Project Title:	Bulb/salad onions and leeks: A strategy for control of bean seed fly and onion fly
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Location:	ADAS High Mowthorpe and commercial crops of onions in Essex, Norfolk and Worcestershire
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The results and conclusions in this report are based on an investigation conducted over one year. The conditions under which the experiment was carried out and the results obtained have been reported with detail and accuracy. However because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results especially if they are used as the basis for commercial product recommendations.

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Grower Summary

Headline

- Bean seed fly was shown to be a widely distributed problem whilst onion fly appears to be a localised pest. Correct identification is important to ensure that appropriate control measures are employed.
- Yellow water traps are an effective method of monitoring bean seed and onion fly activity.
- Most onion fly was caught at the end of May with a second smaller generation in August.
- Peak activity for bean seed flies was during the first three weeks of May.
- The risk of bean seed fly attack is greatest where the previous crop was particularly trashy or where stubble turnips were grown. Friable soil types in late April are also thought to be susceptible to the pest.

Background and expected deliverables

Bean seed fly (*Delia platura, D. florilega*) and onion fly (*Delia antiqua*) have become an increasing problem on salad onions, bulb onions and leeks in the past five years, at a time when there are few effective approved control measures. Both pests can cause significant crop losses. In the Breckland area of Norfolk there are approximately 2500 ha bulb onions and about 5% are lost annually due to bean seed fly and to a lesser extent onion fly. This equates to a financial loss of £365,624 per year in this onion growing area alone. In Essex, onion fly attacks are sporadic but economically important. For example, two years ago 12 ha of crop were ploughed in due to onion fly damage with a loss of approximately £60,000. Significant losses in salad onions due to fly larval attacks have also been reported in Kent, but whether this was due to onion fly or bean seed fly is not known. The two pests, although very closely related, attack different stages of the crop and have different egg laying sites. It is not possible to confirm the species responsible for damage in field, and microscopic examination is required to identify the larvae.

Bean seed fly reduces plant stands, either by preventing emergence, or by killing recently emerged plants. The risk of attack is dependent upon previous crop and most damage occurs following trashy crops or where stubble turnips were grown. Soil conditions in late April are also thought to be important with friable sites being at greatest risk (Tom Will, Personal communication).

Onion fly can cause serious damage to bulb and salad onions. Leeks and shallots are also attacked but damage on these crops is less common and not so severe. The worst damage usually occurs in June and early July and small plants can rapidly wilt and collapse. Attacks can also occur in August and early September and in large plants maggots feed in the bulb of the onion or in the shank of the leek affecting crop marketability. Correct identification of bean seed fly and onion fly is essential as treatment strategies differ for the two pests.

Currently some growers in the UK are using seed treatments. There is a Specific Off-label Approval (SOLA) for tefluthrin (Force) on onions and leeks for control of bean seed fly and onion fly. However, by the time second generation onion fly attack occurs on bulb onions and leeks, the seed treatment is no longer effective. There are no approved drench, spray or granular treatments for control of either pest. Therefore insecticidal treatments for bean seed fly and onion fly are severely limited.

In Germany there has been work on forecasting the risk of onion fly attack and the use of Sterile Insect Technique to control the pest. A predictive model has been developed in Germany for onion fly in chives and in the Netherlands SIT is regularly used on 3300 ha of onions. However, at present it is unknown whether the model or SIT would be applicable to the UK.

The current project will address the problems of control of bean seed fly and onion fly in onions and leeks, and the key deliverables will be:

- To evaluate the efficacy of a range of insecticides and plant parasitic nematodes against onion fly.
- To monitor bean seed fly and onion fly populations to determine the optimum time for treatment.
- To assess the relevance of a German predictive model for onion fly to UK conditions.
- To assess the potential for the use of Sterile Insect Technique (SIT) to reduce onion fly damage in the UK.
- To collate results from all the above to formulate guidelines for an effective strategy for bean seed fly/onion fly control.

