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VIRGINIA FIELD CROPS AND VEGETABLES BMSB RESEARCH UPDATE

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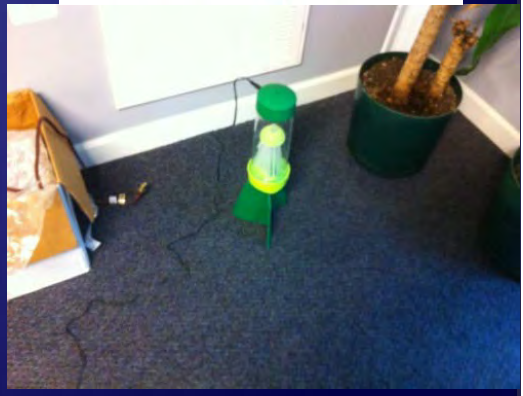
Virginia Tech

Evaluating indoor light traps

- Aigner, J.D. and T.P. Kuhar. 2014. Using Citizen Scientists to Evaluate Light Traps for Catching Brown Marmorated Stink Bugs in Homes in Virginia. J. of Extension (*in review*)



Deltamethrin-incorporated polyethylene mosquito netting

BMSB threat to cotton

- Kamminga, K., D. A. Herbert, M.D. Toews, S. Malone, and T. Kuhar. 2013. *Halyomorpha halys* (Hemiptera: Pentatomidae) feeding injury on cotton bolls. J. Cotton Sci. *in press*

Can BMSB take the heat?

- In the lab, temps. >40˚C (104˚F) resulted in significant mortality to all life stages of BMSB after < 4hrs exposure
- BMSB development is negatively impacted at temps > 33˚C (91˚F) and no development occurs > 35˚C (Nielsen et al. 2008)

Nielsen, A.L., G.C. Hamilton, and D. Matadha. 2008. Developmental Rate Estimation and Life Table Analysis for *Halyomorpha halys* (Hemiptera: Pentatomidae). Environ. Entomol. 37(2): 348-355 (2008)

Where is BMSB in Virginia?

Species complex of stink bug adults observed on wooded borders and agricultural crop plants* from May until Oct 2012 and 2013 in two regions of Virginia.

	Southwestern		Eastern Shore	
Stink bug	**2012**	**2013**	**2012**	**2013**
Halyomorpha halys	930	311	3	27
Chinavia hilare	10	13	596	128
Euschistus servus	47	14	463	176
Murgantia histrionica	67	2	13	0
Brochymena sp.	10	13	1	0
Oebalus pugnax	0	5	6	1
Thyanta spp.	4	0	11	12
Euschistus tristigmus	7	2	0	0
Other stink bug*	8	1	0	0

* Brassica plants were excluded from the dataset because of the high numbers of harlequin bug, *Murgantia histrionica*, which would skew the data. Harlequin bugs found on non-brassica plants were included.

