Factsheet 03/13 Project FV 339

Field Vegetables

Bean seed fly

Rosemary Collier, Warwick Crop Centre

Bean seed flies (*Delia platura* and *Delia florilega*) are small flies that are closely related to the cabbage root fly and onion fly. The fly larvae feed on a wide range of crops, affecting more than 40 different host plants, which they generally attack during germination, reducing emergence and therefore causing serious economic losses. Host plants include onion, bean, cucurbits, spinach, Brassicas, radish, beet, asparagus, sweetcorn, cereals and clover. Bean seed flies can sometimes occur as secondary pests, extending damage caused by other pests or diseases. These species have a wide geographic distribution, being major pests in Europe, North and South America and are also very common in Northern Africa, Japan, India, Australia and New Zealand. They can complete several generations in a year depending on the local climate.

Damage

Damage can be localised and sporadic, even though the adult flies are common. The severity of damage depends on the size of the larval population and also on the attractiveness of the ground to the adult female for egg laying. Females prefer to lay eggs in freshly disturbed soil, especially where there are residues of vegetable matter or where large amounts of farmyard manure have been applied. Usually, the first sign of damage is the patchy emergence of seedlings and it is impossible to control an infestation at this point.

Beans

In beans, the most serious damage is caused in the spring (Figure 1). The larvae feed on the buried seed or the cotyledons of the seedling before sprouting (Figure 2). Usually, when the plant is further developed, its tissues are harder and are less vulnerable to attack. When runner or French beans are very severely attacked, the growing point may be lost, seedlings then emerge in a twisted condition known as ‘snake head’ and soon die (Figure 3 overleaf). Seeds of other vulnerable crops (eg Alliums, sweetcorn) are also vulnerable, especially if sown in later spring or early summer.

1. In beans, the most serious damage is caused in the spring

2. The larvae feed on the buried seed or the cotyledons of seedlings before sprouting

3. Bean seed fly damage on beans causing a condition called 'snake head' where the growing point is lost

Cucurbits

Newly-transplanted cucurbits may be damaged soon after planting. The plants collapse completely, often within days of being transplanted. Later attacks cause plants to wilt during dry weather.

Asparagus

On asparagus, the attacked spears are deformed, often split, and have a bitter taste. Feeding damage by bean seed fly larvae may also cause a plant to rot.

Onions

Damage to onions may appear as poor emergence since the larvae usually attack the seedling between germination and emergence (Figure 4). Plants are often killed at the 'loop' or 'crook' stage. In autumn-sown onions, damage is usually worst where a lot of organic matter or plant debris, often from the previous crop, was ploughed in just before drilling.

4. In onions, the bean seed fly larvae attack the seedlings between germination and emergence, resulting in poor emergence

Identification

5. Adult bean seed fly

6. Bean seed fly stages from egg to pupa

Adult	Small greyish-black fly, similar to cabbage root fly but smaller, being 4-5mm long (Figure 5).
Egg	White, elongated and about 1mm long (Figure 6).
Larva	White maggot, similar to a cabbage root fly maggot, which reaches 5-8mm in length when fully-grown (Figure 6). Head is indistinct, there are dark curved mouth hooks and the last segment is obliquely truncated.
Pupa	Reddish-brown and about 5mm long (Figure 6).

Life Cycle

Bean seed flies overwinter as pupae in the soil. In early spring (March-April), flies start to emerge and after feeding and mating, the female lays her eggs just below the soil surface, generally singly. Females may lay as many as 40 eggs in a day. There is generally a period of several days before a further batch of eggs is laid. The presence of a plant is not necessary for egg laying and studies have shown that substances produced by fungi/microorganisms (either in the soil or on the seed surface) can stimulate egg laying. Decomposing organic material, organic fertiliser and fish meal have all been shown to stimulate egg laying by bean seed flies.

