Management of capsid (mirid) bugs infesting outdoor celery crops

Figures 1a and 1b. Capsid damage on celery

Introduction

The Miridae are a large and diverse family of insects. They are true plant bugs, commonly referred to as capsid bugs or leaf bugs. The most widely known capsids are species of agricultural pests that pierce plant tissues, feed on the sap, and sometimes transmit plant viruses.

Action points

- **Growers should monitor crops and field margins to determine levels of *Orthops* spp. activity as this will be useful in helping to time control methods**
- **Growers can use fine mesh netting to exclude *Orthops* spp. from susceptible crops. Once a crop is uncovered, if there are capsid bugs in the field margins, they will move into the crop very rapidly**
- **Destruction of wild hosts (members of the carrot family) in field margins may reduce the size of infestations of *Orthops* spp.**
- **Of the insecticides approved for use on celery, lambda-cyhalothrin appears to be the most effective against adult *Orthops* spp. Pyrethrins are ineffective. A recent EAMU (No. 1516 of 2017) has been issued for deltamethrin, which should show similar efficacy to lambda-cyhalothrin**

Most species of capsid are between 3–6mm long. They are elongate to oval in shape. Many of them have a hunched look, because the head is bent down. Some are brightly coloured and attractively patterned. The majority live on plants that produce seeds and their development is often synchronised with the reproductive development of their host plant.

Recent high incidences of capsid damage in celery (Figures 1a and 1b) suggests that the status of capsids as pests of this crop is increasing, particularly in organic crops. Crop invasion by capsids appears to be unpredictable and relatively little is known about their biology. Current control of capsids in celery relies on the use of a small number of generally broad-spectrum synthetic insecticides, and options for control of capsids in organic crops are very limited.

The aim of this factsheet is to improve current understanding of the capsid bugs that can infest celery crops and consider approaches to control. It is based mainly on the findings of AHDB Horticulture project FV 441 whose aim was to improve understanding of the capsid bugs that can infest celery crops, identify the key pest species and determine and evaluate approaches to control.

Figure 2. Capsid damage on celery stems

Damage and species responsible

Damage

Feeding damage by capsid bugs results in brown feeding marks/scars to the stems and foliage, and to distortion of celery plants (Figure 2). In severe cases, feeding damage caused when the plants are young may totally destroy the celery heart; in this case, the symptoms may be confused with black heart. To date, damage has been most severe in organic crops and has been seen particularly between early July and the end of August.

Pest species

Prior to the detailed sampling carried out as part of project FV 441, it was not clear which species were responsible for the damage to celery. In the project, sampling of affected crops and of field margins (which may harbour populations of the pests) was undertaken. While adult common green capsid (*Lygus pabulinus*) and European tarnished plant bug (*Lygus pabulinus*) were found in samples from the field margins, only adult *Orthops* spp. (small capsid bugs) were found in the crop samples. The most abundant species was *Orthops campestris* (Figure 3), although other species of *Orthops* occur in the UK (*Orthops kalmii, Orthops basalis*) and a specimen of *O. kalmii* was also identified from a crop sample. *Orthops campestris* is about 4mm long, is usually green or green-tinged (the other species are not green) and is the smallest species of *Orthops*. Within the crop, feeding damage was caused by both the adults and the immature bugs – nymphs (Figure 4); the latter cannot be identified to species level.

Figure 3. Adult *Orthops campestris*

Orthops campestris is a very common bug throughout the UK. It appears to prefer to live and feed on members of the carrot family (Apiaceae) and is often associated with wild parsnip (*Pastinaca sativa*). Further wild hosts are wild carrot (*Daucus carota*) and hemlock (*Conium maculatum*). The other species of *Orthops* also prefer members of the carrot family as hosts.

While there is little recent information on *O. campestris* as a pest of crops, there are a number of older publications on *Lygus campestris* and it appears this is the same species. In these publications, *L. campestris* is described as a pest of carrot crops grown for seed production, and of celery and fennel.

Figure 4. *Orthops* spp. nymph on celery

Life cycle

Orthops campestris spends the winter as an adult, hidden among herbaceous vegetation. As temperatures rise in the spring, the adults become active and start to feed before mating and laying eggs. The eggs hatch into nymphs which feed on the same types of vegetation as the adults. Sampling data collected from field margins during 2014–2016 suggest there are three peaks in the numbers of adults and nymphs each year (Figures 5 and 6).

