Grower Summary

Developing biocontrol methods and #their integration in sustainable pest and disease management in blackcurrant production

SF 012

Annual report 2014

Project title:	**Developing biocontrol methods and their integration in sustainable pest and disease management in blackcurrant production**
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Headline

Key components of an Integrated Pest and Disease Management programme for blackcurrant have been developed

Background and expected deliverables

The overall aim of the proposed project is to develop new management methods for key pests and diseases of blackcurrants, giving priority to alternative, biological methods, and then integrate them into an Integrated Pest and Disease Management (IPDM) programme which will be evaluated and refined in large scale field experiments in the final two years of the project. Work will target Botrytis, the most important disease of blackcurrants which causes significant losses in fruit quality, and two important pest problems, blackcurrant leaf midge and sawfly which are currently controlled by routine insecticide applications. The aim will be to develop appropriate improved management methods for each target to improve control whilst reducing dependence on and unnecessary use of pesticides.

Summary of project and main conclusions

Progress on each objective of the project is summarised below

Objective 1: *Botrytis cinerea*

Effect of pollinating insects on blackcurrant yield and quality
Caged field trials showed that supplementing blackcurrant with *Bombus terrestris dalmatinus* nest boxes at the point of flower opening increased yield and fruit size of berries (Ben Hope and Ben Gairn). This was shown to be particularly important in a period of poor weather when the naturally occurring pollinating insects were less active. Bagging strigs of betties to exclude insects in open field conditions demonstrated that insect pollination contributes up to 35% fruit set of Ben Gairn.
Experiments indicated that bees may vector botrytis but that this was marginal and far outweighed by their contribution to pollination. Field trails with *B. t. audax* were inconclusive as the weather at flowering was good in 2001 and increased sampling of fruit set was needed. Wild bumblebees and solitary bees were important contributors to blackcurrant pollination; honeybees less so.
In 2012 at pre blackcurrant flowering no bees were seen visiting flowers. However, observations on flowering plants were not long enough to be conclusive. All bumblebees seen at this time were queens – mostly searching for nesting sites, although *B. lapidarius* was seem moving between blackcurrant bushes. Solitary bees were mostly seen basking on leaves or flying around bare earth – possibly males waiting for females to emerge. Bumblebee queens were particularly attracted to rough grass verges in headlands. Weather during the flowering period of Ben Garin in 2012 was poor with rainfall throughout. However, provisioning plantations with *Bombus terrestris audax* nest boxes did not improve the fruit in the blackcurrant plantations. High variability of crop management between farms and fields may have made it difficult to tease these effects apart. Bumble bees can forage for up to 2-3 km and so are not restricted to the plantations even though placed in the centres of the crops. However, bumblebees were observed foraging on blackcurrant flowers within a few minutes of opening the nest boxes. It is also likely that botrytis also affected fruit set as withered strigs of fruit were observed at the assessment time.
Although landscape scale surrounding land use varied between plantations provisions for nest sites could be manipulated within the plantation to bolster numbers of solitary and bumblebees (the main foragers of blackcurrant flowers). Many important blackcurrant forager bees were present before and after blackcurrant flowering within the vicinity of the crop. Hence provisioning with nest sites and diverse forage will help to foster better populations for pollination in future years. Most sites in this study were very forage poor, especially pre blackcurrant flowering, and some lacked numbers of bees and nest sites. *Osmia rufa* was a poor blackcurrant flower visitor and, therefore, not an important pollinator of blackcurrant.
In 2013 methods were developed that enabled us to test the nutritional quality of insect pollinated, hand pollinated (optimal pollination) and insect excluded fruits. Results were encouraging with but unclear. Experiments will be designed to further test these effects in 2014.

