Influence of sticky card color and tree species on three parasitoid genera of *Halyomorpha halys* (Hemiptera: Heteroptera)

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Abstract

Halyomorpha halys (Hemiptera: Pentatomidae), or brown marmorated stink bug, is an invasive species in the U.S. that causes significant economic damage to a diversity of crops. Biological control by egg parasitoids is a promising measure that needs further research. Accurate sampling for parasitoid activity is critical for assessment of the impact of multiple genera of egg parasitoids shown to be associated with *H. halys*. To test color and tree species preference of three parasitoid genera (*Anastatus*, *Trissolcus*, *Telenomus*), different colored sticky cards were placed on three species of trees. We found that the three parasitoid genera appeared to have preference for yellow and green sticky cards over blue and red. Parasitoids appeared to have preferences in tree species, but their preference varied for each species. Results suggest that *Anastatus* may prefer green sticky cards and cherry trees, however more research should be done to support this finding.

Introduction

- Several egg parasitoids of *H. halys* have been identified through field studies in both Asia and North America, where the most commonly reported genera in the U.S. are *Trissolcus, Anastatus*, and *Telenomus* with *Anastatus* showing the most promise (Rice et al., 2014; Jones et al. 2017). The use of biological control to mitigate agricultural damage from *H. halys* is compelling, but further research is necessary to understand how parasitoids of different genera interact with *H. halys*.
- Studies show egg parasitoid wasps use visual cues, particularly color, as a means of locating their hosts (Kawamata et al., 2018). While yellow-colored sticky traps are commonly used to survey insect activity, variability in insect color preference suggests use of yellow traps could be misrepresentative. For example, aphids and whiteflies show preference towards the color yellow, thrips are found to be more attracted to blue, while some insects are drawn to red, such as the spotted wing *Drosophila*. (Devi, 2017; Broughton, 2012; Little et al., 2019). It is questioned whether color preference is unanimous amongst parasitoid genera. Additionally, studies show rates of parasitism of *H. halys* eggs differed among tree species (Jones et al. 2017).
- Through this study, we hope to explicate the preference of the three parasitoid genera known to parasitize *H. halys*, and observe any effect of tree species on parasitoid prevalence.

Methods

- **Sticky Cards**: Five colors were selected: yellow, blue, red, green, and clear (control), with each card measuring 3”x 5.” The cards were hung from tree branches using twist ties, with one sticky side exposed per card.
- **Field Site:** Raemelton Farm, Adamstown, MD. Certified organic field, Field 7o.
- **Tree Species:** Three tree species tested were red maple (*Acer rubrum* ‘Franksred’), Eastern redbud (*Cercis canadensis*), and Kwanzan cherry (*Prunus serrulata* ‘Kwanzan’).
- **Experimental Design:** One sticky card of each color was hung from 9 pre-selected trees (three trees of each species) in a uniform distribution and randomized order. The sticky side of each card faced an eastern exposure, relative to the position of the sun. The 9-replicate color treatment was completed once per week, for 3 weeks. After each seven day period, the cards were collected and stored in a -18 ℃ walk-in freezer. Captured parasitoids were identified to genus and counted. Data were summarized by color and tree species.

Results

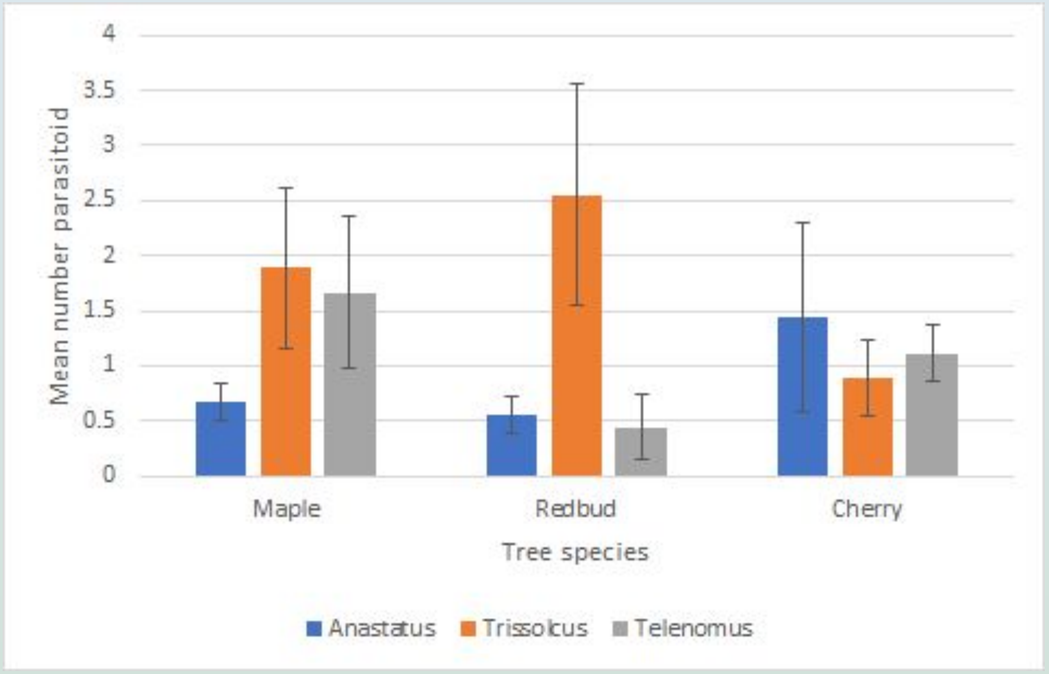

Figure 1: Figure 1: Mean (±SE) number of each parasitoid genera (*Anastatus, Trissolcus, Telenomus*) captured on sticky cards of each tree species (maple, redbud and cherry).

