Grower Summary

SF 012 (GSK217)

Developing a sex pheromone lure and trap for blackcurrant leaf midge 2008

Annual 2008

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Project Leader:	Jerry Cross, East Malling Research
Contractor/(s):	East Malling Research
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Further information

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GROWER SUMMARY

Headline

- Good progress is being made in developing a sex pheromone lure and trap for blackcurrant leaf midge control in commercial blackcurrant plantations.

Background and expected deliverables

The chemical structure of the blackcurrant leaf midge pheromone, a mono-unsaturated 17 carbon diacetate, has been determined by EMR and NRI in previous work. The compound has 4 stereoisomers but until now, it was not known which one of the four is attractive or whether the other stereoisomers have inhibitory activity. The pheromone racemate (a mix of the 4 stereoisomers) had also been synthesised and the 4 individual stereoisomers separated by High Pressure Liquid Chromatography (HPLC).

The project work expected to demonstrate which stereoisomer is attractive and which are inhibitory, to identify a suitable dispenser, optimise pheromone blend and release rate, develop a practical effective trap and demonstrate its use for monitoring the pest in commercial plantations.

Summary of the project and main conclusions

- The third stereoisomer eluting from the HPLC column ‘C’ was shown to be the natural attractive stereoisomer and the other 3 isomers were shown to be unattractive.

- The first and fourth eluting stereoisomers A and D are partially inhibitory of the natural attractive stereoisomer C, whilst the second eluting, B, was not.

- The racemate is attractive but significantly less so than the single natural stereoisomer. It would be possible to use the racemate in monitoring lures, but sensitivity would be low.

- Rubber septa lures loaded with 1 µg of the racemate showed maximum attractiveness, higher dose lures being progressively less attractive and those with > 30 µg of the racemate being virtually unattractive.

- Lures loaded with the natural attractive stereoisomer C were much more attractive, though the attractiveness of high lure loadings (> 10 µg C/lure) was not investigated. A lure loading of 10 µg C is proposed as a standard for sex pheromone monitoring traps, though further work is needed to confirm that this gives adequate sensitivity without leading to excessive catches and trap saturation.

- Pheromone traps deployed at a height of 3 cm above the ground caught the greatest numbers of midges with strongly (exponentially) decreasing catches at greater heights. Traps at 30 cm caught < 30% of the numbers of midges compared to those at 3 cm and traps at 1 m height caught very few midges. A height of trap deployment of 3 cm is recommended for maximum sensitivity.

- No significant effects of trap or sticky base colour on leaf midge catches in sex pheromone traps were found. Catches of non-target insects were affected by trap colour, black traps having the smallest catches, yellow ones the greatest.

- Sex pheromone traps deployed in 7 different commercial blackcurrant plantations in England and Scotland showed >10 fold variation in catches. The date of first catches in spring also varied between the week of 21 April and the week of 26 May. Sprays of chlorpyrifos and/or thiacloprid (Calypso) applied at most sites in April to May failed to prevent continuing catches of midges in the sex pheromone traps or the occurrence of a high percentage shoot damage at some sites.

- Overall, the results indicate that blackcurrant leaf midge sex pheromone traps will prove useful for monitoring the timing and numbers of midges attacking different blackcurrant plantations and could lead to an improvement in the control of midge if they are used to time sprays.

- A practical, free-standing 20 x 20 cm base red delta trap with a fine mesh grid at each entrance to prevent non-target contamination is proposed for future development, as a standard blackcurrant leaf midge sex pheromone monitoring trap.

Work proposed in 2009

Although the experiments carried out during 2008 show that stereoisomer C of the blackcurrant midge pheromone is the attractive isomer, the absolute configuration of this is unknown. Work is ongoing at NRI to determine the absolute configuration of stereoisomer C as part of Ms Lakmali Amarawardana's PhD studies. Once this is known, it will be necessary to devise a synthetic route to this stereoisomer as separation of commercial quantities of this isomer by HPLC would be impractical. It is hoped that an application for a new 3 year PhD studentship recently made by EMR and NRI will be supported for continued work on the sex pheromones of blackcurrant leaf midge as well as blackberry midge and blueberry leaf midge. However, such a studentship would not effectively start until 2010.

The following work could be considered for 2009:

- Field testing the proposed new blackcurrant leaf midge delta trap with vs. without grids at entrances.

- Examining the relationship between trap catches and numbers of galls formed in different commercial crops to establish a trap threshold.

- Conduct a spray trial to examine how sex pheromone traps can be used for timing of sprays of insecticides that are known to be effective against blackcurrant leaf midge (e.g. chlorpyrifos and a pyrethroid).

- Conduct a spray trial to examine the efficacy of novel insecticides for control of blackcurrant leaf midge, with sprays timed according to sex pheromone trap catches.

- Establish the relationship between lure load and male midge attraction for stereoisomer C.

- Prepare mating disruption and 'attract and kill' formulations of the racemate and stereoisomer C for field evaluation for control of the midge in 2010.

Financial benefits

Once the sex pheromone trap has been refined and trap thresholds developed, growers will improve their monitoring of the pest in blackcurrants, helping them to improve the timing of spray application, potentially reducing the number of insecticide applications required to gain control.

Action points for growers

- At present, there are no direct action points emanating from this work, but growers should follow the results of further work with an expectation of acquiring pheromone traps on a commercial basis.