

First Report of Brown Marmorated Stink Bug (Hemiptera: Pentatomidae) Associated With *Cannabis sativa* (Rosales: Cannabaceae) in the United States

Kadie Elizabeth Britt,^{1,3} Mika K. Pagani,² and Thomas P. Kuhar^{1,✉}

¹Department of Entomology, Virginia Polytechnic Institute and State University, 170 Drillfield Drive, 220 Price Hall Blacksburg, VA 24061-0319, ²Department of Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg, VA 24061, and ³Corresponding author, e-mail: kadieb@vt.edu

Subject Editor: Boris Castro

Received 18 January 2019; Editorial decision 3 April 2019

Abstract

Brown marmorated stink bug, *Halyomorpha halys* (Stål), is a highly polyphagous pest in North America and Europe. Herein, we report our observations of this invasive stink bug on grain hemp (*Cannabis sativa*) in Virginia, which to our knowledge, is the first published report of *H. halys* associated with that crop. Effects of damage to hemp plants from this insect are unknown, so studies were initiated in 2018 to investigate further. Bugs were caged in varying densities for several weeks on seed heads of grain variety industrial hemp in field plots to document damage appearance and yield effects. Seeds were removed from plants in the laboratory, counted, and weighed to assess differences between treatments. In another study, bugs were reared on hemp seed heads in a lab setting from the second instar stage to adulthood. We found that bugs developed successfully to adulthood. Although further studies are needed, it appears that at this time, *H. halys* may not be a threat to yield and quality of industrial hemp.

Key words: stink bug, first report, industrial hemp

The brown marmorated stink bug, *Halyomorpha halys* (Stål), is an invasive species from east Asia (Lee et al. 2013) that likely entered the United States in the mid-1990s, first detected in eastern Pennsylvania (Hoebeke and Carter 2003). Since the early 2000s, *H. halys* has spread throughout much of the United States, has established in Canada and several European countries, and has become a significant agricultural pest (Haye et al. 2015, Leskey and Nielsen 2018). *Halyomorpha halys* is a highly polyphagous pest with a broad host range of over 170 plant species including a wide array of agriculturally important crops (Leskey and Nielsen 2018). In our examination of the literature, there is currently no documentation of *H. halys* feeding on industrial hemp, *Cannabis sativa* L. (Lago and Stanford 1989, McPartland et al. 2000). Herein, we report our observations of this invasive stink bug on grain variety industrial hemp (*C. sativa*) in Virginia. In September of 2016, one of the co-authors (T.P.K.) inspected a research planting of industrial hemp at Virginia Tech's Kentland Farm in Whitethorne, VA (37.196106N, -80.580221W). At time of inspection, plants were mature with fully developed seed heads and numerous *H. halys* adults were observed feeding on seeds (Fig. 1). Since initial observations in 2016, *H. halys* has remained the most commonly observed stink bug species on grain/fiber hemp at this location in 2017 and 2018. Nymphs, adults, and eggs of this species have been found on plants (Figs. 2 and 3). On 28 August 2018, we received laboratory colony *H. halys* egg masses

from USDA-ARS in Beltsville, MD. On 7 September 2018, we placed 28 second instars into a cage containing a potted *C. sativa* plant along with fresh field-harvested seed heads of *C. sativa*. Survival and development of *H. halys* was assessed comparatively against corn (*Zea mays*), a known suitable host plant (Kuhar et al. 2012); this was evaluated in four cages ($n = 4$) for each host plant type. The study was terminated on 8 October 2018 when there were no remaining live insects in cages. Nymphs successfully completed development on both *Z. mays* and *C. sativa* with an average of 24% (2, 10, 4, and 1 stink bugs developing to adult stage) and 66% (20, 23, 23, and 9 stink bugs developing to adult stage), respectively, which is similar, if not higher, to other published studies of *H. halys* development on various beans, seeds, carrot, or tree fruit (Nielsen et al. 2008, Medal et al. 2012, Acebes-Doria et al. 2016, Dingha and Jackai 2016); Nielsen et al. (2008) observed 52.5% of *H. halys* nymphs on a diet of beans and peanuts and Dingha and Jackai (2016) reported 60–80% survival of *H. halys* nymphs on carrot, green beans, princess tree leaves, and various seeds. Given the developmental success on *C. sativa* compared with *Z. mays*, it appears that *C. sativa* may be a suitable host plant for *H. halys*. More evaluations are needed on reproductive ability to understand the suitability of *C. sativa* as a host for *H. halys*.

