Horticultural
Development
Company

Grower summary

SF 102 Year 2

Biology and integrated control of blackberry leaf midge on blackberry and raspberry

Annual Report 2010

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The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Headline

- Improved understanding of the life-cycle of the blackberry leaf midge in protected blackberry has been gained in year 1 of this project.

Background and expected deliverables

To meet consumer demand for soft fruit over an extended season, there has been a substantial increase in UK production of blackberries and raspberries under protection, mainly using 'Spanish' tunnels. This has led to increased problems with insect pests that were previously considered to be 'minor' localised pests in outdoor rubus crops. One such pest is the blackberry leaf midge, *Dasineura plicatrix*, which has now become widespread and is damaging on blackberry crops both in fruiting and in propagation. The larvae feed on the leaf tips, causing leaf twisting and distortion, cane stunting and branching and reduced yield in the following year's crop.

The life cycle of blackberry leaf midge on protected blackberry and raspberry is not fully understood. On protected crops, the pest seems to have more than the two generations per season reported to occur on outdoor crops. This will lead to increased midge numbers and an extended period of damage on protected crops. There is a shortage of approved, effective pesticides for use against the pest on protected rubus crops, particularly on protected blackberry. In addition, some of the pesticides available for control are not compatible with bees used for pollination, and /or biological control agents used against other pests in Integrated Pest Management (IPM) programmes. There is a need to confirm the life cycle of the pest on protected blackberry and raspberry crops and to develop integrated control methods for use in IPM programmes.

The aims and expected deliverables of this project are to confirm the location and timing of key life-stage events of blackberry leaf midge on commercial protected blackberry and raspberry crops and to test integrated control methods for use on protected blackberry, with a view to extrapolating the methods to protected raspberry.

Summary of the project and main conclusions

The work has been split into two objectives.

Objective 1: To confirm the location, timing and duration of key life-stage events of blackberry leaf midge on protected blackberry and raspberry

- The biology and life stage events of blackberry leaf midge were confirmed in two protected blackberry crops during 2009, one grown in pots (Meadow Field), the other grown in the soil (Chivers Field).

- The pest overwintered in 2008/2009 as cocoons in the soil. Most were found in soil to a depth of 3 cm, at the edge of the ground-cover matting running under the crop canopy. They were also found in the soil in the planting hole, under the polythene covering the ground between plants and in plant debris on the polythene.
- Monitoring with water traps detected the first male midge on 8 April in Meadow Field and the first females on 15 April in both Meadow and Chivers Fields.
- Sampling of leaf tips detected the first midge eggs and larvae on 15 and 22 April in Meadow and Chivers Fields respectively.
- Soil temperature data between March and June was modelled in a similar manner to the ADAS raspberry cane midge model to predict first generation blackberry leaf midge emergence and first egg-laying dates. First eggs were predicted on 20-21 April in Meadow Field and on 27-29 April in Chivers Field. These results were very promising as the predicted dates were only five days earlier than the actual dates when first eggs were found in leaf tips, i.e. 15 and 22 April in the two respective fields. As the leaf tips were only sampled weekly, the first eggs could have corresponded even more closely with the predicted dates. The data suggested that blackberry leaf midges emerge and lay eggs slightly earlier than raspberry cane midge, at an accumulative soil temperature of around 280℃ days above a base tempe rature of 4℃.
- Numbers of midge adults remained low (below two per trap) until June and July. Mean numbers per trap peaked on 22 July in Meadow Field (24 per trap) and on 8 July in Chivers Field (132 per trap), see Figure 1.
- From late June to mid-August during peak adult activity, numbers of males trapped were much higher than those of females in both fields. This could possibly be due to differences in the behaviour of males and females rather than an uneven sex ratio in the population.

