BIOLOGY OF THE BROWN MARMORATED STINK BUG HALYOMORPHA HALYS (HETEROPTERA: PENTATOMIDAE) IN THE LABORATORY

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The brown marmorated stink bug (BMSB), Halyomorpha halys (Heteroptera: Pentatomidae) probably arrived accidentally in the United States from Asia most likely in packing material. Native to Asia (Hsiao 1977; Zhang 1985) it was first found in Allentown, Pennsylvania in 1998. As of Dec 2012 it has spread or was sighted in approximately 40 states (NAPIS 2009; The Northeastern IPM Center 2012). Several interceptions of the BMSB have been reported through Florida in recent years, but it is not apparently established (Julieta Brambila, Personal Communication). In its native range, it feeds on a wide variety of plants including fruits, ornamental, legumes, vegetables, and weedy plants (Hamilton & Shearer 2003; Nielsen & Hamilton 2009a; Gill et al. 2010). BMSB survives the winter by invading houses and other enclosed structures, and then in the spring it migrates back into crop fields in search of potential host plants. Large populations typically appear in the summer and fall (Gill et al. 2010; Maryland Dept. Agric. - Office of the Secretary 2010).

The biology of BMSB under quarantine-laboratory conditions in Gainesville, Florida is reported herein. The BMSB has 3 developmental stages (egg, nymph, adult). The barrel-shaped eggs are light yellow to light blue, laid in clusters of 20 to 32 eggs (mean = 28.7; mode and median = 28 eggs; n = 32), and glued to the host surface (leaf, stem, fruit). Egg clusters of the BMSB were obtained from a quarantine colony kept under an intense bright light (HOT 5 bulbs; 6,400K) at 16:8 h L:D, 25 °C, and 50-55% RH. Thirty-two egg masses were individually placed in a clear plastic Petri dish (14.5 cm diam × 2.5 cm height) with moistened tissue paper, and checked daily for emergence. Nymphs are oval in shape and have a tick-like appearance. They are yellowish brown, and mottled with red and black. The last instars are darker with white bands on the antennae and legs, similar to the adults. Nymphs were reared on common bean pods (Phaseolus vulgaris L.; Fabales: Fabaceae) and carrot (Daucus carota L.; Apiales: Apiales: Apiales: Apiales) purchased from local markets. Food was replaced every other day, and moistened tissue paper was provided daily. The nymphs were checked daily to determine survival, and number and duration of the individual instars. Development or molting time was determined by the presence of exuvia or molted skin. After the final molt to adult, all individuals were sexed. Males (1.20 cm length; n = 30) are smaller than females (1.44 cm length; n = 30), and can be distinguished by a rear ventral scoop (Fig. 1). Nymphs emerged in approximately 4 to 7 days (mean = 6 days) after the eggs were laid. The 5 nymphal stages (Fig. 2) from hatching to adult took from 33 to 55 days (mean = 43 days). The mean lengths in cm of the stages based n = 30 per stage were as follows: 1.43 (1st instar), 2.75

Fig. 1. Brown marmorated stink-bug, Halyomorpha halys, adults (female left; male right); upper panel: dorsal view, lower panel: ventral view.
(2nd instar), 4.29 (3rd instar), 9.44 (4th instar),
and 11.39 mm (5th instar) (Table 1). The length
of the 1st instar recorded in this study is shorter
than the length (2.4 mm) reported in other stud-
ies, but we found no differences in our measure-
ment of the lengths of the subsequent instars
and those of Jacobs (2011). The developmental
time of each of the first to 4 instars was ap-
proximately 1 wk, which was shorter than that
of the fifth instar that lasted approximately 2
wk at 25 °C and 55% RH. The developmental
times of the first to fourth instars assessed at
25 °C were similar to those obtained at 30 °C
by other researchers, but shorter than those re-
ported at 20 °C (www.geochembio.com/biology/
organisms/stinkbug).

