

WIREWORMS: *Agriotes* spp.

Host Crops

Peas, field beans, broad beans, green beans.

Symptoms of Infestation

Wireworms are the larvae of click beetles. Damage is seen in early spring to early summer. Seedlings are damaged by the wireworms when they bite through the stem or tunnel through seeds (21). Depending on the severity of damage, the young plants may not survive. Older plants are usually more able to withstand attack. Signs of injury include narrow holes through the seed or stem at, or just below, soil level. Damaged seedlings may wilt and die along short runs of rows or in patches where the pest has aggregated.

Economic Importance

Usually attacks are sporadic and localized to small areas of the crop. Some plant loss is acceptable but where the infestation is high, then high plant losses occur.

Pest Cycle

In early summer, the beetles lay eggs singly or in small clusters just below the surface of grassy or weedy ground. The adults are elongate beetles, black to brown in colour, and are 6–12 mm long (22). They are so-called because of the sound made when jumping. The larvae are very slow growing and can feed on crops or debris for up to 5 years before they mature. In the middle of summer, the larvae, which are thin, yellow and smooth bodied and up to 25 mm in length (23), move down deeper in the soil where they pupate and emerge in summer or overwinter as adults.

Prevention and Control

Ploughing of grassland in early spring should be followed by further soil cultivations to expose the larvae to predation or desiccation. There is little opportunity for controlling wireworms once damage has commenced, and re-drilling is not a wise option where the pest remains in the soil.



21 Wireworm (*Agriotes* sp.) larval damage to pea seedlings. (Courtesy of PGRO.)



22 Click beetle (*Agriotes* sp.).



23 Wireworm (*Agriotes* sp.) larva.

BEAN SEED FLY (SEED CORN MAGGOT): *Delia platura*

Host Crops

Green beans, dry beans, peas, broad beans.

Symptoms of Infestation

Seed of late-planted peas or beans is attacked during germination. Larvae from eggs laid in the soil by the adult feed on decaying vegetable matter and also tunnel into freshly imbibed seeds (24). The larvae feed within the cotyledons and damage the developing plumule and root. Tunnelling can take place inside the stem and the growing point can be damaged (25), resulting in a 'baldhead' symptom, where the stem elongates but there is an absence of terminal leaves (26). In peas and Vicia beans, secondary shoots can develop from the seed, but in Phaseolus beans, the seedlings fail to compensate for the damage. Severely damaged seeds fail to produce a seedling and decay before emergence. Damage is often noted in patches in a field as the flies tend to aggregate before egg laying. Late-cultivated fields which contain large amounts of green weed vegetation or fresh crop debris are more likely to be infested.

Economic Importance

Bean seed fly is a very common pest and can be found in most temperate countries affecting a wide range of large seeded crops including peas, beans, marrows, lupins, maize, and soya beans. In severe infestations, large numbers of seedlings can be lost, severely affecting the plant population. This may result in re-drilling and subsequent loss of production of high value vegetable crops early in the season.

Pest Cycle

Adults (27) are attracted to freshly disturbed soil which contains debris from the previous crop, freshly

24 Bean seed fly (*Delia platura*) larva in damaged pea seed.



25 Bean seed fly (*D. platura*) larval damage to pea seedlings.



26 Bean seed fly (*D. platura*) larval damage to Phaseolus bean seedlings.



27 Bean seed fly (*D. platura*) adult.

cultivated weeds, or high levels of organic matter such as farmyard manure. Eggs are laid on the soil surface and after a few days larvae hatch and feed on the vegetable material or newly planted seeds. After feeding for 10–14 days, the larvae pupate (28) and emerge as a new generation of adults which fly to suitable egg laying sites. There can be several generations each season, the first occurring from late spring and continuing until early autumn.

Prevention and Control

Plantings made from late spring until late summer are more susceptible to damage. Seedbed preparation should ensure that any weed growth has died down before cultivation, or spring cultivations made to reduce the weed population before planting. Runner beans can be planted under polythene or seeds pre-germinated in containers under cover, prior to transplanting for small-scale production. Insecticidal seed treatments are available for peas and beans in some countries and good protection can be obtained where these are used. In some cases, a soil application of insecticide may be used immediately after sowing, but the level of control is very much less than with seed treatment.



