

BROWN MARMORATED STINK BUG IN ORNAMENTALS

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The invasive Brown Marmorated Stink Bug (BMSB) (*Haylomorpha halys*) is native to northeastern Asia and has been found in many of the U.S. states. This pest was first detected in Oregon in 2004, within crops in 2012, and crop damage was just recently reported in 2013 by BMSB. In addition to agricultural losses in fruit orchards, BMSB is a nuisance as it aggregates in the thousands in people's homes for the winter. BMSB can be a devastating pest because it is highly polyphagous, utilizing hosts ranging from tree fruits (apple, peach, pear, cherry), nuts (hazelnut), small fruits (grape, raspberry), and ornamentals (crabapple, elm, hawthorne, lilacs, maple, ornamental *Prunus*).

Results from our monitoring, biological control in the landscape, olfaction protocol validation, and voltinism study are presented.

Monitoring. BMSB were monitored in 2011-2013 in nurseries with baited pyramid traps (p), hanging Rescue Trap and 100 beat samples (b) (Table below). In 2011, we sampled 14 sites each week within two large nurseries with a wide host variety, and BMSB was collected on two dates in the field. In 2012, we sampled 16 sites over a larger geographical area in retail and production nurseries, but collected no BMSB. In 2013, sampling was reduced to 3 sites with the pheromone + synergist, and BMSB were collected in August to October.

Year	Location	Habitat	Sample	Dates	Catch BMSB?
2011	Canby (3 miles spread)	Elm	P,b	July 11 -	
		Pear near sawdust	P,b	Nov 23	
		Cherry stock block (unsprayed)	Rescue		
		Plum stock block (unsprayed)	P,b		nymph (b) Sep 8
		Poplar and plum	P,b		
		Plum next to filbert	P,b		
		Crabapple next to hawthorne	P,b		
		Crabapple next to burn pile	P,b		
	Dayton (1 mile spread)	Plum (young and old)	P,b		nymph (p) Oct 7
		Hedge near abandoned orchard	Rescue	July 19 -	
2012	Philomath	Euonymus	P	Nov 22	
		Crabapple and plums	P, b		
		Syringa	P, b		
		Philomath	Plum, cherry, nut trees	P	Jun 5 -
	N Corvallis	Mix of ornamentals	P	Nov 6	
		S Corvallis	Mix of ornamentals	P	
	E Corvallis	Cherry laurel	P, b		
		Conifers	P		
	Dayton (1 mile	Hedge near abandoned orchard	P	Jun 11 -	
		Oak grove	P	Nov 1	

	spread)	Mix of ornamentals	P		
	S Dayton	Rose	P		
	(5 mile	Apple	P, b		
	spread)	Cherry	P, b		
	Canby	Crabapple	P, b		
	(1.5 mile	Hawthorne	P, b		
	spread)	Plum stock block (unsprayed)	P, b		
	Gervais	Cornus	P		
		Euonymus	P		
2013	Canby	Plum stock block (unsprayed)	P, b	May 20-	adult (p) Aug 14 ^a
	Dayton	Hedge near abandoned orchard	P	Oct 23	
	Portland	Mix of ornamentals	Rescue		

^a Additional collections of BMSB were made at this site: 2nd instar Sep 4, 2nd-4th instars Sept 11-18, and adults and nymphs Oct 23.

Biological control. Parasitism and predation was monitored on BMSB eggs in 2013. One hundred clutches of frozen sentinel eggs were placed on the underside of leaves of Cherry laurel, English holly, Oregon Grape and Red Maple in the Corvallis urban landscape. Eggs were exposed for a one-week period in June, July, and August. *Trissolcus euschistii* was the only parasitoid found from egg clutches with/without predator enclosure cages surrounding them. Predation by piercing-sucking and chewing was also observed (Table below, data pooled over dates and caged/uncaged).