Objective 2: Blackcurrant leaf midge

Objective 3: Blackcurrant sawfly

A range of isomers of isopropyl tetradecenoate were synthesised and the isopropyl (Z)-7-tetradecenoate shown to have identical GC retention times and mass spectrum to the compound produced by female sawfly. The synthetic compound elicits a very strong EAG response from the males and is proposed to be the major component of the female sex pheromone. Similarly a range of isomers of the 16-carbon homologue has been synthesised and isopropyl (Z)-9-hexadecenoate shown to have identical GC retention times and EAG activity to one of the minor compounds produced by female sawflies. Lures containing these compounds were tested in the field in 2013 and were shown to attract large numbers of male blackcurrant sawfly. In 2014 we will optimise the pheromone blend and demonstrate the best trapping device for monitoring the pest.

Commercial benefits

New knowledge obtained in this project will enable growers to manage the important pests and diseases on blackcurrant more effectively with less reliance on pesticides. In particular:

1) Accurate predictions of *B. cinerea* infection risk may enable growers to time sprays and hence to increase spray efficacy.
2) Integration of biocontrol agents with fungicides may reduce botrytis development without increasing fungicide use.
3) Potential correlation of physiological characters with botrytis development may accelerate breeding of less susceptible cultivars.
4) Understanding fungi responsible for filter blockage may enable appropriate control measures to be developed and implemented.
5) Crop damage assessment of blackcurrant leaf midge would allow growers to focus control measures where they are needed and avoid spraying in plantations where damage is cosmetic.
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7) Establishment of thresholds for the newly developed leaf midge sex pheromone trap will enable sprays to be scheduled and timed to improve control and reduce insecticide use.
8) A pheromone based control method for leaf midge would allow growers to control the midge without use of insecticides.
9) A monitoring trap for blackcurrant sawfly and attendant treatment thresholds would allow growers to focus control measures where they are needed and avoid spraying in plantations unnecessarily close to harvest.
10) An improved Integrated Pest and Disease Management programme combining the above components would allow a substantive reduction in pesticide use, reduced incidence of residues and improved sustainability

Action points for growers

- Survey bee numbers in plantations and supplement with bumblebees where populations are low or where there has been a history of poor fruit set or fruit storage problems. This may also be necessary in poor weather conditions.
- If provisioning plantations with bumblebee nests, protect from badger attack.
- Sustain and increase bee numbers when plantations are not in flower, by providing alternative food sources.
  - Provide flowers with an open habit (e.g. Umbelliferae, Rosaceae, *Prunus*) to encourage a wider diversity of bees.
  - Blackthorn and Willow can be encouraged in hedgerows as an early source of forage.
  - Compositae/Asteraceae are foraged by solitary bees and can be encouraged in the alleyways. Alleyways can be most before spraying protective insecticides to discourage bees in the crop at that time.

    - Grow natural species, rather than plants that have been subject to horticultural breeding as nectar and pollen are more accessible in the former.
    - Make sure that you have a variety of plants that can provide season long flowers from mid March to late August.
    - Grow good sized patches of favoured plants as these are more attractive.
- Bees need to refuel after emerging from overwintering sites (February to March) and a good food supply (April to September) will help to ensure high populations into the following year.
- Provide undisturbed, south-facing areas of sparsely vegetated ground for solitary bees to nest in.
- Bare ground compacted by vehicles is also good, as long as these areas are in sunshine and not used too frequently.
- Avoid waterlogging soil, and loose, crumbly soil is best for bees to dig.
- Leave untidy areas of rotting wood, preferably areas of woodland, and tussocky grasses for bumblebees to overwinter and nest in (See http://bumblebeeconservation.org/about-bees/habitats/)

- Control of blackcurrant leaf midge in newly planted, establishing or cut down blackcurrant bushes is important, but control in established crops is less important providing there is adequate regenerative growth
- Lambda cyhalothrin (Hallmark) is the most effective currently available insecticide for blackcurrant midge. Sprays should be applied within a few days of threshold catches (>10 midges/trap) for the first and second generation.
- Growers interested in using the newly designed blackcurrant leaf midge trap to time spray applications should contact Jerry Cross (jerry.cross@emr.ac.uk).

- The first three fungicide sprays applied from first flower are the most important treatments for Botrytis control. If an effective fungicide programme is applied at this time then there is no benefit from additional sprays near harvest.