BioGreenhouse

Plant health

Food sprays for supporting predatory bugs in greenhouse crops

Generalist predatory bugs of the family Miridae are important natural enemies for biological control in conventional and organic cropping systems. They are true omnivores feeding both from the plant and prey. Growers often “inoculate” their crops with these predatory bugs at the start of a new cropping cycle in low numbers in order to save money. However, the population increase is often too slow to reach densities that can effectively control pest infestations. Here we present methods to support predator establishment and augmentation with food sprays and we address some needs for future research.

Mirid predatory bugs

Zoophytophagous predators of the family Miridae (Heteroptera), which feed both on plant and prey, are increasingly used for pest control in greenhouse vegetable crops either through augmentative or conservation biological control. The most commonly used and commercially mass-produced species are currently *Macrolophus pygmaeus* (Rambur) (Figure 1) (formerly identified as *Macrolophus caliginosus* Wagner) in northern Europe and *Nesidiocoris tenuis* (Reuter) in southern Europe. Other species that naturally appear in greenhouse crops (mainly Mediterranean area) are *Dicyphus errans* (Wolff) and *Dicyphus tamaninii* Wagner Typically these predators feed on multiple pest species such as whiteflies, aphids, thrips, spider mites, leaf miners and lepidopteran species, including *Tuta absoluta*.

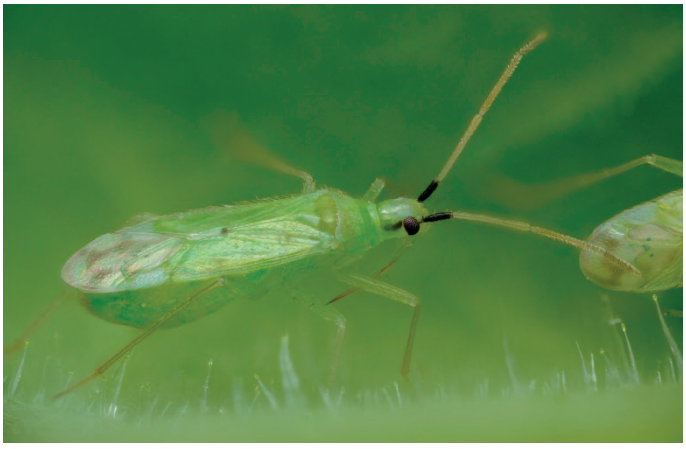

Figure 1. The predator *Macrolophus pygmaeus*.

The problem

Although mirid predatory bugs can develop in plants without prey, they develop very slowly. Low densities in spring are often not effectively controlling pest infestations such as whiteflies. This problem could be solved by providing alternative food sources that promote the reproduction rate of mirid predatory bugs in absence of prey.

Potential food sources

Several food sources are potentially useful for supporting mirid predatory bugs. Figure 2 shows the effects of sterilized eggs of the flour moth *Ephestia kuehniella* Zeller, maize pollen, freeze dried cysts of the shrimp *Artemia franciscana* Kellogg or the product Predfeed® compared to their natural prey greenhouse whitefly and no additional food.

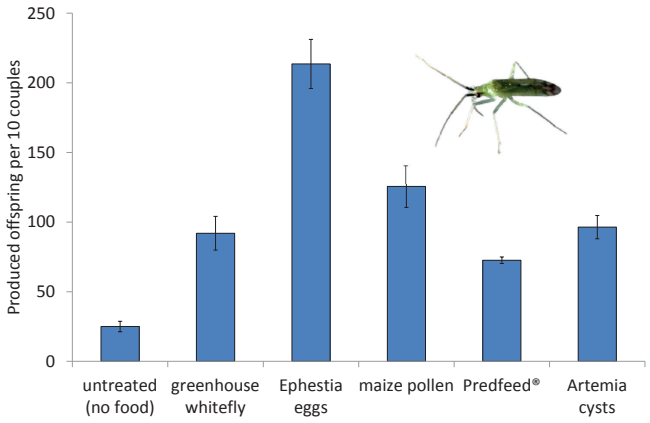

Figure 2. Reproduction of the predatory bug *Macrolophus pygmaeus* on tomato plants with different added food sources.

