Factsheet 09/11

Field Vegetables

Control of thrips in Allium and Brassica crops

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The onion thrips (*Thrips tabaci*) is a pest of several crops in the UK, particularly leek, salad onion and stored cabbage (Figure 1). This factsheet is aimed at summarising best available knowledge on biology and control of onion thrips in outdoor crops – principally Allium crops but also stored cabbage. While there are still gaps in knowledge and availability of effective insecticides, it will aim to provide guidelines on cultural, chemical and integrated control of thrips.

Action points

- Adult onion thrips can be monitored using sticky traps. Blue and white are considered to be the preferred colours. It may be sufficient to trap thrips at one or two locations within a region as the pattern of activity appears to be consistent in any year.
- In many cases, adult thrips have been captured on sticky traps before they were found on Allium plants, indicating that traps could be used to provide an early warning of colonisation. However, there seems to be little opportunity to use the actual numbers of thrips captured on traps to predict the severity of infestation on plants.
- Thrips infestations can also be monitored directly by examining the crop and it is probably easier to assess damage than to count them on plants. The best approach may be to assess the youngest leaves on Allium crops, as this will indicate the current level of damage rather than old damage.
- For chemical control read the Insecticidal Control Section which lists the results of recent work on onion thrips. Not all of these insecticides are approved on other crops susceptible to onion thrips infestations so consult a BASIS qualified advisor before applying insecticides.
- Growers should remember that insecticide resistance to pyrethroid insecticides in field populations of onion thrips was confirmed by scientists at Rothamsted Research in 2006. Since pyrethroids are also likely to harm beneficial insects, their use for thrips control should be avoided.
- In addition, since onion thrips populations are known to be able to develop resistance to insecticides, growers should employ a resistance-management strategy by alternating the application of insecticides with different modes of action.
- The information obtained to date suggests that there seems to be little benefit in applying sprays ‘early’ to attempt to suppress the development of thrips infestations and that growers should apply spray treatments when thrips numbers are increasing (indicated by sampling with sticky traps or by sampling plants).
- Similarly, trials indicated that control is required until thrips numbers on plants decrease and sometimes thrips are abundant until October.
- Targeting of control applications in the early afternoon, particularly on warm days, when the highest proportion of the population is vulnerable, might well lead to an increase in efficacy against adult thrips.
- The application of irrigation may reduce thrips numbers.

1. **Onion thrips is a pest of several crops in the UK**

Background

The onion thrips, *Thrips tabaci*, is a pest of several crops in the UK, particularly leek, salad onion and stored cabbage. Feeding by adult and larval thrips damages the host plant via direct removal of cell contents. As individual plant cells are killed, scarring of the leaf in the form of silvering is observed (Figure 2). Plants with obvious thrips feeding damage are considered unacceptable for sale in many cases and therefore the economic impact of a thrips infestation can be severe. Most of the recent research on thrips control in the UK has been undertaken on Allium crops but the general principles are relevant to cabbage.

