>98</b>	<b>100</b>	90

\*PF- Pom Fruits, SF- Stone Fruits, G- Grapes

\*\* Mortality includes dead plus moribund

\*\*\* - cyclodiene organochlorine (IRAC 2A)

<sup>1</sup> – based on dry residual bioassays T. Leskey, USDA ARS

# BMSB mortality based on direct contact bioassays – pyrethroids, IRAC 3

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE tested	FRUIT REGISTRATION*	Percent DIRECT MORTALITY**			RESIDUAL: LETHALITY INDEX <sup>1</sup>
				24 h	72 h	120 h	
<b>Asana XL</b>	esfenvalerate	14 oz	Apple, Pear, SF	<b>15</b>	<b>27</b>	<b>48</b>	43
<b>Baythroid XL</b>	beta-cyfluthrin	2 oz	PF, SF, G	<b>7</b>	<b>13</b>	<b>37</b>	55
<b>Baythroid XL</b>	beta-cyfluthrin	2.8 oz	PF, SF, G	<b>42</b>	<b>30</b>	<b>53</b>	55
<b>Bifenture EC</b>	bifenthrin	12.8 oz	G, Pears	<b>98</b>	<b>100</b>	<b>100</b>	92
<b>Brigade 2EC</b>	bifenthrin	10 oz	G, Pears	<b>100</b>	<b>100</b>	<b>95</b>	92
<b>Danitol 2.4EC</b>	fenpropathrin	12 oz	PF, SF, G	<b>87</b>	<b>65</b>	<b>60</b>	67
<b>Danitol 2.4 EC</b>	fenpropathrin	16 oz	PF, SF, G	<b>95</b>	<b>82</b>	<b>82</b>	67
<b>Hero</b>	bifenthrin zeta-cypermethrin	10 oz	Not registered	<b>93</b>	<b>87</b>	<b>82</b>	92 52
<b>Lambda-Cy EC</b>	lambda-cyhalothrin	4.4 fl oz	Not registered	<b>52</b>	<b>40</b>	<b>35</b>	53
<b>Mustang Max</b>	zeta-cypermethrin	4 oz	PF, SF, G	<b>67</b>	<b>37</b>	<b>30</b>	52
<b>Pounce 25 WP</b>	permethrin	16 oz	PF, SF	<b>45</b>	<b>42</b>	<b>35</b>	77
<b>Warrior II</b>	lambda-cyhalothrin	2 oz	PF, SF	<b>73</b>	<b>72</b>	<b>77</b>	53
<b>Warrior II</b>	lambda-cyhalothrin	2.5 oz	PF, SF	<b>52</b>	<b>51</b>	<b>53</b>	53

\*PF- Pome Fruits, SF- Stone Fruits, G- Grapes

\*\* Mortality includes dead plus moribund

<sup>1</sup> – based on dry residual bioassays T. Leskey, USDA ARS

# BMSB mortality based on direct contact bioassays – carbamates (IRAC 1A)

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE	FRUIT REGISTRATION*	Percent DIRECT MORTALITY**			RESIDUAL: LETHALITY INDEX <sup>1</sup>
				24 h	72 h	120 h	
<b>Carzol SP</b>	formetanate	1 lb	PF, SF	<b>58</b>	<b>68</b>	<b>68</b>	64
<b>Lannate LV</b>	methomyl	2 pt	Apple, Peach, G	<b>88</b>	<b>90</b>	<b>90</b>	90
<b>Lannate LV</b>	methomyl	3 pt	Apple, Peach, G	<b>87</b>	<b>92</b>	<b>92</b>	90
<b>Lannate SP</b>	methomyl	6 oz	Apple, Peach, Nectarine	<b>52</b>	<b>55</b>	<b>60</b>	90
<b>Lannate SP</b>	methomyl	9 oz	Apple, Peach, Nectarine	<b>88</b>	<b>92</b>	<b>92</b>	90
<b>Lannate SP</b>	methomyl	12 oz	Apple, Peach, Nectarine	<b>85</b>	<b>87</b>	<b>87</b>	90
<b>Lannate SP</b>	methomyl	16 oz	Apple, Peach, Nectarine	<b>92</b>	<b>98</b>	<b>98</b>	90
<b>Sevin XLR Plus</b>	carbaryl	3 pt	PF, SF	<b>3</b>	<b>12</b>	<b>8</b>	9
<b>Vydate L</b>	oxamyl	4 pt	Apple, Pear	<b>52</b>	<b>58</b>	<b>63</b>	34
<b>Vydate L</b>	oxamyl	6 pt	Apple, Pear	<b>68</b>	<b>73</b>	<b>82</b>	34