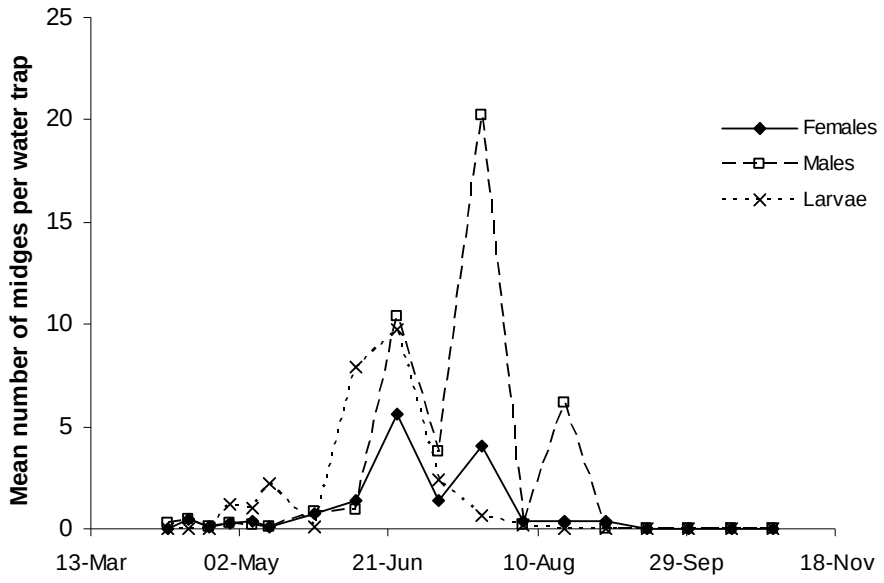

Figure 1. Meadow Field: Mean numbers of blackberry leaf midge males, females and dropped larvae per water trap.

- Following first adult emergence and egg laying, the percentage of leaf tips infested with eggs and larvae increased rapidly in both fields, from 30% and 5% in Meadow and Chivers Fields respectively in mid-April, to 60% and 55% respectively in late April and to 90% and 100% respectively in late June/early July (see Figure 2). Larval feeding activity continued until late September.

- Midge larvae fed for approximately two weeks in the leaf tips, causing them to twist. Severely damaged leaves turned brown and withered.

- When fully fed, the larvae dropped to the ground to pupate in cocoons. No pupae were ever found in the leaf tips, and dropped larvae were found in the water traps under the crop canopy that were used for monitoring adult activity (see Figure 1).

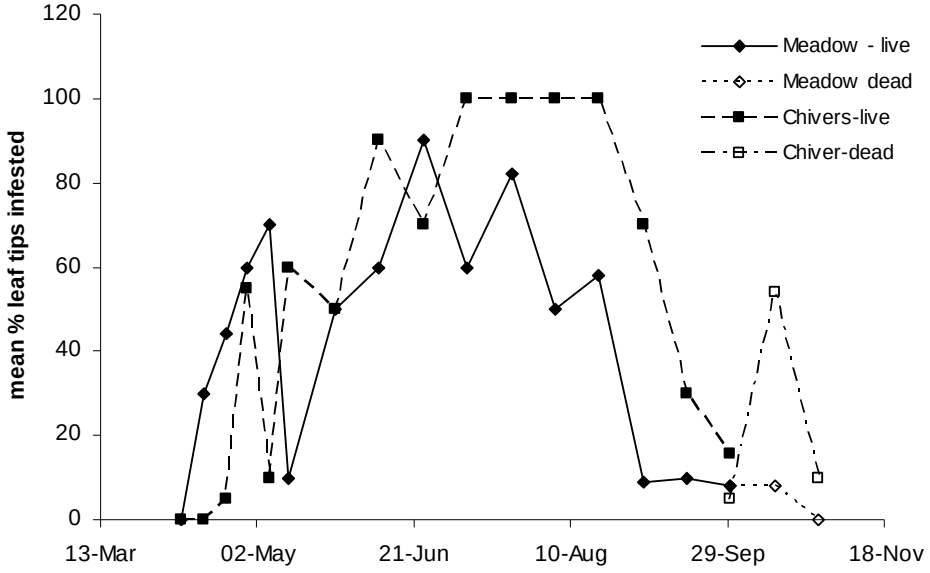

Figure 2. Percentage of leaf tips infested with eggs and/or larvae in Meadow and Chivers Fields between 8 April and 28 October.