Favorite Host Plants

Paulownia

Tree of Heaven

Catalpa

Corn

Peach

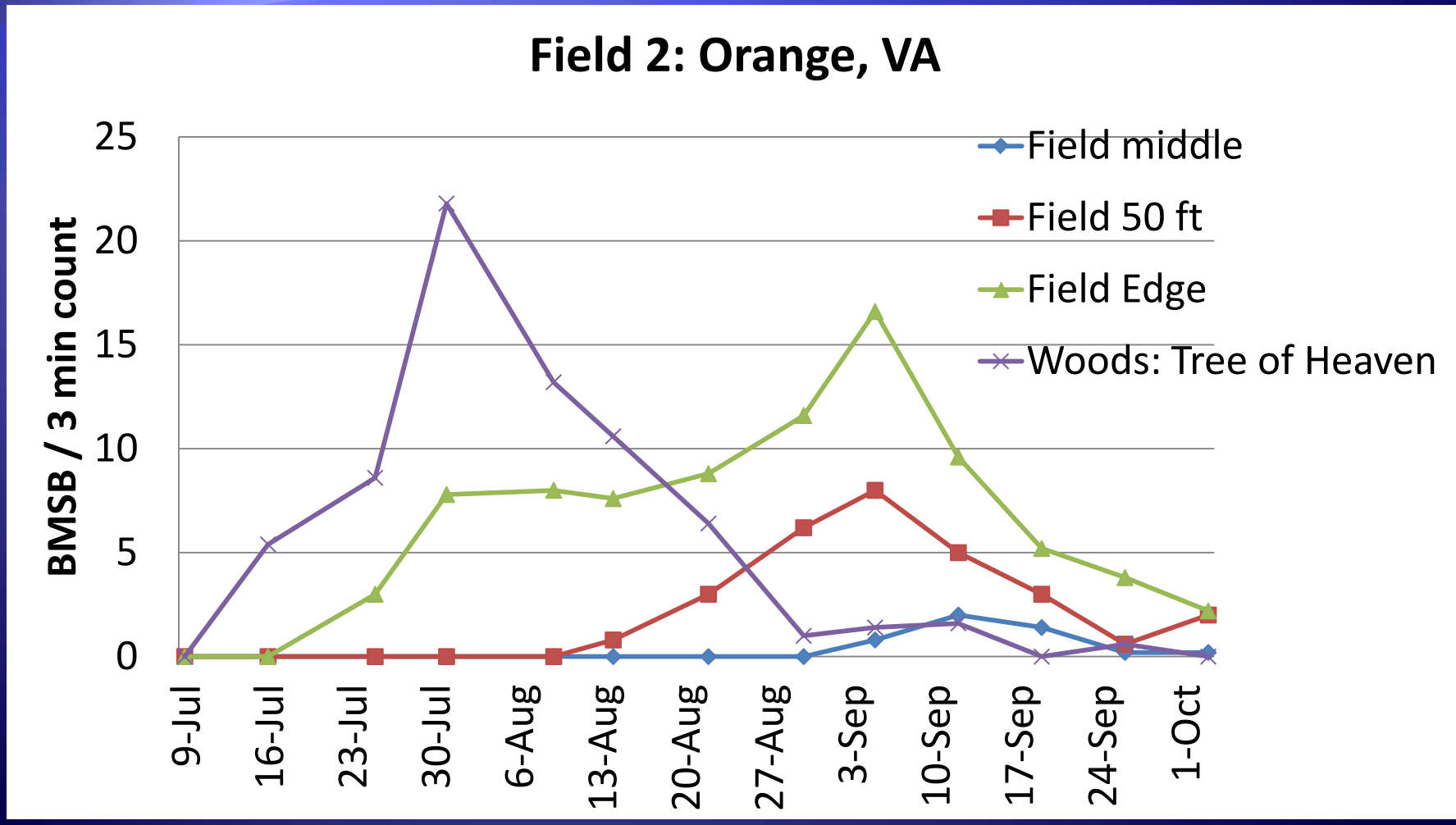
Mulberry

Wild cherry

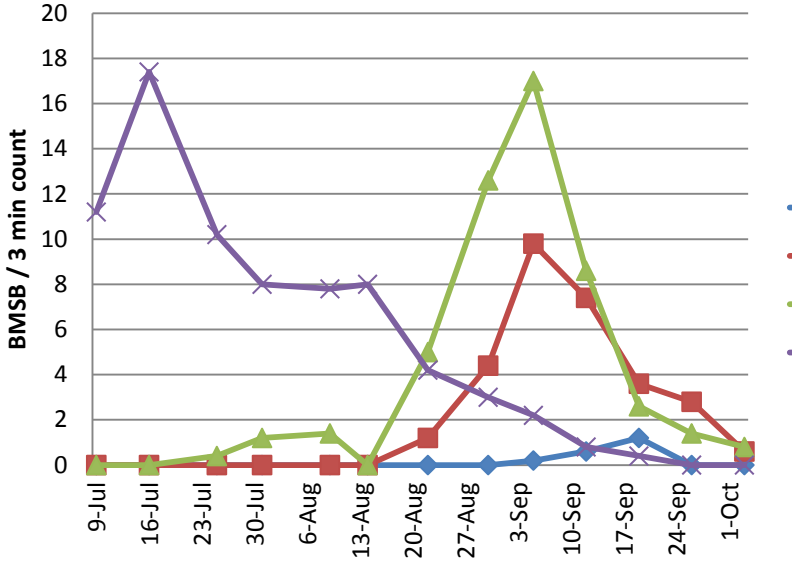
Host Plants of the Brown Marmorated Stink Bug in the U.S. Technical bulletin publication of the Brown Marmorated Stink Bug IPM Working Group in conjunction with the Northeastern IPM Center posted Online http://www.StopBMSB.ORG , October, 7, 2013.