\*PF- Pome Fruits, SF- Stone Fruits, G- Grapes

\*\* Mortality includes dead plus moribund

<sup>1</sup> – based on dry residual bioassays T. Leskey, USDA ARS

# BMSB mortality based on direct contact bioassays – neonicotinoids, IRAC 4A

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE tested	Fruit REGISTRATION*	Percent DIRECT MORTALITY**			RESIDUAL LETHALITY INDEX <sup>1</sup>
				24 h	72 h	120 h	
<b>Actara</b>	thiamethoxam	4 oz	PF, SF, G	<b>92</b>	<b>95</b>	<b>97</b>	56
<b>Actara</b>	thiamethoxam	5 oz	PF, SF, G	<b>77</b>	<b>95</b>	<b>98</b>	56
<b>Admire Pro</b>	imidacloprid	7 oz	PF, G	<b>82</b>	<b>87</b>	<b>88</b>	40
<b>Assail 30SG</b>	acetamiprid	6 oz	PF, SF, G	<b>87</b>	<b>87</b>	<b>63</b>	19
<b>Assail 30SG</b>	acetamiprid	8 oz	PF, SF, G	<b>83</b>	<b>83</b>	<b>95</b>	19
<b>Assail 70WP</b>	acetamiprid	3.4 oz	PF, SF, G	<b>78</b>	<b>83</b>	<b>75</b>	19
<b>Belay</b>	clothianidin	6 oz	PF, Peach, G	<b>100</b>	<b>100</b>	<b>100</b>	56
<b>Calypso 4F</b>	thiacloprid	8 fl oz	PF	<b>58</b>	<b>52</b>	<b>53</b>	18
<b>Endigo ZC</b>	lambda-cyhalothrin thiamethoxam	3 oz	PF, SF	<b>93</b>	<b>95</b>	<b>87</b>	53
							56
<b>Endigo ZC</b>	lambda-cyhalothrin thiamethoxam	5 oz	PF, SF	<b>98</b>	<b>100</b>	<b>98</b>	53
							56
<b>Leverage 360</b>	imidacloprid beta-cyfluthrin	2.8 oz	PF, SF, G	<b>95</b>	<b>93</b>	<b>88</b>	40
							55
<b>Scorpion 35SL</b>	dinotefuran	5 oz	G	<b>97</b>	<b>98</b>	<b>97</b>	67
<b>Venom</b>	dinotefuran	3 oz	G	<b>93</b>	<b>98</b>	<b>98</b>	67

\*PF- Pom Fruits, SF- Stone Fruits, G- Grapes

\*\* Mortality includes dead plus moribund

<sup>1</sup> – based on dry residual bioassays T. Leskey, USDA ARS



## BMSB mortality based on direct contact bioassays – Various IRAC Groups

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE tested	FRUIT REGISTRATION*	Percent DIRECT MORTALITY**			RESIDUAL LETHALITY INDEX <sup>1</sup>
				24 h	72 h	120 h	
<b>Agri-Mek 0.15EC</b>	abamectin	15 oz	Apple, Pear, SF, G	<b>2</b>	<b>7</b>	<b>8</b>	16
<b>Altacor</b>	chlorantraniliprole	3 oz	PF, SF, G	<b>3</b>	<b>7</b>	<b>12</b>	N/A
<b>Avaunt</b>	indoxacarb	6 oz	PF, SF, G	<b>0</b>	<b>5</b>	<b>13</b>	11
<b>Beleaf 50SG</b>	flonicamid	2.8 oz	PF, SF	<b>5</b>	<b>10</b>	<b>15</b>	8
<b>cyazypyr</b>		100 ppm	Not registered	<b>5</b>	<b>3</b>	<b>5</b>	
<b>Delegate WG</b>	spinetoram	7 oz	PF, SF, G	<b>0</b>	<b>3</b>	<b>15</b>	N/A
<b>Esteem 0.86EC</b>	pyriproxyfen	5 oz	PF, SF	<b>0</b>	<b>5</b>	<b>8</b>	N/A
<b>M-Pede</b>	insecticidal soap	2%	PF, SF, G	<b>0</b>	<b>2</b>	<b>5</b>	N/A
<b>M-Pede Spray</b>	insecticid soap	2%	PF, SF, G	<b>10</b>	<b>15</b>	<b>15</b>	N/A
<b>Neemix 4.5</b>	azadirachtin	16 oz	PF, SF, G	<b>0</b>	<b>2</b>	<b>8</b>	N/A
<b>Rimon 0.83EC</b>	novaluron	30 oz	PF, SF	<b>0</b>	<b>2</b>	<b>2</b>	N/A
<b>Stylet Oil</b>	mineral oil	2%		<b>2</b>	<b>2</b>	<b>5</b>	
<b>Voliam Xpress</b>	lambda-cyhalothrin chlorantraniliprole	10 fl oz	PF, SF	<b>40</b>	<b>40</b>	<b>38</b>	53 N/A
<b>Voliam Flexi</b>	thiamethoxam chlorantraniliprole	6 oz	PF, SF, G	<b>100</b>	<b>100</b>	<b>100</b>	56 N/A

