Augmentative releases of the native egg parasitoid Anastatus bifasciatus for the control of the invasive Halyomorpha halys in northern Italy

Authors: Maistrello Lara[5], Haye Tim[2], Costi Elena[5], Butturini Alda[6], Moretti Christian[1], Di Bella Emanuele[5], Bombardini Enea[1], Vaccari Giacomo[3], Casoli Luca[3], Grazia Tommasini Maria[5], Bariselli Massimo[6], Landi Matteo[1], Preti Michele[1] and Caruso Stefano[3], [1]ASTRA Innovation and Development Test Facility, Italy, [2]CABI, Delémont, Switzerland, [3]Consorzio Fitosanitario Provinciale di Modena - Plant Protection Service, Italy, [4]CRPV, Cesena, Italy, [5]Department of Life Sciences, BIOGEST-SITEIA Interdepartmental Centre, University of Modena and Reggio Emilia, Italy, [6]Plant Protection Service of Emilia-Romagna Region, Italy

Abstract: The invasive Brown Marmorated Stink Bug (BMSB) Halyomorpha halys (Heteroptera, Pentatomidae) is currently the most serious pest of fruit crops in northern Italy, where it caused €588 million damage in 2019. Management of BMSB is very challenging, due to its mobility and very high polyphagy. To face this threat, farmers doubled the number of treatments with broad-spectrum insecticides, seriously disrupting previous IPM programs. Biological control is the most sustainable alternative to manage invasive pests; however, legal restrictions prevented the use of exotic biocontrol agents in Italy until 2019. The generalist Anastatus bifasciatus (Hymenoptera: Eupelmidae) is the predominant species of native egg parasitoids attacking BMSB in Europe, and it is able to successfully develop on viable BMSB eggs. In order to verify the potential of this parasitoid as a biocontrol agent for augmentative releases, a first field trial was carried out at the end of July 2018, releasing 600 A. bifasciatus females at once in 0.5 ha organic pear orchard in Emilia-Romagna. Results showed an average parasitization of 16% on frozen BMSB eggs and up to 48.5% on naturally laid eggs (Stahl et al. 2019). In 2019, further trials were performed in the same region releasing the parasitoids in woody areas near IPM fruit orchards and verifying parasitization on both, fresh and frozen sentinel egg masses. Releases were performed once a week at the beginning of the BMSB oviposition period(from mid-June to early July) reaching a density of 1 female per m2. In trial ‘A’ (in Modena province), a total 20,000 A. bifasciatus females were released in a wooded area of 2 ha adjacent to an IPM pear orchard. In trial ‘B’ (in Ravenna province), 1,300 A. bifasciatus females were released in a wooden area of 0.13 ha surrounded by tree fruit crops, including an IPM pear orchard. Both trials included a control area in which no parasitoid release was performed.
In trial “A”, where 11,312 eggs were exposed, average parasitism was 6% on naturally laid eggs (obtained in sleeve cages) and 1.5% on frozen sentinel eggs, with no differences between control and release areas. In trial ‘B’, where 7,712 sentinel eggs were exposed, in the release area average parasitism was 1.4% on the fresh egg masses (laid on Vicia faba potted seedlings) and 0% on frozen eggs; in the control area parasitism was 1.1% on fresh eggs and 2.0% on frozen ones.
Results from 2019 indicated that mass releases of A. bifasciatus were not efficient for biocontrol of BMSB under the current test conditions.

Cooperative or not? Big groups of foundresses in a quasisocial parasitoid

Authors: Malabusini Serena[2], Hardy Ian[1], Jucker Costanza[2], Lupi Daniela[2], Savoldelli Sara[2], [1]Uni. Helsinki, Finland, [2]University of Milan, Italy,

Abstract: In the parasitoid genus Sclerodermus, multiple foundresses communally produce and care for broods. When hosts are large, group members have greater reproductive success than when attempting to reproduce alone. Prior studies evaluated groups of ≤10 foundresses but the natural range of group sizes is undocumented. We create groups of up to 55 foundresses and explore the consequences for the success and timing of cooperative brooding and on brood sex ratios. As group size increases, brood failures increase and per capita success decreases. Most broods fail at the early developmental stages. Foundresses competition for oviposition sites is likely as is determined by reproductive dominance and ovicide. While most foundresses likely produce some progeny, many foundresses do not produce any adult sons. Sex ratios are very biased: 10% of offspring are males. Based on this result, and a recent finding that larger and earlier-arriving females within smaller foundress groups produce most male offspring, we suggest that Sclerodermus brood sex ratios are the result of a combination of local mate competition and the dominance (via suppression or infanticide) of male production by some foundresses within what initially appeared to be cooperatively reproducing groups.

Insect-plant-soil microbial tug of war: which is the major force structuring insect- and plant-associated microbiomes?

Authors: Malacrinò Antonino[2], Bennett Alison[3] and Karley Alison[1], [1]The James Hutton Institute, Dundee, Scotland, United Kingdom, [2]The Ohio State University, Columbus (OH), United States, [3]The Ohio State University, United States

Abstract: Insect herbivores are a driving force in shaping plant communities and their relationship with the surrounding environment. Microorganisms are key partners of both insects and plants, influencing their development and physiology, and can modulate the outcome of plant-herbivore interactions. In this plant-microbe-insect system, a question is still open: which is the major force structuring insect- and plant-associated microbial communities? Answering this question will increase our ability to predict the effects of the environment on plant and insect microbiomes and, in turn, their influence on plant-insect relationship. Here, we tested whether soil microbiome, plant species and herbivory are able to influence insect- and plant-associated microbiomes. Using a microcosm setup, we manipulated the herbivore, plant species and soil microbial diversity, and we characterized the microbiota at different compartments: rhizosphere, roots, leaves and herbivore. We showed that herbivores drive a top-down effect shaping the microbiota of leaves, roots and rhizosphere. Furthermore soil microbiome and plant species drive a bottom-up effect that influences the microbial communities at rhizosphere, roots, leaves and, eventually, the microbiota of the herbivore. The soil-drive effect not only influenced insect microbiota, but also the insect fitness.