

**AGRICULTURAL RESEARCH FOUNDATION
INTERIM REPORT
FUNDING CYCLE 2020 – 2022**

TITLE: Nontarget effects of the samurai wasp on native stink bugs when used for biological control of the brown marmorated stink bug in field settings

RESEARCH LEADER: Dr. Nik Wiman

COOPERATORS: Northern Willamette Research & Extension Center, Mid-Columbia Agricultural Research & Extension Center, and Southern Oregon Research & Extension Center

EXECUTIVE SUMMARY:

Claire Donahoo was hired in September, 2019 as a graduate research assistant for this project. She is pursuing her PhD in horticulture with a concentration in entomology and her assistantship is currently partly funded. Claire conducted her research for this project from January 2020 through January 31, 2021 (Year 1 of the grant). She continues to conduct research as part of Year 2 of the grant. Research that was a result of this grant was presented at multiple virtual events in Year 1, including the Entomological Society of America Annual Meeting, Wilbur-Ellis Willamette Valley Hazelnut Grower Seminar, Annual Pacific Northwest Insect Management Conference, and the Annual Orchard Pest & Disease Management Conference.

We slightly modified our procedures from our original objectives, as Year 1 presented quite a few limitations. Travel and staffing restrictions were put in place due to the pandemic and the wildfires, which limited our sampling locations for this project. This also decreased the number of sites to collect adult stink bugs to be reared in the lab, which resulted in reduced sentinel egg masses. Additionally, Claire and our collaborators found far fewer BMSB in the field compared with previous years, further reducing our availability of sentinel egg masses. Finally, mass rearing and production of *P. maculiventris* (one of four research species) was halted due to the pandemic restrictions, so we were unable to purchase and rear *P. maculiventris* colonies in our lab.

However, despite our inability to complete most of our sentinel egg mass field work, we were still able to collect wild BMSB egg mass data providing us with a parasitism rate, as well as successfully rear three of four of our intended stink bug species. We also collaborated with researchers in northern and southern Oregon to assess samurai wasp establishment using yellow sticky cards. These data aided in identifying samurai wasp colony locations and successful dates of samurai wasp recovery, which will both be utilized in Year 2.

OBJECTIVES:

The objectives of this research are to determine potential nontarget effects of samurai wasps on native stink bugs when used for biological control of BMSB in field settings. We plan to conduct host-choice tests using sentinel egg masses placed in the field across different ecoregions where samurai wasps are established. We will examine parasitism of nontargets known from quarantine host tests as susceptible or unsusceptible to attack when paired with egg masses of nontarget pentatomids.

PROCEDURES:

- Acquire specimens of *Halyomorpha halys* (BMSB), *P. maculiventris* (spined soldier bug; native predatory stink bug with conservation biological control value, known susceptible from quarantine testing), *Banasa dimidiata* (native stink bug, susceptible from quarantine testing), and *Chlorochroa ligata* (not susceptible from quarantine testing) and rear colonies in lab).
- Place sentinel egg masses of each species in field for 5 days in locations with established samurai wasp populations in riparian, agricultural, and urban habitats. Nontarget egg masses will be paired with BMSB egg masses and also placed alone when possible.
- Assess samples for parasitism rates.
- Assess samurai wasp offspring emerged from each pentatomid species for differences in body and tibia lengths (proposed nontarget egg masses vary widely in size).
- Provide all offspring with sentinel BMSB egg masses to determine their fecundity and reproductive potential
 - This will help answer the question: do wasps emerged from smaller nontargets experience reduced fecundity or attack abilities against the target pest?

SIGNIFICANT ACCOMPLISHMENTS TO DATE:

