MANAGEMENT OF STRAWBERRY BLOSSOM WEEVIL AND EUROPEAN TARNISHED PLANT BUG IN ORGANIC STRAWBERRY AND RASPBERRY USING SEMIOCHEMICAL TRAPS "Softpest Multitrap"

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Introduction

Many European growers of organic strawberry and raspberry have large losses in yield (sometimes >80%) and reduced quality of their products because of insect damage. Among the major threats are the strawberry blossom weevil (*Anthonomus rubi* Herbst), the European tarnished plant bug (*Lygus rugulipennis* Popp.) and the raspberry beetle (*Byturus tomentosus* De Geer). In organic soft fruit production there are no effective control measures for these pest insects.

For many insects species pheromones and host plant volatiles are of major importance in mate finding and location of host plants for mating, feeding and oviposition. Thus, there is potential for using these insect-insect and/or insect-host plant interactions to develop new strategies and effective control measures for pest insects. In this project we want to extend our knowledge of these systems to develop effective control measures to control these pests in organic crops.

The main hypothesis for the study of host plant volatiles of *A. rubi* and *L. rugulipennis* is that the flower volatiles present in the original host plants in combination with the insect's respective pheromones are the most effective in attraction of the beetles and the bugs. Conversely, volatiles from unhealthy host plants infested with fungi might deter the pests from feeding and hence provide a source of candidate repellent compounds. We further hypothesize, based on our previous research, that the natural semiochemical mechanisms of these pests and their host plants can be exploited in highly effective semiochemical traps for control by mass trapping. In addition, it is speculated that the attractive mechanisms for these two species are independent and can be combined into a single multi 'species' trap.

The aim: To develop knowledge about how to manage populations of strawberry blossom weevil (*A. rubi*), European tarnished plant bug (*L. rugulipennis*) and the raspberry beetle (*B. tomentosus*) in organic strawberry and raspberry so that these soft fruit crops can be grown without significant economic losses by these pests.

Methods and material

To identify important volatile cues for both *A. rubi* and *L. rugulipennis* host plant volatiles are collected and quantified by using headspace sampling. The volatile samples are analysed using gas chromatography linked to mass spectrometry (GC-MS). The identified volatiles are then evaluated as synergists for sex pheromone lures to attract the pest insects to traps in strawberry crops and raspberry crops. Volatiles identified from unhealthy/dying (e.g. fungi infested) strawberry plants that might act as repellents for *A. rubi* are also tested in field trials. In addition, we will use traps baited with speciesspecific volatile lures to determine overwintering sites and seasonal distribution of the pest insects, elucidating phenology and migration between different habitats and the effect of cropping methods. In raspberry crops studies of *B. tomentosus* are also included. The current traps, effective for monitoring purpose, are a green funnel (bucket) traps with cross vanes and the lure fixed at the top. An optimised trap design and method of deployment for *A. rubi* and *L. rugulipennis* mass trapping will be developed in strawberry, and for *A. rubi* and *B. tomentosus* in raspberry. The project period is 2012-2014 and there will be three field seasons.

Results and discussion

Here we present results from the first field season (2012):

Chemical analysis of plant volatiles

- Wild strawberry plants and cultivars of strawberry have revealed differences in volatiles between the leaf and the bud.
- New volatiles in the host plants have been identified and candidates will be tested as attractants in the field.
- Analyses of fungi infected wild strawberry plants have identified possible candidates to repel pest insects in the fields.

In strawberry crops

- In Norway *A. rubi* catches of the new generation (August) were conspicuously larger than those of the overwintered generation. The same was recoded in Denmark although the density of weevil was lower.
- *A. rubi* catches increased with crop age, while *L. rugulipennis* catches tended to decrease with crop age.
- The temporal pattern of *L. rugulipennis* catches depended on latitude, probably reflecting differences in voltinism: in Norway, catches ceased after mid-June, while in UK and Denmark they peaked during July-August

In raspberry crops

- Large variation in catch rates of *A. rubi* between Switzerland and Norway was recorded. In Switzerland there was no effect of the habitat (crop, boundary, forest) whereas in Norway the habitat had a significant effect.
- In spring, *A. rubi* starts its activity when the temperature reaches 18°C. Mating occurs in May which corresponds to the development of leaves in the crop (April/May). A 2nd population peak appears during fruit development in Switzerland. This is the 2nd generation, appears about one month later, depending on the temperature.
- In both Norway and Switzerland *B. tomentosus* was present before flowering, and in Norway there was a big peak at that time. In Switzerland a weak population peak is observed at the "flowers development" stage.

Trap design

- In strawberry crops the most practical and effective traps targeting *A. rubi* and *L. rugulipennis* are green cross vane bucket traps with no grid. These traps catch both species without attracting bees.
- In raspberry crops the best traps targeting *A. rubi* and *B. tomentosus* are currently white cross vane bucket traps with a grid to prevent bees being captured. This design catches weevils and beetles without impeding numbers caught.
- The height of the trap in the raspberry crops had an effect on the A. rubi catch. Significantly more *A. rubi* were found in traps on the ground that those placed at 0.75 or 1.5 m

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