ree of Heaven

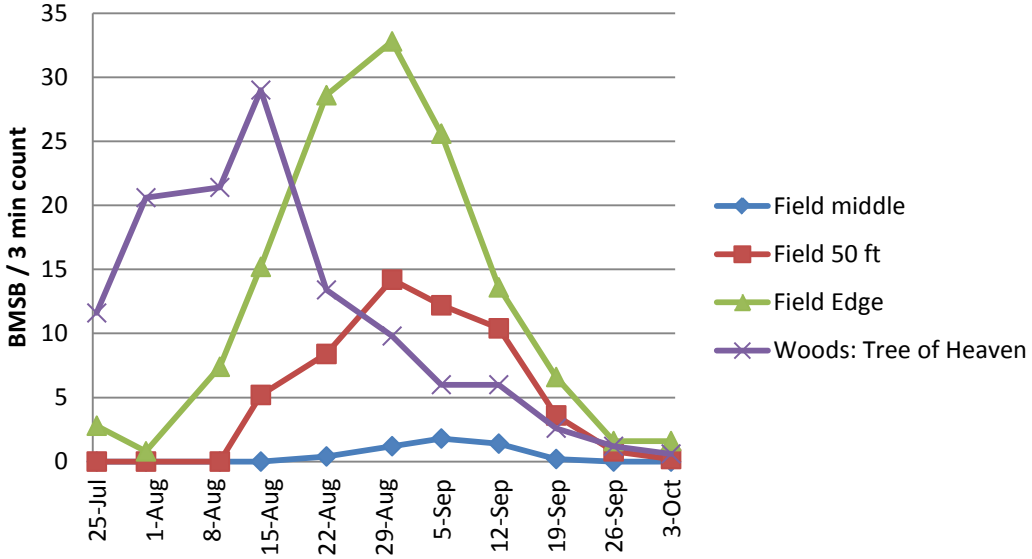
Sampling soybean fields in VA



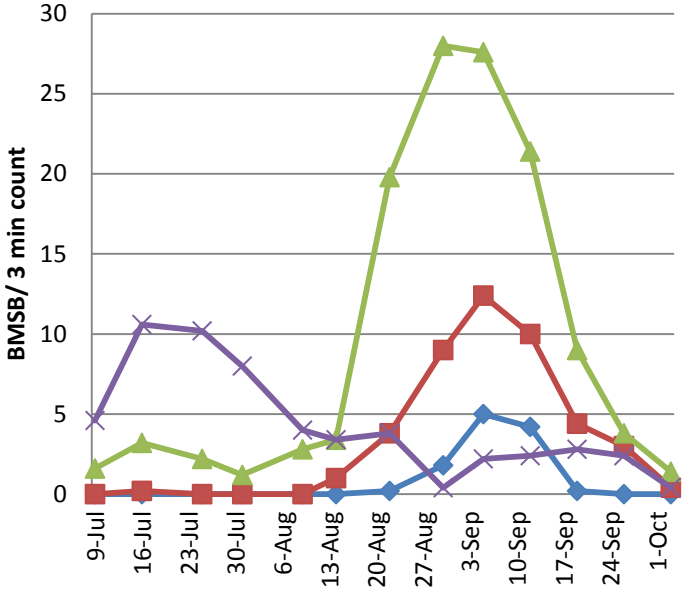
Field 3: Orange, VA



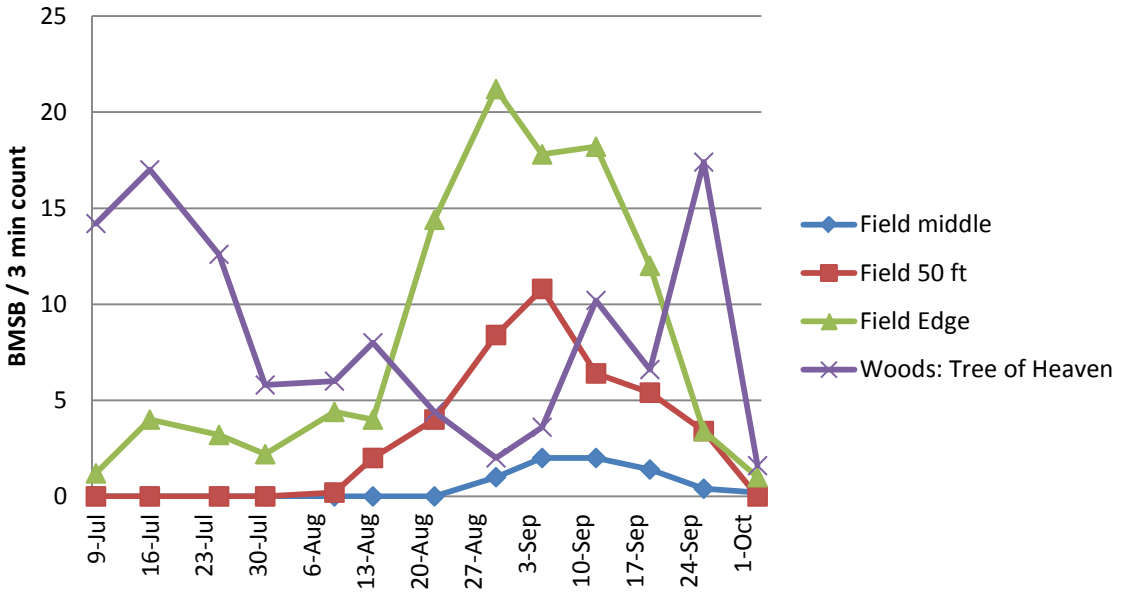
Field 6: Madison Co.