28 Bean seed fly (*D. platura*) pupa.

PEA AND BEAN WEEVIL: *Sitona lineatus*

Host Crops

Peas, field beans, broad beans.

Symptoms of Infestation

Early sown spring peas and broad and field beans are usually the most susceptible to attack by pea and bean weevil. Feeding damage by the adult weevils is characterized by semi-circular notches around the leaf edges of newly emerged seedlings, and the damage is seen as soon as the first leaves begin to expand (29, 30). In cool growing conditions, the loss of leaf area can outstrip new growth. The adult can continue feeding for some time on newly developing leaves, but often the young plants will grow away from the attack. Larvae (31), produced from eggs laid by the feeding adults, feed below ground on the nitrogen-fixing root nodules (32), thereby reducing the available nitrogen and allowing invasion by soil-borne, root infecting fungi. The pest is present in most areas where peas or beans are grown including the USA, Europe, Russia, and Australasia.

Economic Importance

Seedlings and young plants may have a considerable area of leaf tissue eaten but the plants do not often appear to be permanently damaged, except where continual feeding occurs in periods of slow growth. Damage to the root nodules, however, can have an effect on yield, particularly in crops grown as dry harvesting, when the seed weight may be reduced due to nitrogen deficiency. This is particularly noticeable when plant damage occurs in conjunction with other factors such as drought or poor soil conditions, which result in plant growth stress. Experiments have shown that leaf damage alone does not result in yield loss but where larval attack is severe, yield can be reduced by about 25%.

Pest Cycle

The adult weevil is beetle-shaped and about 4–5mm long. Its colour varies between grey-brown to a sandy or a dark brown, with faint striping along the length of the wing cases (33). It has a short rostrum

but conspicuous elbowed antennae. It shelters under soil clods once in the crop but, while feeding, the adults climb freely over the foliage.

The adults overwinter in grassy field edges of the last host crop or in hedge bottoms or ditch sides. As temperatures increase in early spring, weevils migrate to newly emerged pea or bean crops or to established winter sown legumes. The adults move across the soil surface when daytime temperatures exceed 12°C, but will fly when these rise to above 18°C. Often damage is first noted along the headlands before the adults have migrated fully into the crop. Eggs are laid very shortly after arrival into the host crop and are washed down into the soil by rain. The creamy white larvae have dark brown heads and they feed within the root nodules for

29 Leaf notching caused by adult pea and bean weevil (*Sitona lineatus*) on pea.



30 Notching damage to *Vicia* bean leaf caused by adult pea and bean weevil (*S. lineatus*).

32 Nodule destruction on field bean root caused by pea and bean weevil (*S. lineatus*) larvae.



6–7 weeks. After maturing, the weevil larvae pupate in the soil (34) and emerge as adults in the middle of the summer (35). They often feed on any green leaf area present in the crop before moving to the overwintering sites. There is only one generation each year.



31 Larvae of pea and bean weevil (*S. lineatus*).



33 Pea and bean weevil (*S. lineatus*) adult.

Prevention and Control

The weevil is one of the most common pests of peas and beans. Peas growing near to *Vicia* beans are particularly at risk, but attacks can occur wherever the crops are grown. Newly emerging crops growing slowly in cold conditions should be examined for leaf injury, and an insecticide applied before wide scale damage occurs. These sprays are aimed at reducing leaf damage but also disrupt the egg laying period until such time as the plants have become well established. A second spray applied 10–14 days afterwards, improves the level of response.

A monitoring system based on traps with lures containing the *Sitona lineatus* aggregation pheromone has been developed, to identify the time at which peak migration from the overwintering sites is about to occur. The system is available commercially in the UK. Susceptible crops can then be treated in good time and later sowings of peas or *Vicia* beans may be timed to avoid this period of peak activity. In Europe, insecticidal seed treatments are available which provide excellent control of both adult feeding and larval damage.



34 Pupating larvae of pea and bean weevil (*S. lineatus*).



35 Pea and bean weevil (*S. lineatus*) adult. (Courtesy of Holt Studios/Duncan Smith.)

FIELD THRIPS: *Thrips angusticeps*

Host Crops

Peas, field beans, broad beans.