- Collected & reared specimens of *H. halys*, *B. dimidiata*, *C. ligata* (Figure 1)
 - Several adults of these species were successfully collected and reared in the lab. All eggs laid by *H. halys* were used to propagate samurai wasp populations, due to low BMSB numbers in the field. All eggs laid by *B. dimidiata* and *C. ligata* were placed in the lab freezer to add a third level to our sentinel egg treatment.
- Collected wild BMSB egg masses and assessed for parasitism rates (Figure 2)
 - Out of 73 egg masses, 17 were parasitized, giving us a parasitism rate of 23.3% for 2020. This is consistent with previous findings of parasitized egg mass rates in our lab of 26.8% in 2019 and 22.4% in 2018; However, the egg masses analyzed for those years also contained fresh and frozen sentinel BMSB egg masses. Because of restrictions with travel due to the pandemic and wildfires this summer, egg masses collected and analyzed were all found in Corvallis, Monmouth, and Eugene, Oregon.
- Expanded knowledge of locations of samurai wasp establishment by placing sticky cards on BMSB host plants (Figure 3)
 - Because availability of sentinel egg masses were so limited in Year 1, we also placed yellow sticky cards on host plants of BMSB to assess for samurai wasp establishment. Claire collaborated with other members of our lab, as well as Chamberlain Agriculture in Hood River and the Southern Oregon Research & Extension Center in Jackson. Out of 58 sites sampled in Year 1, samurai wasps were recovered on sticky cards at five locations (Figure 4). Additionally, we analyzed the wasp recovery dates versus the sampling dates to maximize wasp recovery (Figure 5). These data will aid in prioritizing sentinel egg mass sites and sampling dates for Year 2.

ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM:

FUTURE FUNDING POSSIBILITIES:

Specialty Crop Block Grant Program; Ferrero Group; USDA-NIFA SCRI



Figure 1. Collecting adult stink bugs using the beat-sheet method (left). Bug dorms containing reared stink bug adults in a growth room on campus (middle). *Halyomorpha halys* sentinel egg masses laid on sleeve of bug dorm (right).

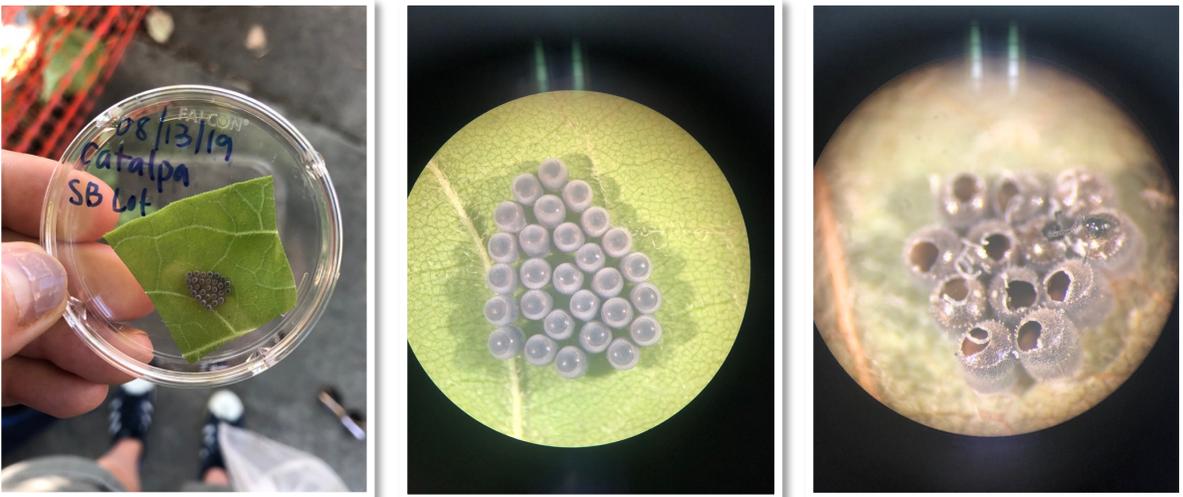


Figure 2. Wild-collected *Halyomorpha halys* egg mass contained in petri dish (left). Magnified view of parasitized *H. halys* egg mass with unemerged samurai wasp (middle). Magnified view of parasitized egg *H. halys* egg mass with emerged samurai wasps.



Figure 3. Yellow sticky card tied to host plant of *Halyomorpha halys* (left). Magnified view of samurai wasp on yellow sticky card (right).

