



The Distribution of Overwintering Brown Marmorated Stink Bugs (Hemiptera: Pentatomidae) in College Dormitories

Authors: Cambridge, John, Payenski, Allison, and Hamilton, George C.

Source: Florida Entomologist, 98(4) : 1257-1259

Published By: Florida Entomological Society

URL: <https://doi.org/10.1653/024.098.0442>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non-commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

The distribution of overwintering brown marmorated stink bugs (*Hemiptera: Pentatomidae*) in college dormitories

John Cambridge*, Allison Payenski, and George C. Hamilton

Halyomorpha halys (Stål) (Hemiptera: Pentatomidae), commonly known as the brown marmorated stink bug (BMSB), is an invasive, non-native agricultural and domestic pest in North America. Since its introduction into eastern Pennsylvania in the mid 1990s (Hoebeker & Carter 2003), it has spread to or been detected in at least 42 states (Leskey 2014). Like many other pentatomids (Saulich & Musolin 2014), BMSB undergoes facultative diapause and overwinters as sexually immature adults (Nielsen & Hamilton 2009). Prior to diapause, this species seeks out and clusters in secluded dark areas, where it remains dormant until spring (Toyama et al. 2006, 2011). In the mid-Atlantic Region of the United States, adults begin moving into overwintering sites in Sep and Oct. They remain in these sites until they emerge in the beginning of spring between Mar and Apr (Nielsen et al. 2008). In its native range of eastern Asia, BMSB is known to be an arboreal species (Bernon et al. 2005) that overwinters in dead standing trees such as oaks, locusts, and paulownias (Lee et al. 2014). In addition to natural overwintering sites, BMSB has a well-documented behavior of moving into structures to overwinter (Kobayashi & Kimura 1969; Wantanbe et al. 1994; Hamilton 2009; Inkley 2012; Leskey et al. 2012). Entrance into these structures is thought to occur through gaps in the window and door trim, roof flashing, and other gaps around doors and ventilation holes (Welty et al. 2008).

Understanding the overwintering ecology and behavior of this insect will be critical in developing effective management techniques for suppressing it (Lee et al. 2014). To address this issue, we conducted a study in 2 student dormitory halls located on the Rutgers University Cook Campus in New Brunswick, New Jersey, USA. The survey portion of this study was conducted between 21 Feb and 14 Mar 2014. The survey asked the participants to identify the dorm unit in which they lived and whether or not they had observed any BMSB in their dorm since Sep 2013. A life-sized color picture of BMSB was included with each survey to help respondents with proper identification. No information about infestation magnitude or insect position within a dorm room was used in the analysis due to the non-uniformity and incompleteness of the responses. Information about observed BMSB in common areas, utility rooms, storage spaces, and bathrooms in the building was not collected in this study. The Perry residence hall and Voorhees residence

hall contain 93 and 115 dormitory units, respectively. All rooms were of approximately equal size (~30 m³). Both buildings had nearly identical floor layouts on the 2nd, 3rd, and 4th floors (Fig. 1). The 1st floor of each building had fewer dorm units than the other floors because it included the common area, utility rooms, and other storage spaces. Data were combined from both dorms and analyzed using a Kruskal–Wallis test with R 3.0.1 statistical software (R Core Team 2015).

Ninety out of 113 units and 69 out of 93 units were surveyed successfully in Voorhees and Perry, respectively. From the 1st floor to the 4th floor in Voorhees, the percentage of rooms with observed BMSB was 20.0, 20.0, 19.2, and 34.5%, respectively. In Perry, the observed

hall contain 93 and 115 dormitory units, respectively. All rooms were of approximately equal size (~30 m³). Both buildings had nearly identical floor layouts on the 2nd, 3rd, and 4th floors (Fig. 1). The 1st floor of each building had fewer dorm units than the other floors because it included the common area, utility rooms, and other storage spaces. Data were combined from both dorms and analyzed using a Kruskal–Wallis test with R 3.0.1 statistical software (R Core Team 2015).

Ninety out of 113 units and 69 out of 93 units were surveyed successfully in Voorhees and Perry, respectively. From the 1st floor to the 4th floor in Voorhees, the percentage of rooms with observed BMSB was 20.0, 20.0, 19.2, and 34.5%, respectively. In Perry, the observed