Field 5: Orange, VA



Field 4: Orange, VA



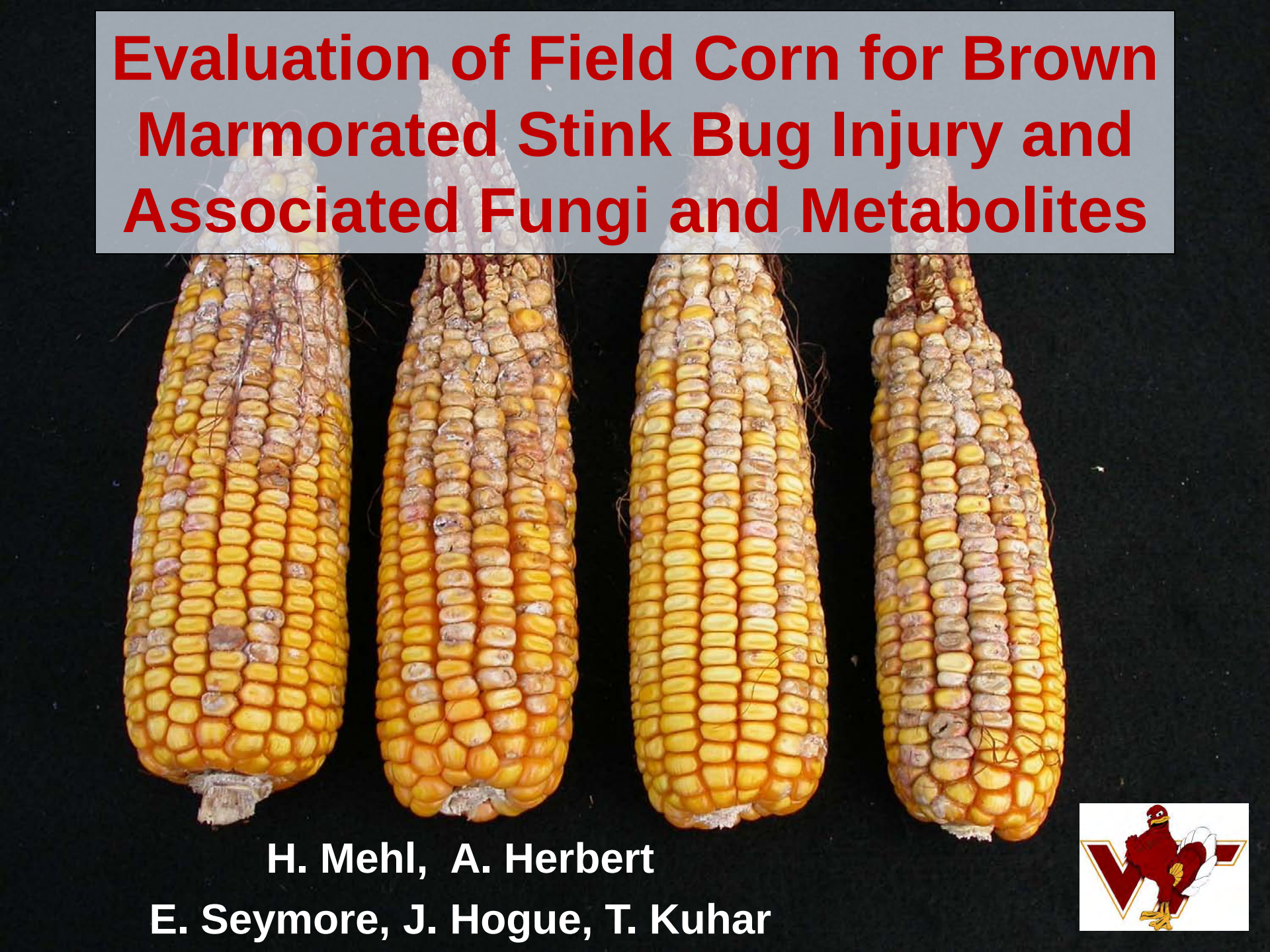
- Stink bugs move into soybean fields at the R4 (full pod) stage
- Injury to soybeans includes undeveloped (flat) pods, punctured and deformed seed

