HOST RANGE TESTING FOR *TRISSOLCUS JAPONICUS* – A POTENTIAL BIOLOGICAL CONTROL AGENT FOR BROWN MARMORATED STINK BUG

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Introduction The brown marmorated stink bug (BMSB), *Halyomorpha halys* (Hemiptera: Pentatomidae), was first reported in the USA in Pennsylvania in 1996. In 2004, Oregon Department of Agriculture detected BMSB for the first time in Portland, Oregon. Now this invasive pest is found in 39 US States and in Oregon in many important agriculture areas. Until 2011, Oregon Department of Agriculture has surveyed for this pest and recorded its continuous expansion from urban to rural areas. Recognizing its wide host range and potential damage to agriculture, Oregon Department of Agriculture (ODA) joined efforts with USDA APHIS and Oregon State University (OSU), in developing a potential biological control method for this emerging pest. In 2011, we started a colony of the egg parasitoid *Trissolcus japonicus* (Hymenoptera:Platygastridae) at OSU's quarantine facility in Corvallis, Oregon. This exotic parasitoid was originally collected by USDA scientists from the Beijing area of China. We maintain the parasitoid colony on eggs of BMSB and have been testing host range and host preference of the parasitoid at the quarantine facility. The goal is to test the parasitoid against commonly found native Pentatomid species from Oregon, and to determine if the parasitoid is a good candidate for eventual release as a biological control agent against the BMSB.

Materials and Methods The parasitoid colony was maintained, and all non-target testing was conducted, in OSU's quarantine facility inside two growth chambers set at 20°C, 60% RH, and 16L:8D light cycle. Non-target Pentatomid species were collected from fields in various locations in Oregon throughout the seasons. These species were brought into laboratories in either Salem or Corvallis and were reared on cut plants or vegetables inside screened cages. These rearing cages were checked daily for stink bug eggs. We conducted two sets of non-target host choice tests: 1) no-choice test and 2) choice test. In the no-choice test, we introduced a mated female parasitoid to a single egg cluster of the non-target stink bug ≤ 24 hr old in a 10 dram plastic vial. The stink bug eggs were taped or glued onto a strip of heavy duty paper. The non-target eggs and the parasitoid were kept together inside the vial for about 24 hours to give the parasitoid sufficient opportunity to attack the eggs. After 24 hr, the parasitoid was removed from the vial, and eggs were reared until the eggs all hatched (if not parasitized) or parasitoids emerged (if parasitized). In the choice test, the procedure was the same, except parasitoids were offered a choice between eggs of BMSB and those of non-target on the same paper strip. The parasitoid could choose to parasitize BMSB, the non-target, or both. Host acceptance and host preference were assessed after all parasitoids emerged from the vial. We first conducted the no-choice tests. If a non-target stink bug was not accepted at all by the parasitoid in the no-choice tests, we did not include that host in the choice tests.

Results We tested the parasitoid against 14 species of Pentatomid including BMSB, all collected from Oregon. Ten genera were included in these 14 species, of which two were predatory Pentatomid and were of special significance because these species (*Podisus maculiventris* and *Perillus bioculatus*) themselves are natural enemies. We have completed no-choice tests on seven of the fourteen species. These completed tests all had greater than 20 replicates, that is more than 20 egg clusters of each species were used for parasitoid testing. The results indicate that the parasitoid did not accept any *Euschistus* (*E. conspersus, E. variolarius*) species as hosts. It accepted *Chinavia hilaris, Chlorochroa ligata, Thyanta custator* and *Podisus maculiventris,* only as occasional hosts. The parasitism rates on these hosts were all below 10% in the no-choice tests. The only non-target host that was readily accepted for parasitism was *Banasa dimiata,* which had about 50% parasitism. The target pest, BMSB, was the most preferred and readily accepted host with more than 65% parasitism rate. In the choice tests, only two non-target species were tested so far. Given a choice, the parasitoid preferred to attack BMSB eggs over those of *Thyanta custator* or *Banasa dimiata*. Overall, the parasitoid parasitized more than 60% of BMSB eggs but only 5% and 31% of *Thyanta custator* and *Banasa dimiata* eggs, respectively.

Discussion This classical biological control effort using introduced parasitoids is coordinated and funded by USDA APHIS and involves multiple state agencies, universities and USDA labs. Oregon is one of the state agencies actively participating in this national project. Our host range testing shows promising results. The egg parasitoid clearly prefers the target pest – the invasive, newly introduced BMSB. Whether in no-choice tests or choice tests, the parasitoid attacked BMSB eggs in a higher percentage than any other non-target stink bug eggs. The parasitoid also successfully developed in BMSB eggs and produced viable offspring. Some non-target stink bugs (e.g., *Euschistus* species) were attacked but the parasitoids apparently did not successfully develop and emerge as adults. Other non-target species were only occasionally parasitized with less than 10% parasitism rates. Only one commonly found non-target species (*Banasa dimiata*) in Oregon seems to be readily accepted in no-choice tests. However, when given a choice in the choice tests, the parasitoid still preferred the target host (BMSB) and parasitized twice as many target hosts as those of the non-target *Banasa dimiata*. So far, our host range testing shows that the introduced parasitoid *Trissolcus japonicus* from China is a promising candidate as a successful biological control agent for the invasive new pest BMSB. We will continue with more testing to assess its suitability as a candidate for biological control, especially by testing more non-target predatory Pentatomids.