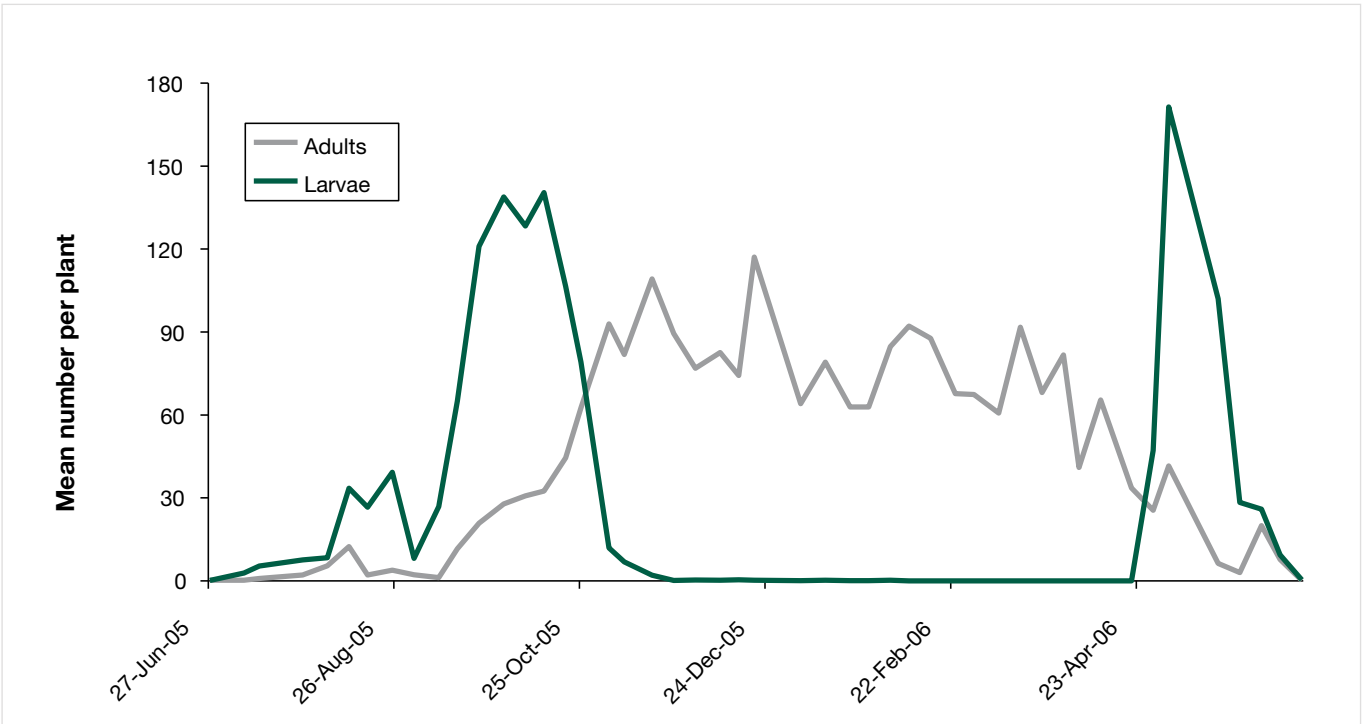
On cabbage, feeding by thrips can result in small, brownish-grey growths on the leaf surface (Figure 3) as well as silver-coloured lesions. During the winter of 2006-7 there were a number of reports of thrips damage to stored cabbage. The winter was exceptionally warm and it is likely that this favoured the continued development of thrips inside cabbage maintained in ambient stores. While outdoor temperatures were probably still too low for continued thrips development, the slightly higher temperatures in ambient stores appeared to have made all the difference. Samples of stored cabbage were examined in late January 2007 and all stages of the thrips life-cycle – adults, larvae, pupae (and presumably eggs) were present between the leaf layers.

2. Thrips cause direct damage to the leaf through feeding and this leaves silver marks on the leaf

3. Thrips damage on cabbage can occur as brownish-grey growths on the leaf surface

Thrips biology and behaviour

In the UK, onion thrips overwinters in the adult stage (Figure 4). Host vegetable crops such as leek are preferred overwintering sites, but the thrips will also overwinter in other locations such as cereal crops. Once temperatures rise in the spring then female thrips start to lay eggs, either after dispersing to new hosts or on the overwintering host if this is still a suitable food source. Female thrips can lay eggs without mating.



4. The numbers of adult and larval *Thrips tabaci* on leek plants at Wellesbourne in 2005-6. Note 1) the high numbers of thrips in September-October 2005, 2) the large numbers of adult thrips overwintering in this particular year and 3) the production of larvae in April-May 2006 following an increase in spring temperatures.

Following egg hatch there are two active larval stages and two inactive stages (pre-pupa and pupa). The two larval stages ingest all the food required by the thrips for development to the adult stage.