Spraying soybean borders

Soybean border spray data - 2013

Location	Date treated	R-stage	Post-treatment sample—number per 15 sweeps									
			Date 1		Date 2		Date 3		Date 4		Date 5	
Stafford	13-Aug	R-5	21-Aug	0	28-Aug	0	6-Sep	0	11-Sep	0	18-Sep	0
Culpeper-1	22-Aug	R-5	28-Aug	0	6-Sep	0	11-Sep	0	18-Sep	0	2-Oct	0
Culpeper-2	24-Aug	R-5	28-Aug	0	6-Sep	0	11-Sep	0	18-Sep	0	2-Oct	0
Culpeper-3	24-Aug	R-5	28-Aug	0	6-Sep	0	11-Sep	0	18-Sep	0	2-Oct	0
Rappahannock	21-Aug	R-5	28-Aug	0	6-Sep	<1	11-Sep	<1	18-Sep	0	2-Oct	0
Clarke-1	30-Aug	R-5	5-Sep	0	11-Sep	<1	18-Sep	0	2-Oct	0	---	---
Clarke-2	30-Aug	R-5	5-Sep	0	11-Sep	0	18-Sep	0	2-Oct	0	---	---

Evaluation of Field Corn for Brown Marmorated Stink Bug Injury and Associated Fungi and Metabolites



H. Mehl, A. Herbert

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Introduction

- **BMSB infestations are usually concentrated on the perimeters of soybean and corn fields**
- **Can have 10+ BMSB on developing ears**
- **Insect injury is often associated with increased levels of fungal infections and mycotoxin contamination**
- **FDA has established regulatory levels for aflatoxin and guidelines for fumonisin and deoxynivalenol (DON) in food and feed (no advisory guidelines for zearalenone)**

Objectives

- **Compare BMSB injury to corn ears at the field edge and interior**
- **Determine the extent to which fungal infection and mycotoxin contamination in corn is associated with BMSB injury**

Materials and Methods

- In mid-September 2013, ears of corn were collected from BMSB-infested 8 corn fields, 8 Virginia counties
- 2-3 mature ears were collected from the field edge and then roughly 12-20 rows straight in from the corresponding edge sample (x3 replicates)
- Corn ears were shelled, dried at 110°F for 72 hours, and stored in seal-top plastic bags
- A 200-ml sample was removed and evaluated for BMSB injury

- **Kernels were classified as BMSB-injured or uninjured using a rating guide**

Results—Kernel injury at edge vs. interior of field

- Average number of corn kernels per 200-ml sample was 525
- Combined over eight fields. there was a significant difference between BMSB-injured kernels from the edge (22.5%) and the interior of fields (2.0%)

Percent BMSB-injured kernels

Location	Albemarle	Culpeper	Frederick	King George	Madison	Orange	Powhatan	Spotsylvania	All counties combined
Edge	23.0	40.1	13.7 a	15.9	32.9 a	24.5 a	8.0	30.6	22.5 a
Interior	2.9	1.1	2.7 b	2.0	0.6 b	1.0 b	5.4	0.8	2.0 b
LSD	NS	NS	4.10	NS	20.80	5.48	NS	NS	5.92