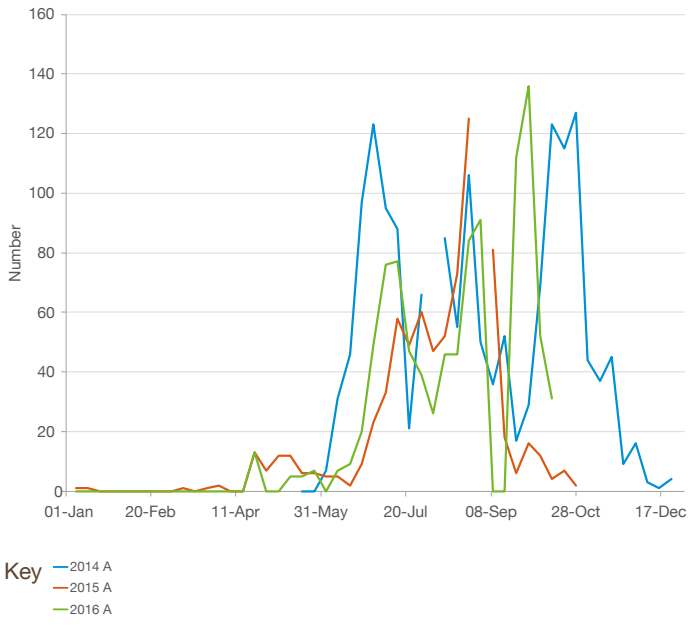

Figure 5. Numbers of adults (*Orthops* spp.) in samples from the vegetation surrounding organic crops of celery at G's in 2014–2016 totalled across locations (data provided by E. Witkowska)

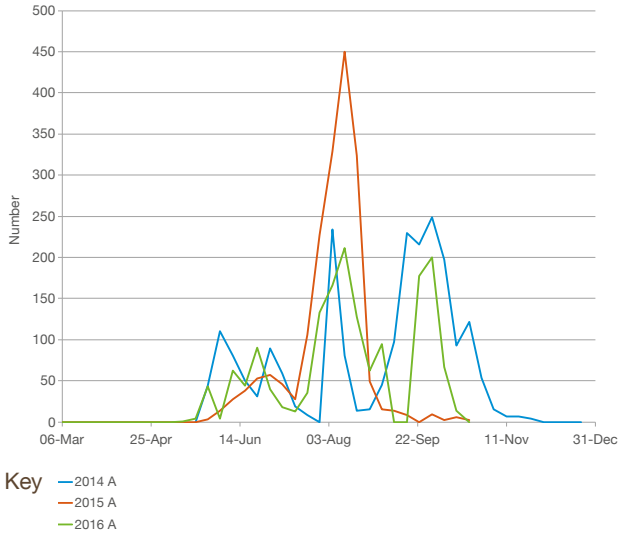

Figure 6. Numbers of nymphs (*Orthops* spp.) in samples from the vegetation surrounding organic crops of celery at G's in 2014–2016 totalled across locations (data provided by E. Witkowska)

Monitoring methods

Several approaches to monitoring capsid infestations were evaluated in project FV 441.

1. Destructive sampling of celery plants to identify the species infesting the plants and causing damage.
2. Sampling of field margins using a sweep net.
3. Sampling of field margins using a method of 'tap sampling' (Figure 7), where a rigid plastic board was used as a tray. The tray was placed underneath the plants and they were tapped by hand a few times in each location. The method is used by other growers, eg strawberry growers to monitor the first appearance.
4. The use of sticky traps was investigated following the observation that capsid bugs were captured on the orange sticky traps used to monitor carrot fly.

Of these approaches, 'tap' sampling and using a sweep net appear to be the most effective methods of sampling the underlying population in the field margins and for tracking the life cycle. With both approaches, it is important to sample in as consistent and repeatable a manner as possible so that captures can be compared between occasions. If they are sufficiently sensitive, captures on sticky traps may also be informative. Regular crop walking is recommended.

Figure 7. Plastic tray used for tap sampling vegetation to collect capsid bugs

Forecasting

In 2014–2016, the numbers of nymphs recovered by 'tap-sampling' field margins at G's peaked on 3 occasions, suggesting 3 generations. There were 42 to 56 days between these peaks and this was equivalent to approximately 330 day-degrees above 10°C or 420 day-degrees above 8°C between generations. Such information might provide the basis for a forecasting system to indicate periods when nymphs would be most abundant. However, such a forecasting system would require further development and validation for it to be reliable.

