Grower Summary

PE 006a

Protected herbs: improved biological control of aphids (extension to PE 006)

Interim Report 2013

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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.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Contractor:	ADAS UK Ltd
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Headlines

- *Ephedrus cerasicola*, *Praon volucre* and *Aphidius matricariae*, either as individual species or as a mix are effective against mint aphid
- *Aphidius matricariae* will be taken forward to the next experiment testing cost-effective release rates for mint aphid control.

Background

Until recently, biological control of aphids on protected crops relied mainly on three aphid parasitoid species:

- *Aphidius colemani* for control of the peach-potato aphid, *Myzus persicae* and the melon-cotton aphid, *Aphis gossypii*.
- *Aphidius ervi* and *Aphelinus abdominalis* for control of the potato aphid, *Macrosiphum euphorbiae* and the glasshouse-potato aphid, *Aulacorthum solani*.

On protected herbs, the peach-potato aphid is a common pest of basil and *A. colemani* usually gives effective control. However, grower experience indicated that two aphid species commonly occurring on all year round (AYR) protected herbs, the hawthorn-parsley aphid, *Dysaphis apiifolia* and the mint aphid, *Ovatus crataegarius*, do not seem to be parasitised by any of the above three parasitoid species.

Hawthorn-parsley aphid is a common and severe pest on AYR parsley, forming dense colonies at the base of the stems. Mint aphid is commonly found on mint and is often mistaken by growers as peach-potato aphid as it is similar in appearance. Commercial experience indicates that aphid predators (the predatory midge, *Aphidoletes aphidimyza* and the lacewing, *Chrysoperla carnea*) and the entomopathogenic fungus ('Naturalis-L') do not give effective control of hawthorn-parsley aphid and there has been little experience of using predators and fungi against mint aphid.

Chemical control on protected herbs is difficult due to the limited range of approved IPM-compatible aphicides and restrictions on frequency and timings of application. For example, pymetrozine (Chess WG) which has an Extension of Authorisation for minor use (EAMU, formerly known as a SOLA) for use on protected herbs, is effective against both target aphid species and is IPM-compatible, but must not be applied between 1 November and 1 March and has a 14-day harvest interval which is limiting on short-term herb AYR herb crops e.g. parsley which has a 5-week production time. In addition, growers are under increasing

pressures to reduce the use of chemical pesticides and are keen to adopt more biological control strategies.

The new aphid parasitoid mix produced by Viridaxis in Belgium includes three newly available parasitoids in addition to the three species named above. The 'new' species are *Aphidius matricariae*, *Praon volucre* and *Ephedrus cerasicola*. The mix has given good control of a wide range of 'difficult' aphid species on strawberry, that were not been controlled by previously available parasitoids (Clare Sampson, personal communication). The mix has also given improved control of aphids on ornamental pot plants and HNS in BCP Certis trials (Clare Sampson, personal communication and subsequent grower use).

The aim of this project (PE 006a) was to develop a robust, cost-effective parasitoid release strategy for reliable control of hawthorn-parsley aphid and mint aphid on protected herbs using the effective parasitoids identified during PE 006.
The specific objectives were:

1. Demonstrate that *Aphidius colemani* will parasitise hawthorn-parsley aphid on pot-thick and spaced parsley plants in replicate cages in a commercial herb glasshouse
2. In small-scale research glasshouse experiments, develop an effective, robust parasitoid release strategy for control of hawthorn-parsley aphid and mint aphid.
3. In an experiment on a commercial herb nursery, validate the success and cost-effectiveness of the selected parasitoid release strategy for control of hawthorn-parsley aphid on parsley.

Summary

The results from this study so far indicate that parasitoids are more effective at parasitising hawthorn-parsley aphids in spaced pots of parsley than in those that are pot-thick. This indicates that the parasitoids might be inhibited from searching for this species of aphid (which infests the base of parsley plants) when closely spaced early in the production cycle. This might be one of the reasons why growers have not observed parasitized hawthorn-parsley aphids during the production cycle.

When comparing the effectiveness of individual and mixed species on the parasitism of mint aphid and hawthorn parsley aphid, the initial experiments had too much variation in the data from replicate cages within the treatments to make confident conclusions. Attempts were successfully made to reduce this variation and results from the second experiment on mint aphid have indicated that this aphid is more effectively parasitized by a mix of parasitoid species (*E. cerasicola, A. matricariae* and *P. volucre)* or *E. cerasicola* alone, than by *A.*

matricariae or *P. volucre* alone. When used in a species mix together with *A. matricariae* and *P. volucre*, *E. cerasicola* was responsible for 82% of the mummies. This result indicated that *E. cerasicola* is the superior parasitoid for mint aphid. Reasons for this could include enhanced host-searching ability and/or the mint aphid being more readily accepted as a suitable host by *E. cerasicola* compared with the other two parasitoid species.

When using mixed parasitoid species in a biological control programme there is the risk that competition between parasitoids for the host may occur and this could lead to reduced total parasitism and thus poorer aphid control. A recent study demonstrated that competition between larvae of *Aphidius ervi* and *Praon volucre* occurs within *M. euphorbiae*, with *P. volucre* being the superior competitor if both parasitoids lay eggs in the same host aphid. This could lead to the exclusion of *A. ervi* over time. It is possible that parasitoid larval competition could also play a role in mint aphid, with *E. cerasicola* larvae more successfully developing in aphids parasitized by multiple species.

During this study, it was also observed that while healthy aphid numbers were reduced significantly in treatments with each of the three parasitoids compared with the untreated controls, very few mummies were observed on the plants. Thus another factor in addition to parasitism may have contributed to aphid control. One possible factor could have been parasitoid host-killing via host feeding, as observed in PE 006 by *Aphidius ervi*, *Praon volucre*, *Ephedrus cerasicola* and *Aphelinus abdominalis* on mint aphid. Another factor could have been aphids dropping from the plant in response to the alarm pheromones produced by other aphids in the presence of parasitoid attack. Host killing and falling aphids are both factors which will enhance the impact of biological control by parasitoids. In the case of mint aphids, the reduction in numbers of healthy aphids by parasitoids, without the production of many mummies is an example of the ideal 'overkill' biological control strategy on a crop such as pot herbs, which are subject to retailer 'zero tolerance' of aphids or mummies.

The next stage of this study is to determine cost-effective release rates for the most effective individual or mix of parasitoids identified in the previous experiments. For mint aphid, the ideal candidate to take forward would be *E. cerasicola* but unfortunately this is not commercially available as a single species. Furthermore, the mix of the three species effective against mint aphid (*E. cerasicola, A. matricariae* and *P. volucre)* are only available as a mix of six parasitoids and it was shown in PE 006 that the three other parasitoids (*Aphidius colemani*, *A. ervi* and *Aphelinus abdominalis*) do not parasitize mint aphid. Following consultation with the supplier of the parasitoid mix, Viridaxis in Belgium, it was confirmed that they do not currently plan to market a mix of parasitoids specifically for mint

growers containing *E. cerasicola, A. matricariae* and *P. volucre* or make *E. cerasicola* available as a single species. Therefore *A. matricariae* was selected to take forward to the next step in the project to test release rates, as this is available as a single species from other suppliers e.g. Koppert. This experiment will commence during April 2013 for mint aphid. The initial experiment comparing single and mixed species for the control of hawthorn-parsley aphid will be repeated during April, using the amended protocol as used for the second mint aphid experiment, in order to select the parasitoid(s) to take forward to a release rate experiment.

Financial Benefits

None to date.

Action Points

None to date.