- **For fungal isolations, a 20-kernel subsample representative of each corn sample was plated on Potato Dextrose Agar (PDA) with chloramphenicol**
- **Kernels were surface-disinfected (10% bleach, 2 min.) then aseptically transferred to PDA plates (5 kernels per plate)**
- **Plates were incubated at room temperature for one week then observed for the presence of fungi**
- **Fungi were identified, and the number of kernels infected was recorded**

Frequency of fungi isolated from corn kernels collected from the edge and middle of fields (based on 20-kernel random subsample)

	% *Fusarium*		% *A. flavus*		% *A. niger*		% *Penicillium*		% Other		% Kernels infected	
Location	Edge	Middle	Edge	Middle	Edge	Middle	Edge	Middle	Edge	Middle	Edge	Middle
Albermarle	47	40	0	0	0	5	17	15	7	2	67	58
Powhatan	17	15	0	0	0	2	2	15	2	0	20	32
Orange	48	25	0	0	7	0	17	8	2	7	72	40
Madison	32	18	0	0	5	0	5	12	5	3	47	35
Culpeper	25	8	3	0	0	0	5	3	3	5	35	15
Frederick	19	4	0	0	5	0	9	8	5	6	35	18
King George	35	23	0	0	0	2	2	8	3	7	40	40
Spotsylvania	30	8	2	0	2	2	0	3	8	7	38	20
Combined	31	18	0.4	0	3	2	7	9	4	5	44	32
P-VALUE: Location	0.06		0.28		0.49		0.16		0.5		0.04	
Edge vs middle	**0.02**		0.07		0.72		0.43		0.86		0.08	
Interaction	0.98		0.28		0.21		0.5		0.68		0.81	

- **The remaining kernels were ground into meal using a Thomas-Wiley Laboratory Mill Model 4, with a 1-mm-opening sieve**
- **A 20-gram subsample of the meal was used in the mycotoxin extraction and quantification process**
- **Mycotoxins were extracted from the ground corn and quantified using Reveal Q+ kits (Neogen) for fumonisin, deoxynivalenol (DON), zearalenone, and aflatoxin**
- **Reveal Q+ mycotoxin kits employ a lateral flow immunochromatographic assay based on a competitive immunoassay format**
- **Test strips were placed in sample extract, given time to develop, and the sample was immediately read using the AccuScan Pro (Neogen) scanner**

Mycotoxin concentrations in corn kernels collected from the edge and middle of fields

	Fumonisin, ppm		Zearalenone, ppb		DON, ppm		Aflatoxin, ppb	
Location	Edge	Middle	Edge	Middle	Edge	Middle	Edge	Middle
Albermarle	4.5	1.9	249	167	2.5	2.4	1.1	0.9
Powhatan	4.9	0.2	85	102	0.9	0.3	1.4	1.3
Orange	15.6	0.1	147	84	0.1	0.1	0.9	1.0
Madison	8.7	0.4	110	93	0.1	0.0	1.0	1.5
Culpeper	4.1	0.3	38	25	0.1	0.6	1.0	0.7
Frederick	9.3	1.3	42	68	0.0	0.1	1.0	1.2
King George	18.3	6.0	94	62	0.1	0.0	0.4	0.4
Spotsylvania	36.7	3.5	60	26	0.2	0.2	0.4	0.2
Combined	13.3	1.9	99	81	0.4	0.5	0.9	0.9
P-VALUE: Location	0.0005		<0.0001		0.0012		0.0002	
Edge vs Middle	<0.0001		0.06		0.21		0.25	
Interaction	0.28		0.11		0.9		0.47	

Results—mycotoxin extraction and quantification

- **Fumonisin, zearalenone, DON, and aflatoxin were all detected from corn kernels, but only fumonisin exceeded FDA advisory levels**
- **Concentrations of all four mycotoxins varied among locations, but fumonisin was consistently higher in BMSB-damaged corn collected from the edge of plot than in corn collected from the middle of fields (*P*<0.0001)**
- **Corn collected from the middle of fields had 58 to 99.7% less fumonisin than corn from the edges**
- **Fumonisin concentrations were positively correlated with the proportion of kernels infected with *Fusarium* (r^2 = 0.33, *P*<0.0001) and the proportion of kernels with BMSB damage (r^2 = 0.26, P=0.0004)**

So What?

Thanks to my wonderful lab crew

And funding sources:
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