Stage 1 larvae are extremely small, around 0.5mm in length and begin to feed very quickly after hatching. The larval diet for both active feeding stages is primarily plant juices, extracted via probing of the leaf surface with piercing and sucking mouthparts and the removal of cell contents. As a result, larvae begin to cause visible plant damage almost immediately after emergence. Once the first stage larvae are approximately 1mm long, they seek out a sheltered area of the leaf to moult.

Second stage larvae feed until they have reached the size of the eventual adult and then move into a two stage period of inactivity, which, depending upon the host plant and conditions, usually takes place in the surrounding soil. The first of these two stages is called the pre-pupa, which is almost completely immobile and this moults into the pupa, which is totally immobile.

Once the thrips has developed fully inside its pupal case, an adult emerges. The rate of thrips development is governed by temperature and they will complete a number of generations during the summer period. Recent studies at Wellesbourne (Burnstone, 2009) showed that a generation (egg to adult) takes about 52 days at 12.5°C and 15 days at 25°C. Development stops at temperatures below about 10°C.

Onion thrips is a comparatively active thrips species and dispersal between plants and between crops is through flight. Thrips populations thrive in warm and fairly dry conditions, which not only promote fast larval development but are ideal for flight. Temperatures close to 25° appear to be optimum for flight activity (Burnstone, 2009).

Although the majority of adult thrips are found on the basal half of the leaves of Allium crops throughout the day, a proportion of them migrate to the apical half of the leaves in the early afternoon. The increased warmth experienced during this period of the day is likely to encourage flight. The larvae are generally confined to the basal half of the leaves and remain there throughout the day.

On cabbage, thrips are usually hidden inside the foliage, although again, adult thrips are likely to move onto more exposed parts of the plant in order to disperse.

Thrips species are attacked by several groups of generalist predators. Potential predators from several groups (eg beetles, bugs, flies, mites) are present in the UK and may reduce onion thrips populations to some extent.

Cultural and biological control

Cultural control

Varietal resistance to onion thrips exists in some cultivars of onion and, in the USA, use of some resistant onion varieties was more effective in control of onion thrips populations than application of insecticides. There has been no comprehensive survey of resistance in cultivars grown in the UK.

Intercropping has been investigated as a method of thrips control in onion crops and was found to reduce infestations by 50% or more. Similarly, undersowing has shown excellent potential for the reduction of thrips populations in leek. With both approaches, competition between the crop and companion plants may limit their usefulness, together with the additional costs of taking such an approach.

There is evidence that the damage caused by thrips populations has declined after periods of precipitation, possibly because individuals are washed off plant surfaces onto the soil. Irrigation to reduce thrips populations is employed by growers in many countries and there appears to be a consensus, based upon the experience of these growers, that this is effective (Figure 5). However, a recent trial to evaluate the impact of irrigation on thrips numbers on salad onions did not demonstrate a consistently useful effect (Burnstone, 2009).

Biological control

There has been some success in controlling thrips species with predators, although this is mainly in protected crop environments and using augmentative or inundative techniques. This technique has not been evaluated outdoors in the UK. Nematodes are known to parasitise thrips species. Investigations into the use of nematodes for the control of western flower thrips in greenhouses have demonstrated their potential and it appears that the nematodes are most effective against the dormant stages in the soil.

Entomopathogenic nematodes were investigated as a potential biological control agent on leek in a recent Defra project (HH3116TFV). The nematodes appeared to survive for several days in water droplets at the base of the leaves of leek plants, but did not do so on the foliage and there was no evidence that they reduced thrips numbers. It is not known whether nematodes trapped in the droplets are able to parasitise nearby thrips and there is the potential for further work in this area to determine whether they are effective either against the larval stages on the foliage or the pre-pupal and pupal stages in the soil. Identification of the susceptible stage would influence the application strategy that might be used.