Nymphal mortality from egg hatch to adult
emergence ranged from 23% to 50% (mean =
36%). The adult is grayish brown with a typi-
cal stink bug shield shape, but it can be eas-
ily recognized by having alternating dark and
white bands on the legs and on the last 2 seg-
ments of the antennae. The edge of the abdo-
men also has alternating white and dark bands
(Fig. 1). Twenty-five recently emerged pairs of
male and female bugs were placed in pairs in
1L transparent plastic containers with an 8
cm mesh screen in the lid. Mating time ranged
from 8.43 to 11.00 min (mean = 10.15 min, n
= 20). Females started laying eggs from 14 to
25 days (mean =18 days) after their final molt.
The number of egg masses per female ranged
from 5 to 9 (mean =6), and the total number of
eggs per female ranged from 124 to 253 (mean =
168), and these parameters differ greatly from
those reported by Nielsen et al. (2008) (average
of 212 eggs and 8 egg masses in BMSB reared
in a growth chamber, and by Kawada & Kit-
mura (1983) (487 eggs per female in a Japanese
H. halys culture). These significant differences
in the number of eggs laid per female could be
partially attributed to different rearing condi-
tions and genetic variability among populations
of different geographical locations. We observed
that 1 mass of eggs was laid every 5 to 12 days.
The shortest interval between successive ovipo-

<table>
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<tr>
<th>Stage</th>
<th>Body length (mm)</th>
<th>Development time of immatures stages &amp; adult longevity (days)</th>
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<tr>
<td></td>
<td>Mean (range)</td>
<td>Mean (range)</td>
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<tr>
<td>Egg</td>
<td>1.2 (1.2-1.3) diameter</td>
<td>6 (4-7)</td>
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<td>1.7 (1.6-1.8) height</td>
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<tr>
<td>1st Instar</td>
<td>1.43 (1.2-1.5)</td>
<td>6 (5-7)</td>
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<td>2nd Instar</td>
<td>2.75 (2.6-3.0)</td>
<td>9 (7-10)</td>
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<tr>
<td>3rd Instar</td>
<td>4.29 (4.2-4.4)</td>
<td>7 (6-10)</td>
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<tr>
<td>4th Instar</td>
<td>9.44 (8.8-10.2)</td>
<td>7 (5-10)</td>
</tr>
<tr>
<td>5th Instar</td>
<td>11.39 (11.0-11.6)</td>
<td>14 (10-18)</td>
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<tr>
<td>Adult Female</td>
<td>14.36 (12.8-15.5)</td>
<td>84 (63-112)</td>
</tr>
<tr>
<td>Adult Male</td>
<td>11.97 (11.1-13.5)</td>
<td>119 (56-224)</td>
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Fig. 2. The 5 nymphal stages of the brown marmorated stink bug, Halyomorpha halys.
The life cycle of the brown marmorated stink bug, *H. halys*, was studied at the Gainesville, Florida quarantine facility at 25°C constant temperature, 16:8 h L:D and 50-55% RH. Nymphs, which emerged from 32 egg masses, were reared on bean pods and carrots in Petri dishes and checked daily to determine the number and duration of each nymphal stadium and percent survival. Twenty-five recently emerged couples were set-up in clear plastic containers, fed daily with bean pods and carrots, and provided with moisture. The pre-oviposition period, number of egg masses, and longevity of males and females were determined. The general life cycle of this potential Florida crop invader is important for the development and implementation of IPM programs.

**Key Words:** stink bug, pest, Pentatomidae, Florida

**SUMMARY**

The life cycle of the brown marmorated stink bug, *H. halys*, was studied at the Gainesville, Florida quarantine facility at 25°C constant temperature, 16:8 h L:D and 50-55% RH. Nymphs, which emerged from 32 egg masses, were reared on bean pods and carrots in Petri dishes and checked daily to determine the number and duration of each nymphal stadium and percent survival. Twenty-five recently emerged couples were set-up in clear plastic containers, fed daily with bean pods and carrots, and provided with moisture. The pre-oviposition period, number of egg masses, and longevity of males and females were determined. The general life cycle of this potential crop pest of Florida is discussed.

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HOLTS, T., and KAMMINGA, K. 2010. Qualitative analysis of the pest risk potential of the brown marmorated stink bug (BMSB), *Halyomorpha halys* (Stål), in the United States. United State Department of Agriculture-APHIS.