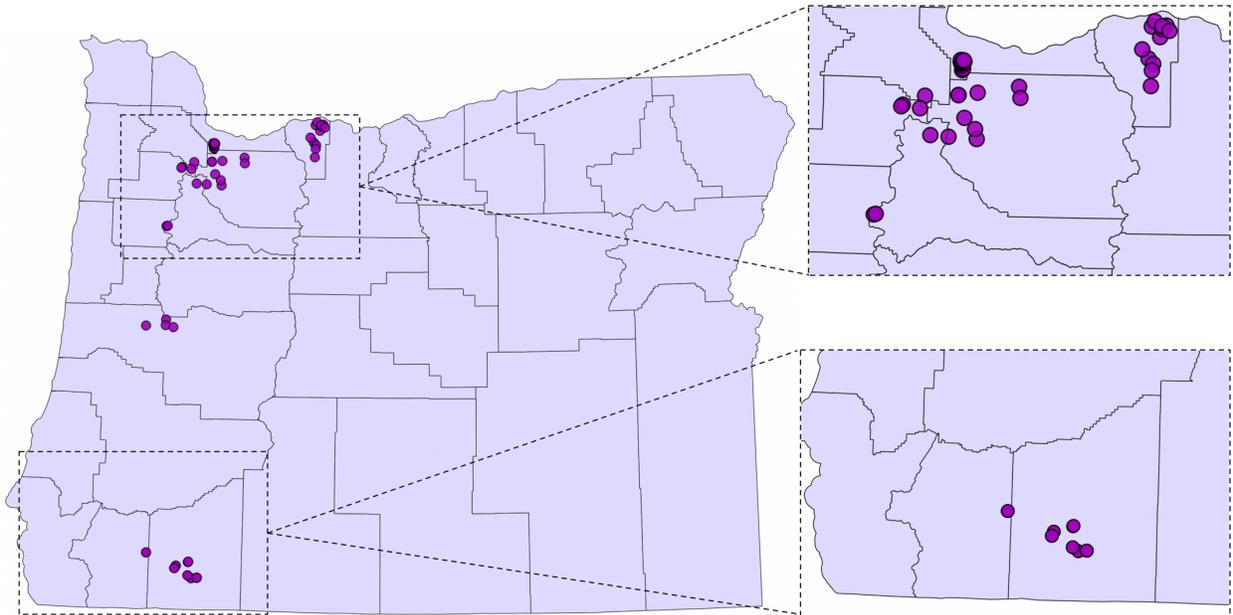


Figure 4. Sampling sites of yellow sticky cards in Oregon in Year 1.

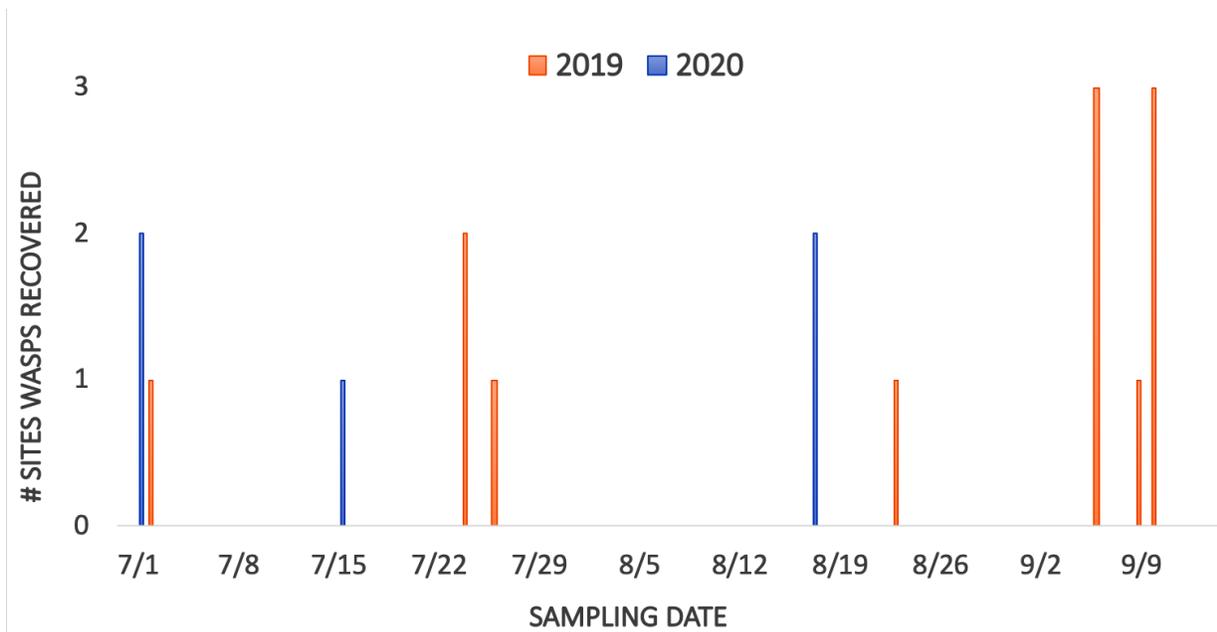


Figure 5. Sampling date of yellow sticky cards (x-axis) and number of sites samurai wasps were recovered (y-axis).