Summary of the project and main conclusions

In general, bean seed flies were far more numerous than onion flies. Bean seed flies were caught at all sites and in total 1729 were trapped. Of these, 63% were male and 37% female. In comparison, onion flies were only recorded at Methwold Hythe, with a total of 113 being caught. Of these, 97% were male and only 3% female.

Peak activity for bean seed fly was during May but could have been earlier as the largest catches were during the first three weeks of the month just after traps had been set. Monitoring of bean seed fly activity at other midland sites (Philip Langley, Personal communication) suggests that peak catches range between the end of March to early May (week 13 – week 19). Traps will be set earlier in 2003 to take account of this. Onion fly were most numerous at the end of May (71% of total catch this month) and were not trapped again until August.

Results suggest that water traps are an effective means of monitoring adult bean seed fly and onion fly activity although they were not compared with any other trapping methods. Onion

fly appears to be a relatively localised pest whereas bean seed fly is more widespread. This finding emphasises the need to distinguish between attacks due to bean seed fly and onion fly.

Financial benefits

Identifying an insecticide, a SIT system or a parasitic nematode which is effective against bean seed fly and onion fly will help to limit potential losses due to these pests. In the Breckland area alone, losses of bulb/salad onions and leeks to bean seed fly and onion fly are estimated at 5% or £365,625/annum. If an effective insecticide or biological control agent could reduce losses to 1% this would save £292,500/annum. This would be considerably improved taking into account the area of bulb/salad onions and leeks not grown within the Breckland. Improved knowledge of the biology and control of both onion fly and bean seed fly will help growers to avoid or control these pests and satisfy the requirements of assured produce protocols. This will have a financial benefit although it is difficult to quantify.

Action points for growers

- Consider yellow water traps as a means of monitoring bean seed fly and onion fly activity.
- Ensure that any larvae found attacking onions or leeks are correctly identified. This can be done by ADAS Pest Evaluation Services, ADAS High Mowthorpe, Duggleby, Malton, North Yorkshire, YO17 8BP (Tel 01944 738646) or CSL Diagnostics, Sand Hutton, York, YO4 1LZ (Tel 01904 462324). Samples should be wrapped in dry tissue paper within a sealed polythene bag and sent via first class post.
- A seed treatment of tefluthrin (Force) is available as a Specific Off Label Approval (SOLA) on onions and leeks for bean seed fly and onion fly. However, the efficacy will decline with the age of the crop and it cannot be expected to give control later in the season, e.g. for second generation onion fly.

Science Section

Monitoring adult bean seed fly and onion fly activity

Introduction

In order to develop an effective control strategy for bean seed fly and onion fly, it is vital to determine when the pests are active. This will help to decide which control measure is likely to provide the best results and when it should be applied. The aim of this monitoring programme was to compare the activity of both bean seed fly and onion fly in areas where there is frequent crop damage.

Materials and methods

The activity patterns of adult bean seed flies and onion flies was monitored at four sites, Methwold Hythe, Norfolk, Frating, Essex, St Osyth, Essex and Great Witley, Worcestershire. These sites were chosen as they had all experienced pest damage in the past. The Frating site was in onion sets and was chosen as it was in a high risk area with overwintering onions, more onion sets and salad onions grown regularly nearby. When the monitored crop was harvested, an alternative site at St Osyth was selected in a drilled crop of onions and adjacent to an onion store with heaps of rotting crop waste. The site at Methwold Hythe has regularly suffered onion fly damage in the past with losses of 15-20% of a drilled onion crop every year. Initially, monitoring was undertaken in a field of onion sets. When these were harvested in the third week of July, an alternative but nearby crop of drilled onions was used.

At each site three yellow water traps were located in the crop headland. These were half filled with water and a sterilising campden tablet to help preserve the catch. Traps were emptied at approximately weekly intervals and the catch was sorted and adult bean seed fly and onion fly identified and counted.