5. Irrigation could be used to reduce thrips populations

Insecticidal control

This page contains the results of HDC and Defra-funded trials. Always check the label recommendation or EAMU. A BASIS qualified advisor should be consulted before applying insecticides on the crops.

Targeting

Insecticides to control thrips are usually applied as foliar sprays. The cryptic behaviour of onion thrips means that they are a very difficult target for insecticides that work by contact action. This may be particularly true for the larvae which do not move onto the higher and more exposed parts of the plant. Targeting of control applications in the early afternoon, particularly on warm days, when the highest proportion of the population is vulnerable, might well lead to an increase in efficacy against adult thrips. In any case, the overall aim should be to achieve good coverage of the foliage to increase the probability that mobile thrips will encounter insecticide residues.

Foliar spray treatments

A range of insecticides have been evaluated for thrips control on leek and salad onion and new insecticides continue to be evaluated in the SCEPTRE project (2010-2014). Of the insecticides approved currently for thrips control on leek (September 2012), 'Tracer' (spinosad) and 'Dursban WG' (chlorpyifos) are the most effective (HH3116TFV, FV 339, FV 375). Not all of these insecticides are approved on other crops susceptible to onion thrips infestations. Application of Tracer with either sugar or Majestik did not improve its efficacy on leek (HH3116TFV).

In trials at Wellesbourne (HH3116TFV), foliar sprays of pyrethroid insecticides were completely ineffective and in a separate study by Rothamsted Research (PS2710), samples of onion thrips from eight commercial Allium crops in the UK were highly resistant to deltamethrin. Consequently, pyrethroid insecticides are unlikely to provide effective thrips control. Since they are also likely to harm beneficial insects, their use for thrips control should be avoided. Indeed, trials showed that damage can be higher on plots treated with pyrethroid insecticides than on insecticide-free control plots (HH3116TFV).

Spray programmes

The information obtained to date suggests that there seems to be little benefit in applying sprays 'early' in the season to attempt to suppress the development of thrips infestations and that growers should apply spray treatments when thrips numbers are increasing (indicated by sampling with sticky traps or by sampling plants) (HH3116TFV). Similarly, research has indicated that control is required until thrips numbers on plants decrease and sometimes thrips are abundant until October (HH3116TFV). Since onion thrips populations are known to be able to develop resistance to insecticides, growers should employ a resistance-management strategy by alternating the application of insecticides with different modes of action.

Seed treatments

A number of experimental seed treatments have been evaluated for thrips control on leek and most of them provided partial control of onion thrips for a number of weeks after sowing. However, it is doubtful whether the use of a seed treatment prior to the application of sprays confers an additional advantage with respect to thrips damage in September. Two of the insecticides evaluated, imidacloprid and fipronil, are used as seed treatments on Brassica crops and they might contribute to thrips control on stored cabbage. No trials have been undertaken to investigate this. The efficacy of seed treatments, albeit for a limited period of time, suggests that systemic insecticides applied as foliar sprays (yet to be identified) might also be effective.

Monitoring and forecasting

Monitoring

Adult onion thrips can be monitored using sticky traps (Figure 6). Generally, blue and white are considered to be the preferred colours for several species of thrips, including onion thrips. In studies on leek in the UK (HH3116TFV), trap catches were usually highest in July-August while, on plants, thrips numbers were highest in August-September (Figures 7 & 8).

