Upper surface black with yellow beneath, three black stripes on thorax.

# Gout Fly

*Chlorops pumilionis*

**Larvae feeding in stems cause a 'gouted' appearance – swollen main stem and primary tillers with leaves puckered and torn above. In winter crops, damage is first seen in December, but mainly in January/February. Infested spring-sown crops show damage in June and July which prevents ear emergence from the flag leaf.**

**Damage tends to be highest in sheltered fields near woodland.**

## Economic importance

The pest is present across the UK, but only causes economic damage from the south coast to the midlands in wheat, barley and triticale. Incidence appears to be moving north. In 2002, high levels of damage were seen in early-sown crops as far north as Staffordshire and Lincolnshire.

Winter damage kills affected tillers and any still dependent on the mother plant. Unaffected tillers, with a developed crown root system can survive and compensate for damage at lower levels of incidence. Where half the crop or more is damaged, yield losses range from 0.25 tonnes/ha to total crop failure.

Shoots damaged by spring generations lose 30% of grain yield on average. Late-sown crops suffer losses up to half of their potential yield.

## Risk factors

Crops emerged by the end of September are at greatest risk from the autumn generation.

Late-sown winter and spring crops are at greatest risk from the spring generation. Egg-laying commences in mid-May in the south of England, late May in the midlands. Crops at, or beyond, GS 37 by this time suffer little damage.

Oats are immune, but gout fly can attack couch grass.

## Natural enemies

Larvae of the parasitoid wasps, *Stenomalus micans* and *Coelineus niger*, feed inside the gout fly larvae. They can kill 80% or more of gout fly larvae. Adult wasps are active slightly later than gout flies and could be vulnerable to late insecticide applications.

***Stenomalus micans***

## Cultural control

- Sow winter wheat and barley in sheltered fields near woodland after late September.
- Sow spring crops as early as practicable in areas where damage is prevalent.

## Chemical control

Chlorpyrifos and pyrethroid insecticides, used to control frit fly and BYDV vectors respectively, will give useful control of the autumn generation where sprays are applied before eggs hatch. In 2002, treatments after early October were ineffective.

### Action thresholds

Limited evidence suggests that treatment is economic in winter crops if eggs are found on more than half of the plants at GS 12.

No threshold exists for spring-sown crops.

**Larvae feed by secreting enzymes to break down surrounding tissues. This causes no obvious damage to shoots. As the stem extends this break develops into a line of damage.**

## Life cycle

There are two generations each year.

| Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Larvae feed. | Larvae pupate in stem. | Pupation | | Adult flies hatch. Eggs laid on uppermost unfurled leaf and hatch in 7–10 days. | Larvae crawl into leaf sheath and feed on leaf sheath beneath ear. | Larvae pupate in leaf sheath. | Adult flies hatch before harvest. | Adults shelter in wooded areas and hedgerows. Eggs laid on upperside of first unfurled leaf. | | Larvae feed. | |

# Wheat bulb fly

*Delia coarctata*

**Wheat bulb fly larvae attack shoots of wheat, barley and rye from January to April. They bore into plants, feed at the shoot base and eat through the central leaf which dies, causing the classic deadheart symptom. Larvae lack legs and are white to pale yellow with a blunt tail end.**

## Economic importance

Yield loss depends on tiller density at the time of attack. Crops still at the single shoot stage in February are most vulnerable and may be totally destroyed. Well-tillered crops generally withstand up to 100 larvae/m² without economic impact on yield.

## Risk factors

All cereals, except oats, can be attacked. Adults fly up to half a mile from previously-attacked fields to lay eggs. They lay eggs on stubbles after cultivation and prefer freshly-turned soil. Under hot, dry conditions they lay eggs between row crops, especially if the foliage is wilting.

Eggs may be laid on:

- bare soil following fallows, set-aside, or early harvested crops (eg vining peas) if cultivated between mid-July and mid-August
- row crops, eg sugar beet, potatoes and onions but not brassicas.