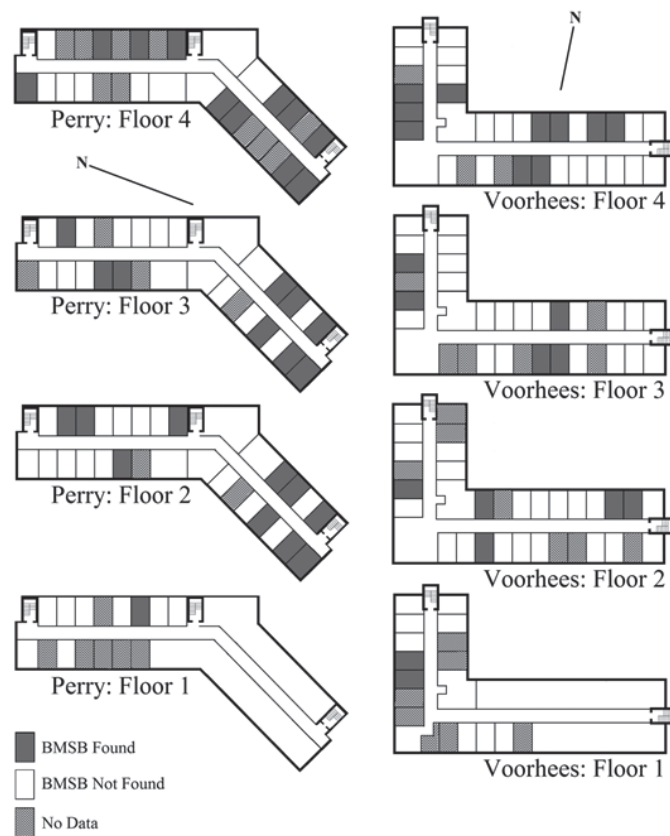


Fig. 1. Floor plans for Perry (left) and Voorhees (right). Gray and white rooms represent rooms where overwintering BMSB was and was not observed, respectively, by the occupants. Diagonally patterned rooms represent rooms where no data were collected.

Department of Entomology, Rutgers University, New Brunswick, New Jersey 08901, USA
*Corresponding author; E-mail: john.cambridge000@gmail.com

BMSB infestation rate was 11.1, 31.8, 40.9, and 68.8%, respectively, from the 1st to the 4th floor. Figure 2 shows the pooled data for both buildings on each floor. These results support the hypothesis that BMSB has a tendency to overwinter towards the tops of buildings ($P < 0.05$, $df = 3$). When tested for cardinal directionality in the buildings, results were insignificant for both individual residence halls ($P > 0.05$, $df = 1$).

As an arboreal species, this insect is found above ground level for much of its life cycle. A previous study looking at the distribution of overwintering BMSB in forests showed that individuals were much more likely to be found in dead standing trees than on the forest floor in fallen logs or leaf litter (Lee et al. 2014). This finding provides a possible behavioral explanation for BMSB's movement into urban buildings through the doors, windows, and other areas higher in the structures. Our results support the hypothesis and provide evidence that BMSB prefers to overwinter above ground level in urban structures. Control protocols to suppress overwintering populations may use these findings to specifically target areas within an infested structure that are likely to contain the most individuals. By focusing on the upper portions of buildings, treatments may eliminate the majority of BMSB without having to incur the cost of treating the entire structure.

This study examined only buildings that were 4 stories tall, and the findings may not be directly translatable to taller buildings that are beyond the height of the host tree species in which BMSB naturally overwinters. Interpretation of these findings should also take into account the fact that the non-residential portions of the buildings were not surveyed. For the data collected, some results may also be inaccurate due to misidentification of BMSB or observer error, because identification was based on comparing pictures of the insect to encounters over the past several months.

Further investigation into how BMSB distributes itself in large, taller, and less homogeneous buildings should be done to more accurately characterize the behavior patterns governing this insect's overwintering habits. This study sampled BMSB locations towards the end of its overwintering period and the findings should be interpreted as such. It is possible that these insects, upon entering a structure, will continue to move around until they either find a suitable location for diapause or die. This study provides evidence on how BMSB are distributed in multi-floor buildings in late Feb to early Mar. Future investigations

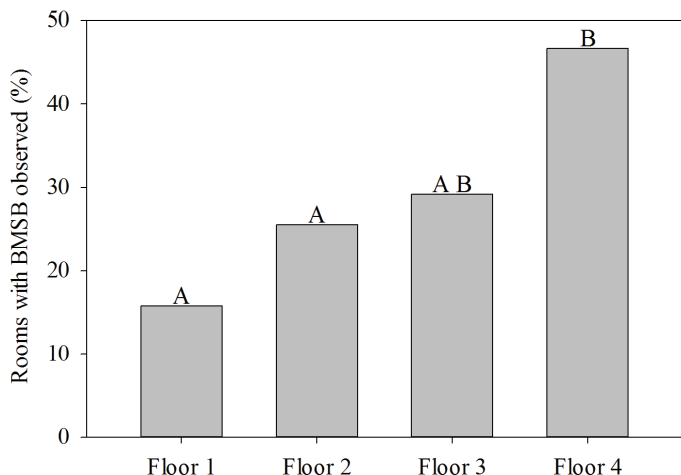


Fig. 2. Percentage of rooms where residents observed BMSB, shown by floor. Data are pooled from Perry and Voorhees residence halls. Bars with the same letter shown above are not statistically different as determined with a Kruskal-Wallis test ($P > 0.05$).

should look into where this insect can be found in these types of structures during other portions of the overwintering season.

The authors of this study do not report any conflicts of interest with the investigation. The study would not have been possible without the help of a large team of surveyors. Thank you to Mario Hernandez, Jeff Geist, Chris Alessi, David Kim, Raynee Morris, Anthony Pepi, and Kelsey Sealey. Thank you to the Rutgers University for the necessary resources and opportunity to conduct this study.

