Pheromones and other Semiochemicals in Integrated Production and Integrated Protection of Fruit Crops
IOBC-WPRS Bulletin Vol. 166, 2023
pp. 90-91

Biocontrol implications of multiparasitism by *Trissolcus mitsukurii* and *Trissolcus japonicus* on the invasive brown marmorated stink bug

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Abstract: The brown marmorated stink bug *Halyomorpha halys* (Stål) (Heteroptera, Pentatomidae), native to Eastern Asia , is an invasive pest of agricultural crops in North America and Europe (Leskey et al., 2018; Maistrello et al., 2018). Its management mostly relied on broad spectrum insecticides, disrupting previous integrated pest management programs and leading to increase in secondary pest outbreaks (Leskey et al., 2018; Maistrello et al., 2017). Long-term and more sustainable management strategies comprise inundative and classical biological control (Conti et al., 2021). In its native range, eggs of *H. halys* are attacked by several species of egg parasitoids. *Trissolcus japonicus* (Ashmead) and *T. mitsukurii* (Ashmead) are sympatric in east Asia (Yonow et al., 2021), and are the dominant parasitoids in China (Zhang et al., 2017) and Japan (Arakawa et al., 2004), respectively. Both species were recently detected in Northern Italy, Switzerland and Slovenia (Zapponi et al., 2021; Rot et al., 2021). Besides, Italy was the first European country to authorize the use of *T. japonicus* for the biocontrol of *H. halys*, and this parasitoid was released in hundreds of sites in northern Italy.

This study aimed at investigating whether these two exotic biocontrol agents exhibit multiparasitism and how this could affect the success of biocontrol programs. Specifically, laboratory experiments were performed to assess the willingness of each species to accept and oviposit in egg masses already parasitized by the other species, when the two species shared the same egg mass, and observations were also performed on the guarding behaviour and the consequence of this interaction on the number of ovipositions and on parasitoid emergence.

Our results showed that both species were able to parasitize egg masses already parasitized by the other species. Competition occurred inside the host eggs and each species prevails on the other when it was the first to oviposit. Importantly, *H. halys* mortality was not affected by the interaction between parasitoids. Moreover, when interactions occurred on the same egg mass, *T. mitsukurii* was more aggressive, engaging in chase-off events in 71 % of cases compared to 50 % of *T. japonicus*. This work can be deepened in a published articles (Costi et al., 2022).

Key words: biocontrol, *H. halys*, multiparasitism, parasitoids

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