Results and Discussion

The numbers of bean seed fly and onion fly caught at all monitoring sites are summarised in Figures 1-4.

Bean seed fly

Catches of bean seed fly at Great Witley, Methwold Hythe and Frating and St Osyth are summarised in Figures 1, 2 and 4 respectively. Bean seed fly were caught at all monitoring sites with 1729 specimens trapped in total. Highest catches were at Great Witley (1311) followed by Frating and St Osyth (224) and Methwold Hythe (194). At both Great Witley and Frating and St Osyth the catch was predominantly males. At Frating and St Osyth 79% of all flies were males and at Great Witley 62% of all flies were male. At Methwold Hythe exactly half of the catch was male and half female. Peak activity for bean seed fly for all sites was during May with between 81% and 86% of the total catch trapped before the end of the month. During the period of peak bean seed fly activity, just over 19 flies were being caught in a trap each day at Great Witley. At the other sites no more than 7 per trap per day were caught.

Onion fly

Onion fly were only caught at Methwold Hythe (Figure 3). In total 113 flies were trapped of which the majority were male (97%). Onion fly were most numerous in May with 71% of the total catch being trapped in this month. The second generation was recorded in August but was much smaller than the first generation. During their period of peak activity between one and two onion flies were being caught per trap per day.

Overall results suggest that yellow water traps are effective at catching both bean seed fly and onion fly. The higher catches of bean seed fly at Great Witley than at any other site may be due in part to the fact that monitoring at Great Witley began approximately two weeks earlier than at the other sites

Water traps caught very few female onion fly. The females are crepuscular, avoiding host crops for much of the day and returning to them from adjacent vegetation in the evening (Mckinlay, 1992). This may explain why so few of them were trapped. It is likely that water traps would be less attractive to flies in the twilight. Male flies also emerge before female flies and this may also contribute to their higher trap catches. Most bean seed flies trapped were also males but the difference between male and female catches was less marked than with onion fly.

Monitoring fly activity using water traps has provided valuable information on the peak activity periods of both bean seed fly and onion fly. This will allow insecticides to be targeted more effectively against these pests. In addition the monitoring will provide a useful source of

data to help validate the German model for predicting onion fly activity. In 2003 fly monitoring will begin earlier to ensure that the start of pest activity is recorded at all sites.

Figure 1. Catches of bean seed fly at Great Witley, Worcs (no/trap/day), May-August 2002