\*PF- Pome Fruits, SF- Stone Fruits, G- Grapes

\*\* Mortality includes dead plus moribund

<sup>1</sup> – based on dry residual bioassays T. Leskey, USDA ARS

## BMSB mortality based on direct contact bioassays – mixes (IRAC various)

G. Krawczyk, PSU FREC 2011.

PRODUCT	ACTIVE INGREDIENT	FIELD RATE tested	FRUIT REGISTRATION*	Percent DIRECT MORTALITY**			RESIDUAL LETHALITY INDEX <sup>1</sup>
				24 h	72 h	120 h	
<b>Endigo ZC</b>	lambda-cyhalothrin thiamethoxam	3 oz	PF, SF	<b>93</b>	<b>95</b>	<b>87</b>	53 56
<b>Endigo ZC</b>	lambda-cyhalothrin thiamethoxam	5 oz	PF, SF	<b>98</b>	<b>100</b>	<b>98</b>	53 56
<b>Hero</b>	bifenthrin zeta-cypermethrin	10 oz	Not registered	<b>93</b>	<b>87</b>	<b>82</b>	92 52
<b>Leverage 360</b>	imidacloprid beta-cyfluthrin	2.8 oz	PF, SF, G	<b>95</b>	<b>93</b>	<b>88</b>	40 55
<b>Voliam Xpress</b>	lambda-cyhalothrin chlorantraniliprole	10 fl oz	PF, SF	<b>40</b>	<b>40</b>	<b>38</b>	53 N/A
<b>Voliam Flexi</b>	thiamethoxam chlorantraniliprole	6 oz	PF, SF, G	<b>100</b>	<b>100</b>	<b>100</b>	56 N/A

\*PF- Pom Fruits, SF- Stone Fruits, G- Grapes

\*\* Mortality includes dead plus moribund

<sup>1</sup> – based on dry residual bioassays T. Leskey, USDA ARS



Summary .....

Brown marmorated stink bug (aka Asian stink bug)  
is not your usual insect pest



**Plethora of available host plants**



**Unrestricted movement ability**

**Undefined biology/monitoring issues**

**Inconspicuous initial injury on fruit**



**Each instar (except eggs) can cause damage**

**No effective biological control**

## Proposed BMSB control timing/product options

<b>Timing</b>	<b>Other pests to remember</b>	<b>BMSB Product Options</b>	<b>Comments</b>
<i>Before bloom/PF</i>	Scale, RAA, mites, EAS, PB	Lorsban, Carzol (PF only)	To suppress early populations
<i>After bloom (May - Mid-June)</i>	CM, OFM, TABM, OBLR, PC, aphids, leafhoppers	Admire, Assail, Actara, Voliam flexi, Voliam xpress, Calypso	To suppress early BMSB populations
<i>Mid summer</i>	Aphids, JB, AM, mites, scales, leafhoppers,	Lannate, Vydate, Actara, Leverage, Assail, Danitol, Belay	Control on stone fruit, suppression on pome fruit
<i>Late summer</i>	CM, OFM, TABM, leafhoppers,	Lannate, Danitol, Belay, Endigo, Warrior,	Control on pome fruit
<i>After harvest (stone fruit, early pome fruit)</i>		Thionex,	Control, suppression  <b>DO NOT USE WHILE FRUIT ARE PRESENT</b>

**Always read and follow product label**

# Alternative BMSB Management/Control Options

## Border applications

- Surround, Surround plus other insecticides,
- Use strong residual products; sprays at fencerows, ditches, borders etc. ..