Symptoms of Infestation

Damage is more severe in dry cold springs. Early spring sown peas or beans, growing on calcareous soils containing a high proportion of stone, are susceptible to thrips damage. The shoots of newly emerging seedlings are pale and distorted and growth appears retarded. As the leaflets expand, they are puckered and leathery with small translucent spots which can be over the leaf surface (36). Damaged leaves of *Vicia* beans develop a rusty under surface (37). Thrips can be found within the developing leaves of the growing point. Occasionally, in peas, damaged plants fail to recover and produce a rosette of basal developed shoots, the leaves of which continue to show a degree of distortion and the plants remain stunted often in discrete patches over the field. This condition is physiological and has been termed as pea dwarfing syndrome or nanism (38).

Economic Importance

Early sowings of peas or beans are often slow to grow away from the damage and can become further damaged by birds. In severe instances where the plants have developed dwarfing syndrome, flowers are not formed or are poorly developed and the yield of the crop is affected if significant areas of plants suffer in this way.

Pest Cycle

Thrips angusticeps can feed on a range of crops including brassica species. They overwinter in the soil as short winged, flightless adults and feed on seedlings in early spring. The adults are tiny, black, elongated insects about 1–1.5 mm in length (39). They produce orange or yellow coloured nymphs during feeding periods, and these can be found on the plant together with the adults (40). Seedlings are infested before they emerge from the soil. After



36 Feeding damage to pea caused by field thrips (*Thrips angusticeps*).



37 Feeding damage to field bean caused by field thrips (*T. angusticeps*).



38 Patches of nanism following field thrips (*T. angusticeps*) damage to peas. (Courtesy of PGRO.)



39 Field thrips (*T. angusticeps*) first generation wingless adult.



40 Field thrips (*T. angusticeps*) nymph.

feeding on the leaf surface, the thrips produce a winged generation which leave the crop from early summer onwards (41); however, some may remain in the soil until the following spring.

Prevention and Control

Stony soils, where brassica crops are grown as part of the rotation, are more likely to contain high populations of thrips. Because damage is seen at the time of seedling emergence, control is difficult, but often plants outgrow the initial effects as soon as temperatures increase, particularly after rainfall. Where damage is experienced each year, prompt treatment of newly emerging crops with a systemic insecticide prevents further damage; however, most contact insecticides are of little value when the insects are protected by the developing leaves. Insecticidal seed treatments are used in some European countries and these give excellent control of thrips.



41 Field thrips (*T. angusticeps*) winged adult.

LEATHERJACKETS: *Tipula* spp.

Host Crops

Peas, field beans, broad beans, green beans.

Symptoms of Infestation

Leatherjackets are the larvae of the crane fly. They live in the soil, feeding on grass roots and other crop debris. Any crop grown in newly ploughed grassland or in fields or stubbles infested with grass weeds the previous autumn may be attacked. In spring, they feed on the newly germinating seedlings and underground stems. The larvae chew a rough-edged cut through the stem just below soil level, causing the plant to collapse. Damage is often concentrated in small scattered areas of the field associated with the distribution of the pest. Damaged plants of peas and Vicia beans may produce secondary stems but these are often weak and fail to survive. Green beans are not able to compensate for stem damage. The pest is abundant in Europe, northern Asia, Canada, and northern USA. It has a wide range of host crops.

Economic Importance

When infestation is high, plant loss is significant. There is also a high risk to re-sown crops if no control of leatherjackets has been possible.

Pest Cycle

Adult crane flies are slender insects with narrow wings and long fragile legs. In the UK, they are known as 'daddy long-legs' (42). The thorax is segmented with faint stripes and a dusky grey colour. Adults emerge from grassland in early summer and are abundant in late summer and early autumn. Eggs are laid in late summer. They are placed just below the soil surface in small batches. After 2 weeks, the eggs hatch and the larvae feed on grass roots. In spring, the larvae or leatherjackets are fully grown. They have a dull, brown-grey coloured body about 30 mm long. The body is slightly tapered with a tough skin, hence the name (43). They are fully developed by early summer and pupate in the soil, emerging as adults in the same summer.

Prevention and Control

Fields with a history of grassland or long-term pasture are more likely to be infested. Where grassland is cultivated in the autumn, the sods should be examined for leatherjackets and treatment

applied to the soil before planting the crop. There are very few insecticides available for leatherjacket control. Avoiding infested fields is the most effective means of prevention.



42 Crane fly (*Tipula* sp.).



43 Leatherjacket (*Tipula* sp.): larva of a crane fly.