Natural enemies

Feeding tests with field collected predators indicated that potentially effective predators include web-forming spiders, earwigs, damsel bug species and harvestmen, and, to a lesser extent, ladybirds, soldier beetles and lacewing larvae. The most effective natural enemies appeared to feed on adult capsids as well as juveniles. It is likely that the use of pyrethroids and other broad spectrum insecticides will kill some of these natural enemies.

Approaches to management in conventional and organic crops

Crop covers

G's has demonstrated that crop covers made of fine mesh netting can be used to exclude all stages of *Orthops* spp. (Figure 8). However, the use of covers may have other consequences. For example, the presence of the covers may exacerbate infection by pathogens and reduce crop quality. The use of crop covers also presents challenges for effective weed control, is expensive and labour intensive. Despite these drawbacks, this approach is particularly important for organic crops where there are currently no effective control options. Additional studies at G's showed that, once the covers are removed, the capsids rapidly moved into the crop from the field margins. Trials to determine the time of day when the capsids were least active were inconclusive.

Figure 8. Use of net covers to exclude capsid bugs from organic celery at G's

Management of wild hosts

AHDB Horticulture project FV 441 confirmed the importance of wild Apiaceae (carrot/parsley family) in sustaining populations of *Orthops* spp. and the strong association between their presence and the presence of the pests (Figures 9a and 9b). This indicates that management of vegetation in field margins may be one of the most effective ways of reducing the abundance of this pest.

Figures 9a and 9b. Wild carrot is one of the hosts of *Orthops* spp. (left image). *Orthops* spp. particularly like to feed in the developing seed heads of wild carrot (right image)

Insecticides

A laboratory trial was undertaken in project FV 441 to evaluate foliar spray treatments for the control of the adult *Orthops* spp. Potted celery plants were used for the trial. Test plants were taken outside and the treatments were applied using a knapsack sprayer fitted with 02F110 nozzles. Water volumes used were 200L/ha. Treatments consisted of lambda-cyhalothrin, spinosad, pymetrozine, pyrethrins, five experimental products and an untreated control. The plants were then placed in cages (one plant per cage) and ten adults were added to each cage. The cages were kept at 20°C and the numbers of live capsids were assessed 1, 2, 3 and 6 days after spraying.

The results for the insecticides approved for use on celery are shown in Figure 10. The percentage live adults declined over time but none of the treatments was instantly effective. Two days after spraying, only lambda-cyhalothrin had reduced the percentage live adults, compared with the untreated control. Reduction in the percentage live adults due to spinosad was nearly significant on day 3 and day 6 after spraying, while pymetrozine was relatively ineffective. The trial confirmed that pyrethrins are ineffective against adult *Orthops* spp.

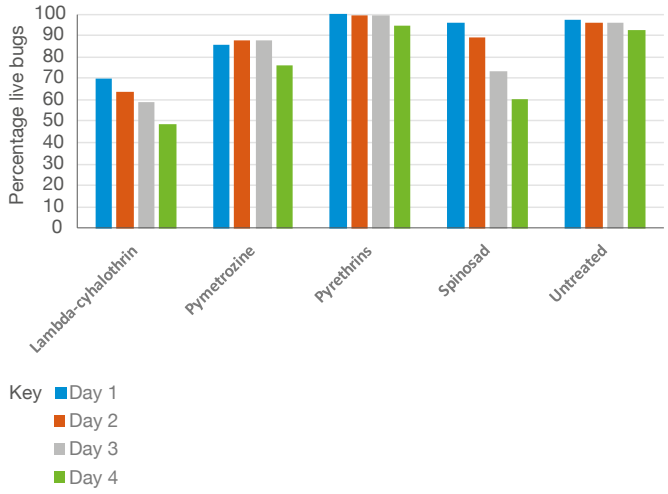

Figure 10. Percentage live adult *Orthops* spp. remaining, following treatment in the laboratory with foliar sprays of insecticide

Conclusion

Species of *Orthops*, particularly *Orthops campestris*, have been confirmed as the pest capsids causing most damage to celery crops in eastern England. A laboratory trial has identified a small number of insecticides that are partially effective against adults of this species. Apart from these insecticides, there are two other approaches to management. The first is the use of crop covers made of fine mesh netting to exclude all stages of *Orthops* spp. This approach successfully excludes the bugs, although it may have other consequences for crop management. Secondly, the strong association between the presence of wild members of the carrot family and the presence of *Orthops* spp. indicate that management of the vegetation in field margins may be one of the most effective ways of reducing the abundance of this pest.

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Acknowledgements

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