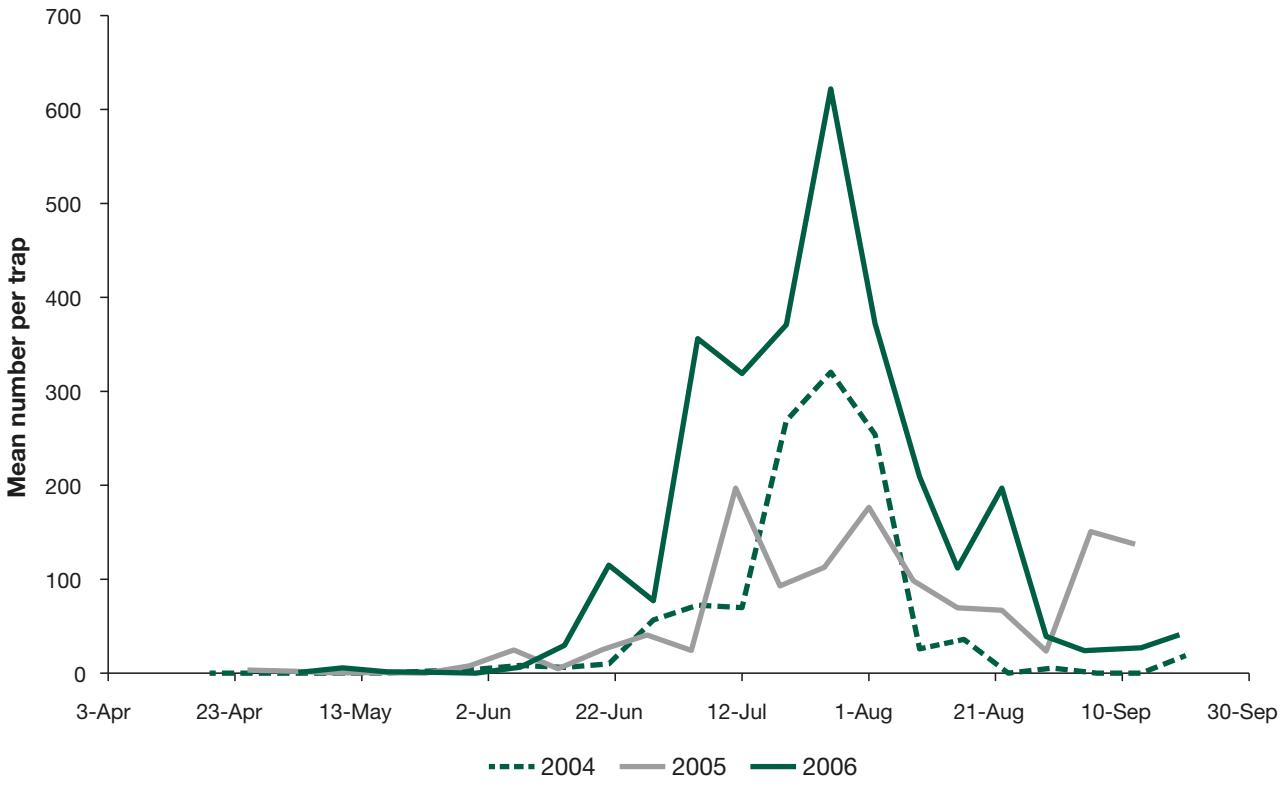
The pattern of thrips flight activity (the number of peaks and their timing) appeared to be very similar within a region and even between regions but varied considerably from year to year. It may therefore be sufficient to trap thrips at one or two locations within a region as the pattern of activity appeared to be consistent in any year. In many cases, adult thrips were captured on sticky traps before thrips were found on plants, indicating that traps could be used to provide an early warning of colonisation by thrips. However, there seems to be little opportunity to use the numbers of thrips captured on traps to predict the severity of infestation on plants.

Thrips infestations can also be monitored directly by examining the crop and it is probably easier to assess damage than to count thrips on plants (to do this accurately requires careful destructive sampling). The best approach may be to assess the youngest leaves on Allium crops as this will indicate the current level of damage rather than old damage.

