

# Brown Marmorated Stink Bug Rearing and Nutrition

James Withers and Loren Linford

Utah State University



James Withers Loren Linford

## I. Introduction (Problem)

The brown marmorated stink bug (BMSB), *Halyomorpha halys*, is an invasive insect from Asia. It has caused millions of dollars in damage to fruit, vegetable, ornamental, and field crops since its arrival in North America, and can be a severe nuisance pest when it congregates on human structures to overwinter. The BMSB caused \$37 million of apple crop damage in the Mid-Atlantic Area in 2007. To study the insect, effective rearing methods are needed. Previous research (Funayama 2004 & 2006; Medal et al. 2012) showed that carrot, raw peanut and soybean increased rearing efficiency. Recent lab experience has found good success with sweet pepper. Our objective was to identify combinations of food sources to increase BMSB survival and reproduction. Carrot was used as a common food source across all treatments.

## II. Methods

This experiment was split up into four treatments and four replicates of each treatment for both adults and nymphs. Measurements were collected each week for eight week of both the adults and nymphs. The food of each treatment was also replaced each week.

### Adult Measurement

The following measurement were collected once a week:

- Number of living males and females per treatment
- Number of deaths of both males and females per treatment
- Total weight per treatment and
- Number of egg masses per treatment
- Number of eggs per egg mass

### Nymph Measurements

- Number of surviving nymphs and their developmental stage
- Number of dead nymphs and their developmental stage
- Weight of surviving nymphs at their developmental stage

### Treatment Contents

- Treatment 1: Lab standard
  - Peppers cut in half to give access to the seeds
  - Carrot ( 3 cm long )
- Treatment 2: Funayama
  - Soybeans ( 15 whole beans )
  - Peanuts (15 whole peanuts or 30 peanut halves)
  - Carrot ( 3 cm long )
- Treatment 3: Novel Bean
  - Green bean ( 2 whole Beans )
  - Carrot ( 3 cm long )
- Treatment 4: Novel Apple diet
  - Apple ( ¼ exposing the seeds )
  - Carrot ( 3cm long )

## III. Results

### Adult BMSB Experiment

- As indicated in Figure 1, treatment 4 had the highest survival rate by the end of the experiment. Treatment 3 was just under treatment 4. Treatment 2 was consistently under treatments 3 and 4. Treatment 1 had the lowest survival rate. Both male and female BMSB adults had similar death rates.
- Treatment 3 produced two small egg masses of 13 eggs and 12 eggs. Treatment 2 produced one egg mass of 27 eggs. Treatments 1 and 4 did not produce any egg masses.
- The weight measurements were very inconsistent. The weight measurements were discontinued after 6 weeks.

Table 1 - Total number of deaths of males and females

	Male deaths	female deaths	total deaths
1- Pepper	11	10	21
2- Peanut & Soybean	8	6	14
3- Green Bean	7	6	13
4- Apple	5	4	9

Figure 2 - Average Nymph Survival

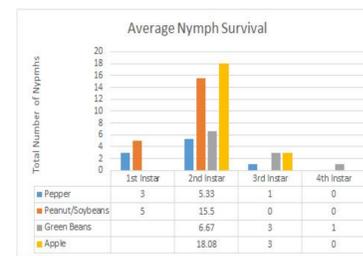


Figure 3 - Average Nymph Death

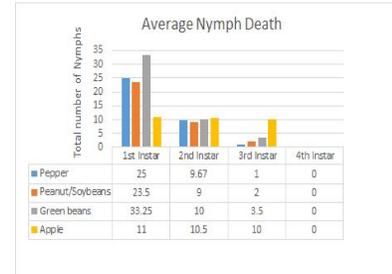
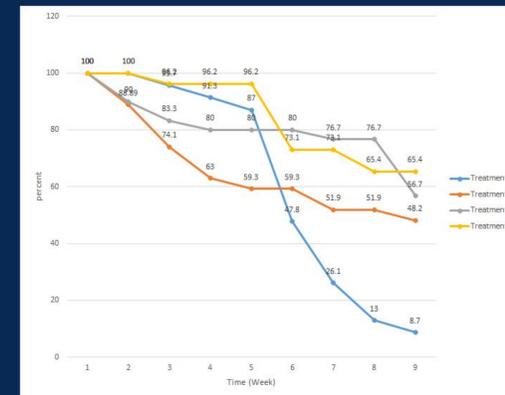


Figure 1 - % Survival Rate of Adults

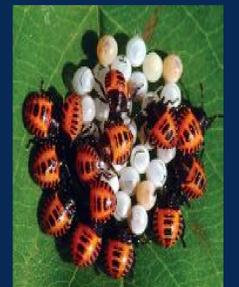


Treatment 1 had the lowest survival rate. Treatment 2, 3, and 4 all had similar ranges of survival. Treatment 4 had the highest survival rate and the least amount of deaths.

Damage to crops



Egg Clutch



Developmental Stages



## III. Conclusions & Future Work

### Adults

The results proved that treatments 4 and 3 had the highest survival rate. Many factors may have influenced the results. The moisture of the apples of treatment 4 may caused the BMSB to out survive the other treatments. Treatments 2 and 3 produced eggs as expected because of the high protein levels.

Environmental factors may have also caused the colony to have a high death rate. The lab is not an ideal place for a BMSB rearing because there is no natural sunlight, the lab is subject to the heating of the building. It is also possible that the high death rates towards the end was due to the season.

### Nymphs

The data shows that a diet of apples will improve the survival rate of the developing nymphs until the point where they are becoming 3rd instars. At this point, a change in diet to green beans will keep them alive until they reach full maturity.

There are many factors that may have influenced a high mortality rate among the nymphs. The container in which the nymphs were held might have been too humid. The fruits were sliced into pieces to accommodate for space, which contributed to the humidity. This humidity also encouraged mold growth, which could have affected the mortality rate. The temperature was subject to the heating of the building. Finally, this is the period of season when the adults are preparing to hibernate until the coming spring. This season does not favor offspring.

## IV. References

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- Funayama, Ken. "Importance of apple fruits as food for the Brown-Marmorated Stink Bug, *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae)." *Applied Entomology and Zoology*, vol. 39, no. 4, 2004, pp.617-623., doi:10.1303/aez.2004.617.
- Leskey, T. C., Short, B. D., Butler, B. R., & Wright, S. E. (2012). Impact of the Invasive Brown Marmorated Stink Bug, *Halyomorpha halys* (Stål), in Mid-Atlantic Tree Fruit Orchards in the United States: Case Studies of Commercial Management [Research article]. <https://doi.org/10.1155/2012/535062>

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Food for Each Treatment



Treatments 1-4: Treatment 1 on top, treatment 2, treatment 3, and treatment 4 on bottom

BMSB Trial Set-up



Adult trials are on the left and nymph trials are on the right