Frequency of attack depends on the population of vulnerable first wheats on the farm:

- more than 25% – regularly
- 10–25% – occasionally
- less than 10% – rarely.

## Natural enemies

The main egg predators are ground beetles and their larvae. Small rove beetles, particularly *Aleochara bipustulata* may parasitise the pupae, and kill up to 50% of them.

## Cultural control

Avoid cultivating fields destined for wheat in late July and early August. This reduces numbers of eggs laid, especially if fields for oilseed rape, and other non-host crops, are worked at this time.

Early sowing reduces the impact of wheat bulb fly, but increases survival of larvae and numbers on the farm the next year.

## Chemical control

**Tefluthrin** seed treatments are effective with later sowings, but may not fully protect earlier-sown crops. Drill treated seed no deeper than 40 mm.

**Chlorpyrifos** egg hatch sprays are applied between the start of egg hatch in January and its peak in February or March. Egg hatch is monitored each year to provide information on timing and the need to add, or switch to, dimethoate for later sprays.

**Dimethoate** is applied when deadhearts first appear in March. It should be applied before larvae move off to attack other shoots in late March.

### Action thresholds

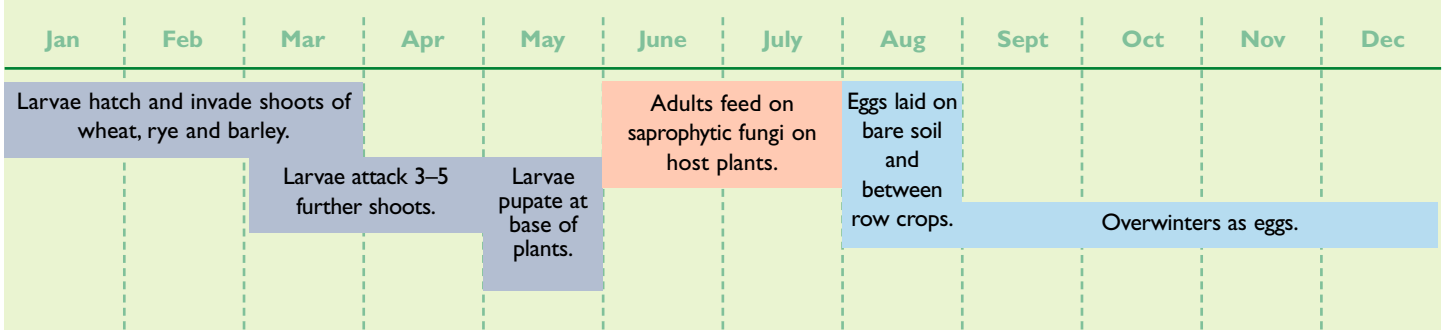
**Egg numbers** can be estimated from soil samples. Each year ADAS forecasts (available through Dow*) the proportion of fields likely to exceed threshold levels:

- above 5 million eggs/ha – damage inevitable, extra measures needed
- 2.5–5 million eggs/ha (sowing Sept–Oct) – damage likely
- less than 1.25 million eggs/ha (sowing Nov–Mar). Late sown crops may suffer damage.


**Plant samples** may be examined to determine numbers of larvae present when deadhearts are first found. Stripping off the outer leaf sheath can reveal a brown stain where larvae are feeding. A small entry hole in the leaf sheaf confirms that a larva has entered. The thresholds assume plant populations of at least 200 plants/m²:

- 10% tillers attacked @ GS 20
- 15% tillers attacked @ GS 21
- 20% tillers attacked @ GS 22 onwards.

## Life cycle

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# Yellow cereal fly

*Opomyza florum*

**Yellow cereal fly, like wheat bulb fly, causes 'deadheart' as larvae enter through the top of the shoot. The yellow cereal fly larva does not leave an entry hole; wheat bulb fly larva does. The larva, yellow and with a pointed end, looks similar to frit fly, but occurs later in the winter.**

## Economic importance

Each larva damages only a single shoot so economic impact is generally low. Most crops can withstand a considerable number of larvae by producing compensating tillers.