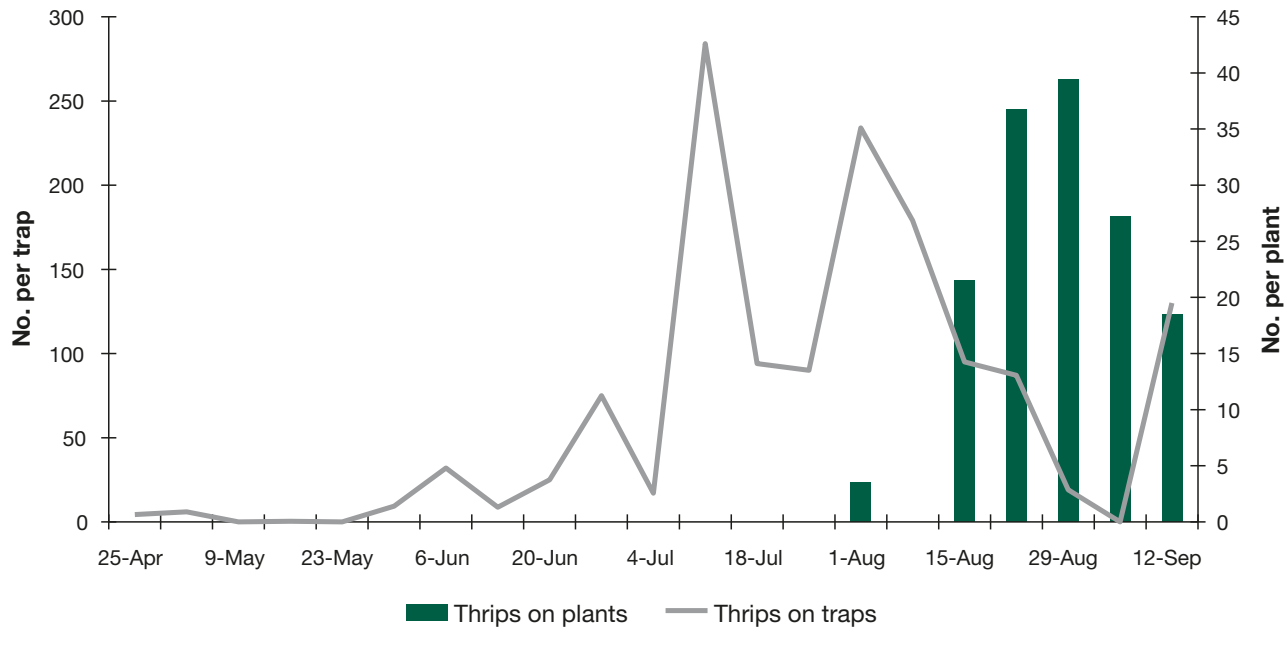
6. Blue sticky trap used to monitor thrips. These traps also catch many other species of insect including bean seed fly

Forecasting

A widely accepted day-degree model for onion thrips development based on a study in North America does not appear to predict season-long population trends on UK crops accurately. The use of a temperature-based forecasting system was investigated in some detail in a recent project (Burnstone, 2009), which concluded that it was not a sufficiently accurate tool.



7. The numbers of adult thrips captured on sticky traps in Cambridgeshire in 2004-6 (data averaged over sites each year)



8. The numbers of thrips captured on sticky traps and adult and larval thrips found on insecticide-free leek plants at one site in Cambridgeshire in 2005

Further information

FV 128 Brassicas: An investigation of the causes of oedema in white cabbage. HDC.

FV 296 Leek and onion: targeting insecticide treatments against *Thrips tabaci*. HDC.

FV 339 Leek and onion: Control of onion thrips and bean seed fly on leek and onion crops. HDC.

FV 375 Leek and onion: Novel strategies for pest control in field vegetable crops. HDC.

HH3116TFV Thrips control on outdoor allium crops. Defra.

PS2710 Evaluating the response of UK strains of Thrips tabaci to deltamethrin. Defra

Burnstone, J. A. (2009). Investigations into the biology and behaviour of *Thrips tabaci* L. PhD Thesis, The University of Warwick

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Figures 1 & 2: Allium and Brassica Centre

Figure 3: Anthony M. Shelton, Cornell State University

Figures 4, 6, 7 & 8: University of Warwick

Figure 5: Vegetable Consultancy Services

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