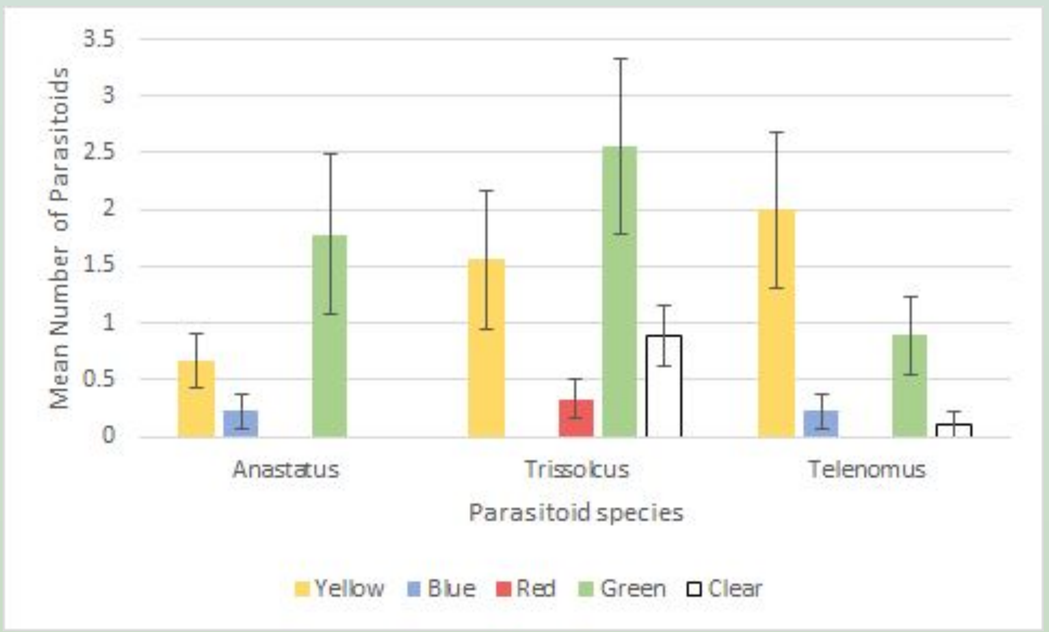

Figure 2: Mean (±SE) number of each parasitoid genera (*Anastatus, Trissolcus, Telenomus*) captured on five colors of sticky cards (yellow, blue, red, green and the control, clear).

Figure 3: Examples of sticky card placement in trees.

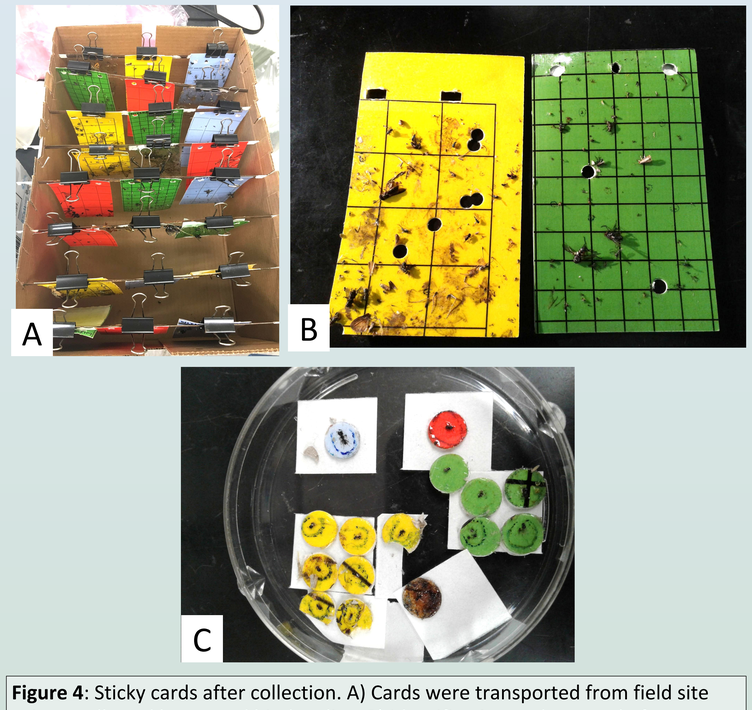

Figure 4: Sticky cards after collection. A) Cards were transported from field site using cardboard boxes and binder clips. B) Identification and removal of parasitoids from cards. C) Parasitoids from each replicate were stored in petri dishes after ID.

Results/Discussion

- Numerically, it appears that *Anastatus* is more abundant on cherry, than maple or redbud, whereas *Trissolcus* is least abundant on cherry (Fig. 1). *Telenomus* appears to be more abundant on maple and cherry, than redbud.
- All parasitoids were numerically more abundant on yellow and green than any other color (Fig. 2). *Trissolcus* was more abundant on clear than red, whereas *Anastatus* and *Telenomus* abundance was low or no, respectively, on clear (Fig.2). These data suggest the parasitoids tested prefer yellow and green more than red and blue.
- Numerically, it appears that *Anastatus* may be less attracted to yellow than *Trissolcus* or *Telenomus*, and more attracted to green than any other color; further testing is needed to confirm this pattern.
- Future plans are to statistically analyze this data, and in the future run the experiment over time through the season to detect seasonal difference in parasitoid activity.

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