- Monitoring of three protected raspberry crops in June confirmed that blackberry leaf midge larvae damaged raspberry leaves but the percentage of infested leaf tips was much lower than that in the protected blackberry crops at this site. This may have been due to the use of chlorpyrifos against other pests such as raspberry cane midge.
- The pattern of adult numbers in traps and that of eggs and larvae in leaf tips suggested that there were four overlapping generations in protected blackberry, between April and September, unlike on outdoor blackberry when only two generations are reported, in May/June and July/August. Thus on protected blackberry, first adult emergence is earlier, there are more generations per season and the pest is active for a longer period than on outdoor blackberry.

Objective 2: To evaluate potential integrated control methods against blackberry leaf midge, for use in IPM programmes on protected blackberry

- Preliminary laboratory experiments indicated that both the predatory mites *Amblyseius cucumeris* and *Amblyseius andersoni* predated young blackberry leaf midge larvae. However, it was not possible to produce sufficient data for statistical analysis due to difficulties with methodology. Further work will be conducted in year 2.

- Releases of both *A. cucumeris* and *A. andersoni* to blackberry plants in slow-release sachets in research tunnels at ADAS Boxworth led to some establishment of *A. cucumeris* in the flowers but no apparent establishment of *A. andersoni*. The latter species can be difficult to find on host crops. However, following grower releases of *A. andersoni* to commercial protected blackberry plants, there was no apparent reduction in the pest when compared with untreated plants. Further work on establishment and potential control by predatory mites will be conducted at ADAS Boxworth in year 2.
- In laboratory pot experiments, neither the predatory mites *Macrocheles robustulus* nor the predatory beetles *Atheta coriaria* gave significant reductions in the numbers of blackberry leaf midge larvae that successfully completed their development in compost and emerged as adult midges. Results indicated that numbers of both predators may need to be equal to or higher than numbers of the target midge larvae in the soil to give significant control of the ground-dwelling stage of the pest. Work in year 2 will include comparing the potential of *M. robustulus* with that of the predatory mite *Hypoaspis* sp. against the ground-dwelling stages of the pest.
- Grower applications of Naturalis-L to the commercial crop did not reduce the percentage of leaf tips infested or mean numbers of live larvae per leaf tip. *Beauveria bassiana* is a contact-acting fungus and is unlikely to reach the target pest inside folded leaf tips. In a laboratory test, application of Naturalis-L to compost did not reduce the numbers of blackberry leaf midge larvae that successfully completed their development in the compost and emerged as adult midges.
- Grower applications of thiacloprid (Agrovista Reggae, SOLA 0467/2008) and abamectin (Dynamec, SOLA 2290/2007) did not reduce numbers of live midge larvae per leaf tip or percentage of infested leaf tips when compared with those in untreated plants.
- Grower application of chlorpyrifos (Alpha chlorpyrifos, label recommendation for outdoor blackberry) to outdoor blackberry reduced numbers of live midge larvae per leaf tip by 87% and reduced the percentage of infested leaf tips by 92% when compared with those in untreated plants. By extrapolation, chlorpyrifos should give some control of the pest on raspberry and various chlorpyrifos products are approved for use on both outdoor and protected raspberry. However, chlorpyrifos is not approved for use on protected blackberry and is not compatible with biological control agents used in an IPM programme.
- Further work on the potential of IPM-compatible pesticides against blackberry leaf midge will be conducted in year 2, in consultation with Vivian Powell at HDC.

- Naturally-occurring anthocorid bugs (both *Anthocoris nemorum* and *Orius* sp.) were observed feeding on blackberry leaf midge larvae in the commercial crop during July and August. Both adults and nymphs were recorded, which showed that the predatory bugs were breeding on the blackberry crop. *Orius laevigatus* are commercially available and work on its potential against the pest when released early in the season will be included in year 2.

Financial benefits

It is too early in the project to predict financial benefits.

Action points for growers

- Monitor for blackberry leaf midge on both outdoor and protected blackberry and raspberry crops.
- If the pest occurs on raspberry, extrapolation of the results in this project on outdoor blackberry indicates that chlorpyrifos should give some control of the pest. Various chlorpyrifos products have approval for use on both outdoor and protected raspberry. However, this pesticide is not approved for use on protected blackberry and is not compatible with biological control agents used in IPM.
- Keep up to date with further results in this project on potential integrated management strategies for the pest by contacting HDC or Jude Bennison: jude.bennison@adas.co.uk, Tel. 01954 268225.