Host plant	% clutches parasitized	% total eggs para.	% eggs para. w/in hit clutch ^b	% success-ful para. emergence ^b	% clutches pierced or chewed	% tot. eggs pierced or chewed
Cherry laurel	15.0	10.0	66.4	7.9	35.0	21.5
English holly	35.0	19.3	55.2	32.4	40.0	26.6
Oregon grape	3.3	3.3	100	0	36.7	14.0
Red maple	11.5	6.0	52.3	27.8	34.6	8.0

^b Sample size is low when only the parasitized clutches are examined, n = 3, 7, 3, 1, respectively.

Olfaction validation. A protocol for testing BMSB olfaction was validated with a 24 mm diameter glass y-tube (19 cm stem, 8 cm arms). **Protocol:** Methods were adjusted from those used for BMSB in a larger 80 mm diameter y-tube (Harris & Zhang, USDA ARS Newark). Naïve adults are isolated by transferring them into vented 4 oz. cups for ¼-1 hr prior to testing. Placement of BMSB within closed containers or movement of BMSB from different labs/locations right before testing will result in low response rates. Humidified air is blown through the tube at 1 L/min. For odors present on bulky mediums, the odor can be added to a secondary flask hooked up after the humidifying flask. This can reduce air flow. Each y-tube is inside a black cardboard box with a translucent window at the back end. Diffuse light is used overhead. Odors are randomly placed in the “A” or “B” arm, and for left and right orientation. In a given day with multiple insects, the y-tube is flipped, so the left and right orientation changes while keeping the odor on the same “A” or “B” arm. No more than six insects are run per tube per day. At the end of each day, y-tubes and flasks are rinsed with warm water, ethanol, and acetone, and air-dried. Trials are conducted within the same time period each day for consistency.

Validation: BMSB were tested for response to the pheromone on a septum and blank within 10 minutes. BMSB originated from the overwintering colony or were collected from Portland in May

2013. Both sexes were tested and pooled in the analysis. Between January 31 and June 28, 54 BMSB were tested, 23 made no choice and were excluded. 22 adults out of 31 selected the pheromone (71%) versus the control (29%), Pearson $\chi^2 = 5.5$, $P = 0.0196$, $df = 1$. This protocol is being used for subsequent studies on plant volatiles with Dr. Wiman.

Voltinism. Voltinism was monitored in outdoor cages set up outside the USDA ARS in Corvallis, Oregon. Wild BMSB adults were either netted onto branches, or fresh egg clutches were placed on leaves at the start. In 2012, cages were placed in full sun. Few 4th instars were seen, and 3rd instars were often last stage seen in cages. No BMSB were found in cages during the first week of August and the 2012 study was ended. In 2013, cages were placed along a fenceline, with partial shading in the afternoon. Egg laying was first observed June 3, and new adults July 31 (Table below lists dates of first observations).

	2013		2012
	Walk-in 6 ³ ft	Tent cage 30"x30"x45"	Cage 1 ³ m
BMSB	Wild adults 2♀: 2♂ in mesh sleeve	Eggs laid by wild adults in lab	Eggs laid by wild adults in lab
Set-up	May 21, 2013	May 20-28, 2013	May 22 – June 12, 2012
Plants	3-4 plants: euonymus, fava, horse chestnut, lilac, maple, paulownia, peach, sunflower, tree of heaven		4 plants: Red maple, Spirea, Syringa, Viburnum
Food	Jelly beans in June, then peanuts and green beans		None
Oviposition	June 3 (ave. June 16) Daylength 15 hr 23 min	<i>In lab eggs laid May 20 – June 3, put outside in 1-3 d</i>	<i>In lab eggs laid May 20^c, June 1-12 put out</i>
Hatch	June 17 (ave. July 2)	June 7 (ave. June 17)	June 12
2 nd instar	June 19 <i>sleeve removed</i>	June 19 <i>freely roaming</i>	June 18
3 rd instar	July 3	June 21	June 28
4 th instar	July 17	July 12	July 9
5 th instar	Aug 5	July 19	-
Adults	Aug 23	July 31	-
2 nd Ovipos.	Sep 3	Did not lay	-
Replicates	4 cages	6 cages	4 cages

^c Eggs laid ~May 20 in the lab failed to hatch outside because of rain water damage. Rain shelters were set up thereafter