So far, the authors have not been able to detect any qualitative or quantitative effects of brown marmorated stink bug feeding

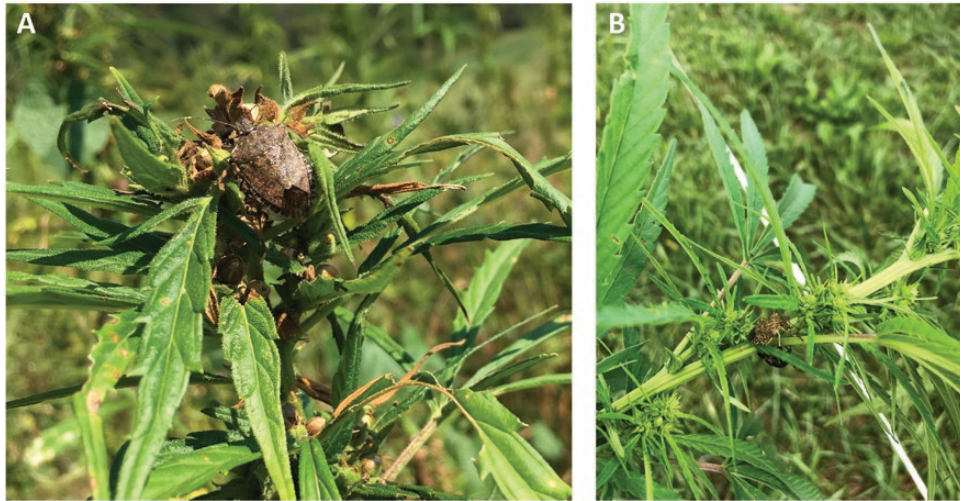


Fig. 1. Brown marmorated stink bug adult on *C. sativa*.



Fig. 2. Brown marmorated stink bug nymphs on *C. sativa*.

injury on leaves, stems, or seeds of *C. sativa*. Among the various types of *C. sativa* crop plants, including those grown for fiber, cannabidiol oil, and marijuana, it is grain hemp that would likely be the most vulnerable to stink bug injury. *Halyomorpha halys* feeds on fruiting or reproductive portions of plants (Kuhar et al. 2012) and in *C. sativa*, seeds from grain varieties are the fruiting or reproductive portions. Occasionally, seeds with a hollow center (unviable seeds) are collected from plants, but at this time we are uncertain if this injury is caused by brown marmorated stink bugs.



Fig. 3. Brown marmorated stink bug eggs on *C. sativa*.

In 2018, the authors conducted a replicated field study in which *H. halys* nymphs were caged on grain hemp plants using 20-liter paint strainer bags at varying densities of 0, 10, and 20 stink bugs per developing seed head/flowering portion of the plant. The experiment was conducted at the aforementioned Kentland Farm and plant and insect health were assessed weekly. Although the brown marmorated stink bugs were observed feeding upon seeds and flowering portions of the plant, seed weight was similar among treatments and there was no visually detectable reduction in quality of seeds. More work should be done to determine the effects of brown marmorated stink bugs on *C. sativa*. However, based on our studies thus far, it does not appear that *H. halys* poses a serious threat to industrial hemp.

References Cited

- Acebes-Doria, A. L., T. C. Leskey, and C. J. Bergh. 2016. Host plant effects on *Halyomorpha halys* (Hemiptera: Pentatomidae) nymphal development and survivorship. *J. Environ. Entomol.* 45: 663–670.
- Dingha, B. N., and L. E. N. Jackai. 2016. Laboratory rearing of the brown marmorated stink bug (Hemiptera: Pentatomidae) and the impact of single and combination of food substrates on development and survival. *Can. Entomol.* 149: 104–117.
- Haye, T., T. Garipey, K. Hoelmer, J. P. Rossi, J. C. Streito, X. Tassus, and N. Desneux. 2015. Range expansion of the invasive brown marmorated stink bug, *Halyomorpha halys*: an increasing threat to field, fruit and vegetable crops worldwide. *J. Pest Sci.* 88: 665–673.

- Hoebeke, E. R., and M. E. Carter. 2003. *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae): a polyphagous plant pest from Asia newly detected in North America. *Proc. Entomol. Soc. Wash.* 105: 225–237.
- Kuhar, T. P., K. L. Kamminga, J. Whalen, G. P. Dively, G. Brust, G. Hamilton, C. Hooks, and D. A. Herbert. 2012. The pest potential of brown marmorated stink bug on vegetable crops. *Plant Health Prog.* 2012. doi:10.1094/PHP-2012-0523-01-BR
- Lago, P. K., and D. F. Stanford. 1989. Phytophagous insects associated with cultivated marijuana, *Cannabis sativa* in northern Mississippi. *J. Entomol. Sci.* 24: 437–445.
- Lee, D.-H., B. D. Short, S. V. Joseph, J. C. Bergh, and T. C. Leskey. 2013. Review of the biology, ecology, and management of *Halyomorpha halys* (Hemiptera: Pentatomidae) in China, Japan, and the Republic of Korea. *Environ. Entomol.* 42: 627–641.
- Leskey, T. C., and A. L. Nielsen. 2018. Impact of the invasive brown marmorated stink bug in North America and Europe: history, biology, ecology, and management. *Annu. Rev. Entomol.* 63: 599–618.
- McPartland, J. M., R. C. Clarke, and D. P. Watson. 2000. Hemp diseases and pests, 1st ed. CABI Publishing, Wallingford, Oxon, United Kingdom.
- Medal, J., T. Smith, A. Fox, A. Santa Cruz, A. Poplin, and A. Hodges. 2012. Rearing the brown marmorated stink bug *Halyomorpha halys* (Heteroptera: Pentatomidae). *Fla. Entomol.* 95: 800–802.
- 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: 348–355.