Application in practice

Ephestia eggs are the most suitable food source for optimizing the reproduction rate of the predatory bug *M. pygmaeus*. However, this food source is also very expensive (ca. €800/kg) and the shelf life in the field is low (ca. 1 week), whereas the less suitable food source *Artemia* cysts is relatively cheap (ca €520/kg) and has a longer shelf life than *Ephestia* eggs.

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Greenhouse trials in a commercial tomato crop showed that weekly application of a 5x higher dose of *Artemia* cysts than *Ephestia* eggs resulted in the largest population increase of predatory bugs. Thus, application of high doses of food sources with a relatively low nutritional value might still be better than application of low doses of a food source with high nutritional value. Food sources can be easily "sprayed" in the crop with several devices that blow the food into the crop with ventilators.

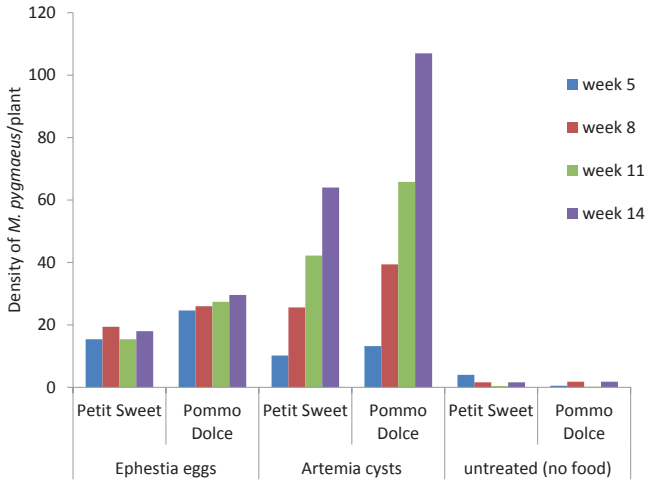

Figure 3. Population increase of *Macrolophus pygmaeus* predators on tomato plants where food sources were weekly applied (35g/ha *Ephestia* eggs versus 175 g/ha *Artemia* cysts).

Future research

This fact sheet shows an example of one of the myriad tools for promoting establishment, persistence and augmentation of natural enemies. Food sprays for mirid predatory bugs can be directly applied by growers, but further research is needed to address some possible risks and to explore new ways of using alternative food in biological pest control.

- Most alternative food sources are also edible for omnivorous pest species, such as the western flower thrips *Frankliniella occidentalis*. Future research could focus on the development of alternative food sources that more specifically support natural enemies and not the pest species.
- The development of food sources that specifically supplement the nutritional value of certain pest species offers opportunities to enhance pest control, as it seems that the nutritional requirements for generalist predators are often better ensured by mixed diets of multiple prey than by only one.
- Conservation of natural enemies could be combined with the use of volatiles that retain natural enemies in greenhouses. This is so far hardly studied and could be further explored.
- Some mirid predatory bugs cause damage to the flowers in tomato plants. (they are considered as a pest by some growers). It is interesting to study how alternative or supplemental food sources can prevent this plant damage.

The conservation method described in this fact sheet is not only important for controlling pests that currently occur in greenhouses, but also for new invasive pest species, which may appear in the future. We expect that this field of research will be especially important in order to further develop biological control strategies in ornamentals, where the low tolerance for pests is currently a stumbling block for natural enemy establishment and in organic cropping systems, where pest control is mainly dependent on biological control with natural enemies.

Figure 4. Nymphs of *Macrolophus pygmaeus* orange coloured after feeding on *Artemia* cysts.

References: Leman, A., and G. Messelink. 2015. Supplemental food that supports both predator and pest: A risk for biological control? Experimental and Applied Acarology. DOI 10.1007/s10493-014-9859-y.

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