The rate of development, and therefore the number of generations, depends on the ambient temperature. There seems to be little difference in the life cycles of the two species. Eggs hatch after a few days (3-4 days at 15°C; 2 days at 20°C) and then the young larvae start to feed. Larval development takes 3-4 weeks at 15°C or 2 weeks at 20°C but will occur more rapidly when temperatures are higher. In the absence of a suitable host plant, the larva is able to complete development by feeding on decomposing organic matter. The larvae pupate in the soil at varying depths. Pupal development takes 3-4 weeks at 15°C and 2 weeks at 20°C.

Bean seed flies can complete between 3 and 6 generations during the year according to the climate. A full generation will take 7-8 weeks at 15°C and about a month at 20°C. In warm climates, bean seed flies can be active throughout the year.

Monitoring and forecasting

Adult bean seed flies (both sexes) can be monitored using coloured sticky traps or water traps (Figure 7). Yellow, blue and white traps will all capture bean seed fly and white traps and certain colours of blue may be preferred. However, all colours are effective for indicating the presence of the flies. A study at Wellesbourne showed that bean seed flies preferred to land on horizontal yellow sticky traps rather than vertical traps and, therefore, water traps are very suitable for monitoring this species.

In an HDC-funded project undertaken by ADAS, most bean seed flies were caught in May (at least 80% of all flies trapped), but it is very likely that flies were active in the field before traps were put out. There was also a suggestion of other smaller, less distinct peaks of activity in mid-April, mid-June and possibly another in late August. In the same project, pot experiments undertaken in August, when trap catches suggested that bean seed fly numbers were declining, showed that plants can still suffer significant damage. There are no thresholds to relate the risk of crop damage to trap catches but traps do indicate when bean seed flies are active and how numbers change during the season. There is no publicly available forecast for bean seed fly but this would not be too difficult to develop as there are data available from a number of studies, including an MSc study undertaken at Wellesbourne several years ago.

7. Bean seed fly adults can be monitored using coloured sticky traps or water traps

Climate change

Since the rate at which the life cycle is completed depends on temperature, the warmer the spring, the earlier flies will emerge from overwintering pupae. Similarly, the warmer the growing season, the greater the number of generations that will be completed. However, there is a suggestion that the species might aestivate in very hot weather as the number of generations per year in Spain is lower than might be expected from the ambient temperatures.

Resistance

Instances of resistance to organochlorine and carbamate insecticides have been recorded (including to dieldrin in the UK), showing that there is a potential risk for bean seed flies to become resistant to insecticides. There are no reports of resistance to newer insecticide groups.

Control

Cultural control

The presence of organic matter in the soil is clearly an important stimulus for egg laying. Therefore, any organic debris from previous crops should be properly buried to reduce risk. The longer the time period between sowing and emergence of the cotyledons, the greater the risk of damage. Thus, any factors which slow down the speed of germination and shoot vigour increase the risk of damage, in particular, low temperatures and excessively deep sowing. High levels of moisture are also thought to increase the risk of damage. Bean seed fly caused serious damage to untreated leek and onion crops in the spring and early summer of 2012, probably exacerbated by the prolonged period of cold wet weather.

Chemical control

Since damage by bean seed fly larvae is apparent only when it is too late to treat the crop, seed treatment is the most effective way of controlling this pest at present. HDC-funded research has indicated novel insecticide and non-insecticidal treatments that might be effective against bean seed fly in future.

Natural control

Natural controls are likely to include generalist predators such as certain species of beetle, spiders, entomopathogens and parasitoids (beetles and wasps). Two species of *Aleochara* (rove beetle), which can be both pupal parasitoids and predators of eggs and larvae, have emerged from bean seed fly pupae.

Further information

FV 026 Control of bean seed fly and onion fly

FV 239 Bulb/salad onions and leeks: A strategy for control of bean seed fly and onion fly

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

FV 375 Novel strategies for pest control in field vegetable crops

Figure references

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AHDB Agriculture & Horticulture DEVELOPMENT BOARD

Horticultural Development Company

Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

T: 024 7669 2051
E: hdc@hdc.org.uk
Twitter: @HDCtweets

www.hdc.org.uk