Summary

This investigation into the pattern of overwintering brown marmorated stink bugs (BMSB) used survey data collected between Dec 2013 and Mar 2014 from residents in two 4-story dormitories on the Rutgers University Cook Campus in New Brunswick, New Jersey, USA. Results suggest that a higher proportion of BMSB overwinters towards the top of urban structures than towards the ground level. This finding can be used by pest control operatives for targeted applications that will reduce the total amount of pesticides needed while still suppressing the majority of urban nuisance populations of BMSB.

Key Words: brown marmorated stink bug; dormitory; structure

Sumario

Esta investigación sobre el patrón de hibernación del chinche café marmorado (CCM) utilizó los datos recolectados en un sondeo entre diciembre del 2013 y marzo del 2014 de los residentes de dos dormitorios de 4 pisos en la Universidad de Rutgers, Cook Campus en New Brunswick, Nueva Jersey, EE.UU. Los resultados sugieren que la mayor proporción de CCM pasa el invierno en la parte superior de las estructuras urbanas que en el nivel del suelo. Este hallazgo puede ser utilizado por los trabajadores en el control de plagas para aplicaciones específicas que reduzcan la cantidad total de los plaguicidas necesarios y al mismo tiempo suprimiendo la mayoría de las poblaciones urbanas de CCM que molestan

Palabras Clave: marmorated marrón chinche; dormitorio; estructura

References Cited

- Bernon G, Bernhard KM, Hoebeke ER, Carter ME, Beanland L. 2005. *Halyomorpha halys*, (Heteroptera: Pentatomidae), the brown marmorated stink bug; are trees the primary host for this new invasive pest? Proceedings of the XV USDA Interagency Research Forum on Gypsy Moth and Other Invasive Species 2004: 12.
- Hamilton GC. 2009. Brown marmorated stink bug. *American Entomologist* 55: 19-20.
- Hoebeke ER, Carter ME. 2003. *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae): a polyphagous plant pest from Asia newly detected in North America. *Proceedings of the Entomological Society of Washington* 105: 225-237.
- Inkley DB. 2012. Characteristics of home invasion by the brown marmorated stink bug (Hemiptera: Pentatomidae). *Journal of Entomological Science* 47: 125-130.
- Kobayashi T, Kimura S. 1969. Studies on the biology and control of house-entering stink bugs. I. The actual state of the hibernation of stink bugs in houses. *Bulletin of the Tohoku National Agricultural Experiment Station Morioka* 37: 123-128.
- Lee DH, Cullum JP, Anderson JL, Daugherty JL, Beckett LM, Leskey TC. 2014. Characterization of overwintering sites of the invasive brown marmorated stink bug in natural landscapes using human surveyors and detector canines. *PLoS One*, 9: e91575.
- Leskey TC. 2014. Where Is BMSB? <http://www.stopbmsb.org/where-is-bmsb/> (last accessed 14 Jan 2015).

- Leskey TC, Hamilton GC, Nielsen AL, Polk DF, Rodriguez-Saona C, Bergh JC, Herbert DA, Kuhar T, Pfeiffer D, Dively GP, Hooks CRR, Raupp MJ, Shrewsbury PM, Krawczyk G, Shearer PW, Whalen J, Koplinka-Loehr C, Myers E, Inkley D, Hoelmer KA, Lee D-H, Wright SE. 2012. Pest status of the brown marmorated stink bug, *Halyomorpha halys* in the USA. *Outlooks on Pest Management* 23: 218-226.
- Nielsen AL, Hamilton GC. 2009. Life history of the invasive species *Halyomorpha halys* (Hemiptera: Pentatomidae) in northeastern United States. *Annals of the Entomological Society of America* 102: 608-616.
- Nielsen AL, Hamilton GC, Matadha D. 2008. Developmental rate estimation and life table analysis for *Halyomorpha halys* (Hemiptera: Pentatomidae). *Environmental Entomology* 27: 348-355.
- R Core Team. 2015. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria, <http://www.R-project.org> (last accessed 1 Sep 2015).
- Saulich AK, Musolin DL. 2014. Seasonal cycles in stink bugs (Heteroptera, Pentatomidae) from the temperate zone: diversity and control. *Entomological Review* 94: 785-814.
- Toyama M, Ihara F, Yaginuma K. 2006. Formation of aggregations in adults of the brown marmorated stink bug, *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae): the role of antennae in short-range locations. *Applied Entomology and Zoology* 41: 309-315.
- Toyama M, Ihara F, Yaginuma K. 2011. Photo-response of the brown marmorated stink bug, *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae), and its role in the hiding behavior. *Applied Entomology and Zoology* 46: 37-40.
- Watanabe M, Arakawa R, Shinagawa Y, Okazawa T. 1994. Overwintering flight of brown-marmorated stink bug, *Halyomorpha mista* to the buildings. *Medical Entomology and Zoology* 45: 25-31.
- Welty C, Shetlar D, Hammond R, Jones S, Bloetscher B, Nielsen A. 2008. Brown Marmorated Stink Bug. Fact Sheet. Agriculture and Natural Resources (FS-3824-08). The Ohio State University Extension, Ohio, USA.