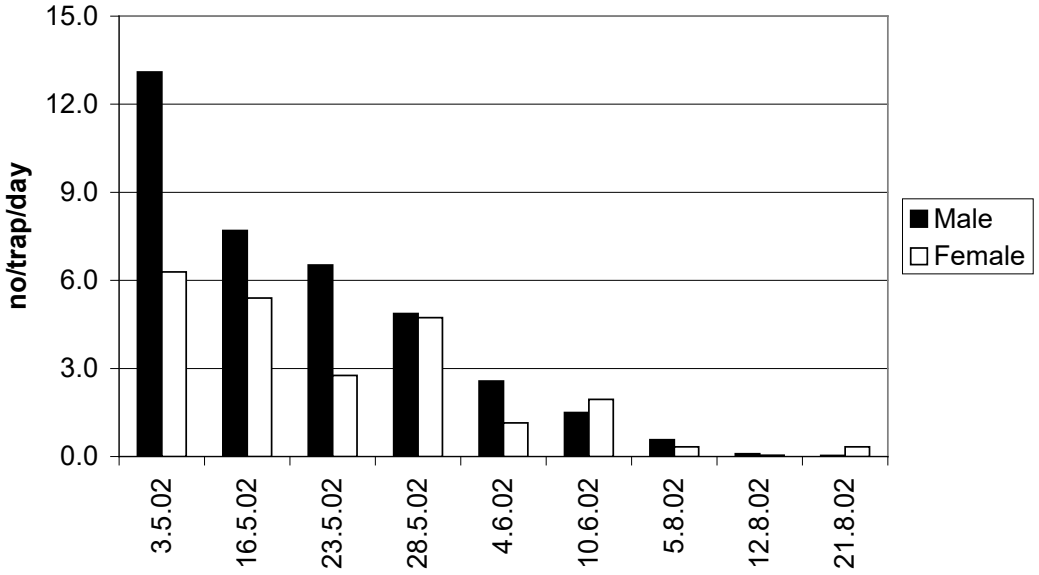


Figure 2. Catches of bean seed fly at Methwold Hythe, Norfolk, May-August 2002

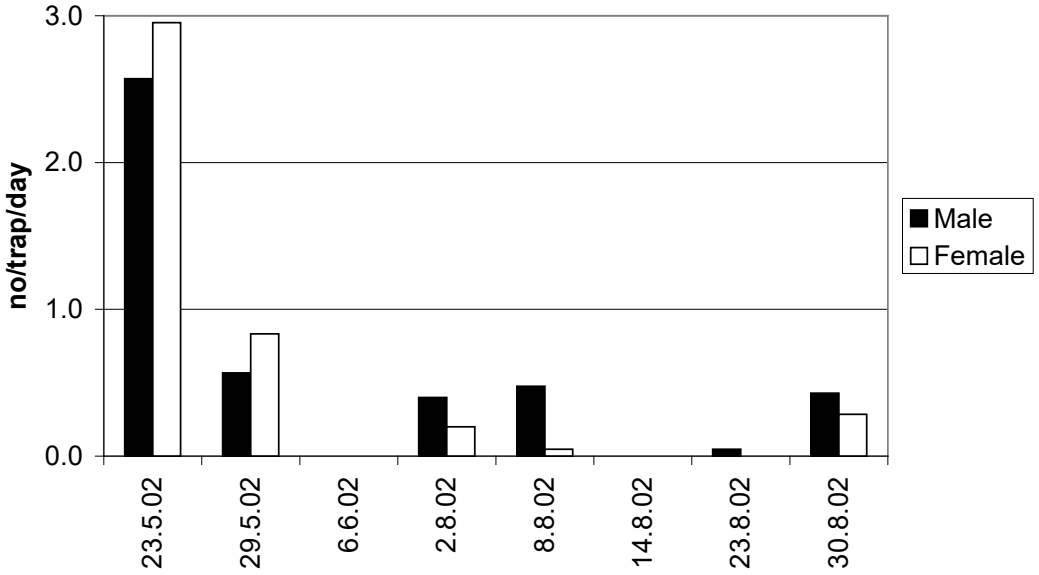


Figure 3. Catches of onion fly at Methwold Hythe, Norfolk, May-August 2002

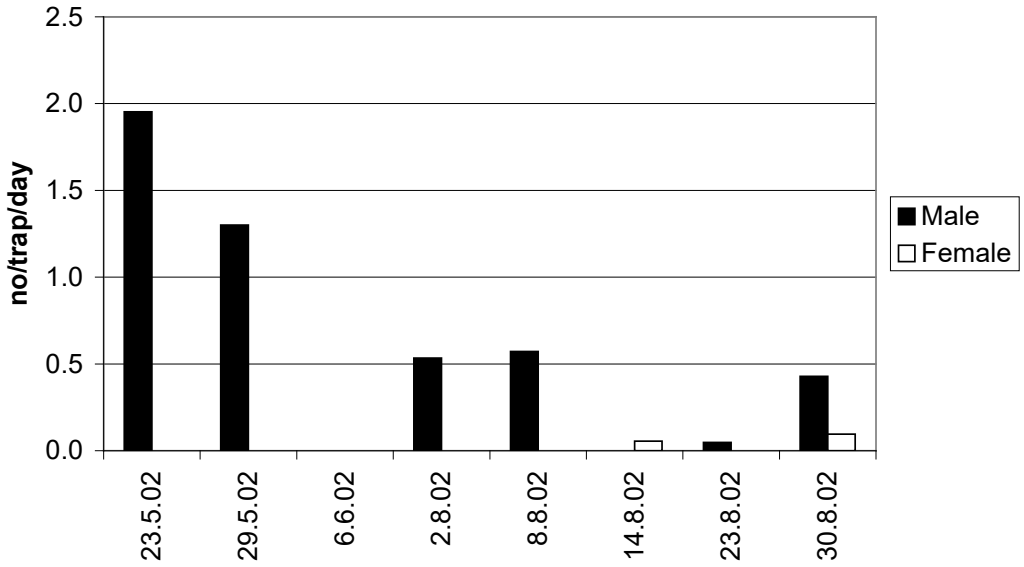
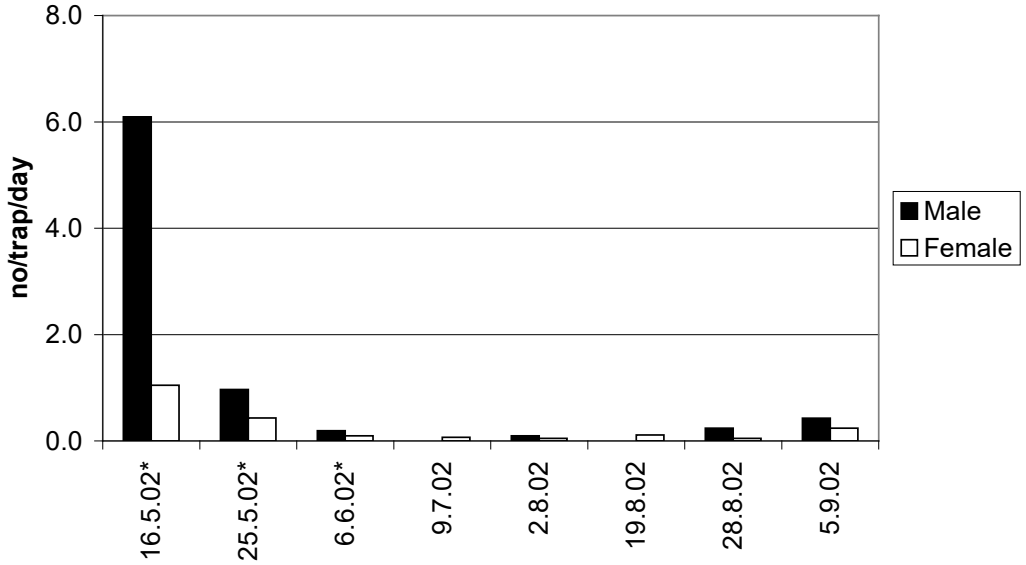


Figure 4. Catches of bean seed fly at Frating (*) and St Osyth, Essex, May-September, 2002



Conclusions

1. Yellow water traps provide an effective means of monitoring bean seed fly and onion fly activity and so improve targeting of insecticides against these pests.

2. There was evidence to suggest that female onion flies are less likely to be caught in water traps than males. More male adult bean seed flies were caught than females but the difference was far less marked than with onion fly.

3. Peak activity of bean seed fly and onion fly was during May. There was also a small second generation of onion fly in August.

4. Onion fly was only caught at Methwold Hythe, suggesting that it is a localised pest. It is possible that damage due to bean seed fly is misdiagnosed as being due to onion fly.

5. Monitoring in 2003 will begin earlier to ensure that the start of pest activity is recorded.

Technology Transfer

As the project only began in April 2002 and to date only the first year of monitoring has been undertaken there has been little opportunity to promote the project. A summary of the results to date was prepared for an HDC member to discuss at a meeting of the European Quality Onion Growers in Poland in autumn 2002. Ultimately it is planned to produce a HDC Fact Sheet after completion of the project.

References

Mckinlay R G. 1992. Vegetable crop pests. Macmillan Press, London; 406 pp.