## Treatments of surrounding vegetation

- Products registered for ground cover treatments
- Talk to your neighbor, monitor surrounding vegetation/fields, especially late season

## Alternative crop plantings

- Possible trap crops (e.g., soybean, Paulownia trees)
- Other to be determined

## BMSB behavior vs. pesticide application

Spatial and temporal distribution of targeted stink bugs during insecticides applications;  
Possible advantage of ARM applications, especially earlier

# Monitor, scout, check, observe....

Throughout the season please see the most recent PSU BMSB management suggestions at:

<http://frec.cas.psu.edu>



# Spring BMSB monitoring



Urban



Agricultural



Woods



**Lures:**  
**AgBio – HR (2011)**  
**AgBio – LR (2010)**

## Early season BMSB monitoring summary

Method	# of locations/ # of observations	Total # of traps	Total # of BMSB adults	Total # of other SB
Traps	9/76	132	70 (1)	30
Visual	9/49	132	229	13

Traps were placed in or around commercial orchards, with documented history of **heavy** BMSB infestation.





# ***PSU's BMSB Resources on the web***

PSU Department of Entomology Fact Sheets:

<http://ento.psu.edu/extension/factsheets/brown-marmorated-stink-bug>

PSU Fruit Times Newsletter updates (special BMSN issue):

<http://extension.psu.edu/fruit-times/combined-recent-stink-bug-articles-figures-and-tables>

PSU management recommendations:

<http://frec.cas.psu.edu/pdf/BMSB-management-suggestions%20.pdf>

<http://frec.cas.psu.edu/presentations/InvasiveSpecies11.pdf>

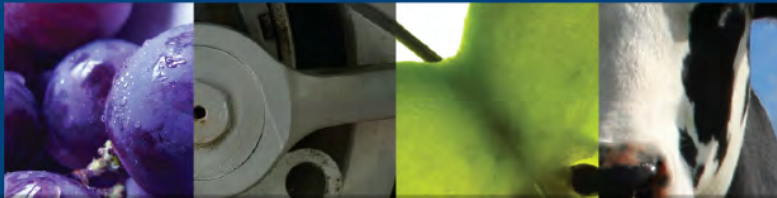
<http://shaponline.org/PDF/2011/BMSB%20Hershey%20update%20fv%20for%20SHAP.pdf>

Interactive map of BMSB distribution:

<http://stinkbug-info.org/>

PSU FREC web site based weekly updated for fruit growers:

<http://frec.cas.psu.edu/weeklybytes.html>



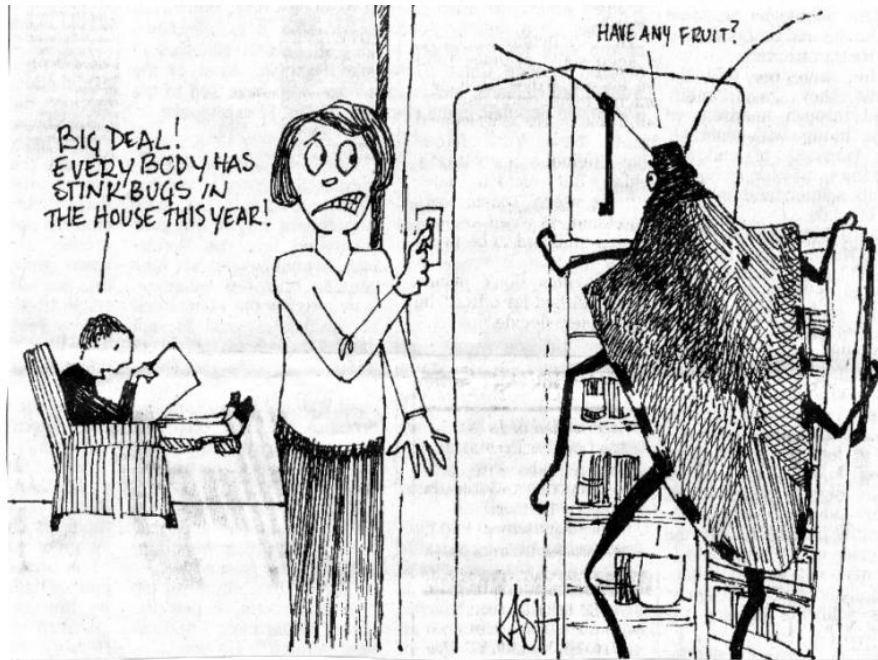
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Thank you  
**Questions?**



*"Evening Sun" York County, PA (Oct 2010)*



June 14, 2011