## Risk factors

Crops at low plant populations and early-sown crops in sheltered fields close to woodland are at greatest risk.

## Natural enemies

The eggs and pupae are the most vulnerable stages to predation by ground beetles.

## Cultural control

- Establish at least 200 plants/m² in vulnerable situations.

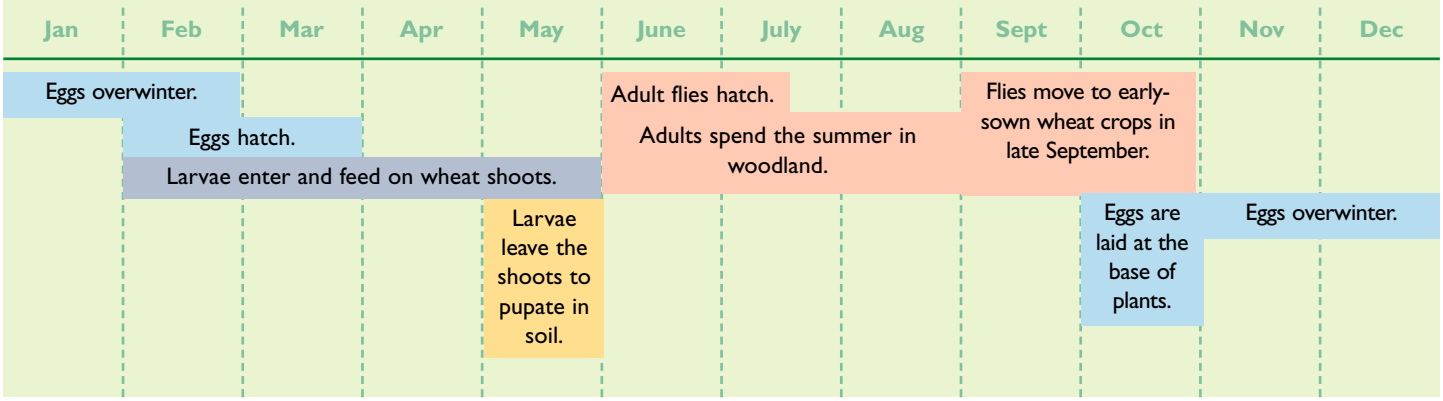
## Chemical control

Pyrethroid sprays applied to control BYDV vectors also control yellow cereal fly. No treatments are recommended once larvae have entered plants.

### Action thresholds

No action thresholds have been established.

## Life cycle




***Arable and cropping and the environment*** – *a guide* assesses how any one management decision affects all other decisions in an integrated cropping system.

# Wireworms

*Agriotes lineatus*
*Agriotes obscurus*

**Wireworms are the larvae of click beetles. Yellow larvae with distinct legs at the front and two dark spots at the tail, bite into stems at the soil surface causing a hole with tattered edges. By the time this is evident, wireworms have usually moved along rows to attack further shoots.**

## Economic importance

Wireworms have become a more serious pest since the withdrawal of organochlorine insecticides and the increase of winter cropping. They can now affect all winter cereal or winter cereal/ley rotations. Heavy infestations can cause yield loss of up to 0.6 t/ha in cereals.

Peas, linseed and flax are more tolerant of damage than other crops.

## Risk factors

Crops at highest risk are sown within two years of ploughing out permanent pasture. However, any rotation with predominant winter cropping, particularly with grass weeds, is at risk.

## Natural enemies

The main natural enemies are fungi and parasitic wasps.

## Cultural control

- Consolidate seedbeds to restrict movement.
- Control grass weeds.
- Consider including a spring crop in the rotation.

## Chemical control

Seed treatment with tefluthrin or imidacloprid controls moderate attacks.

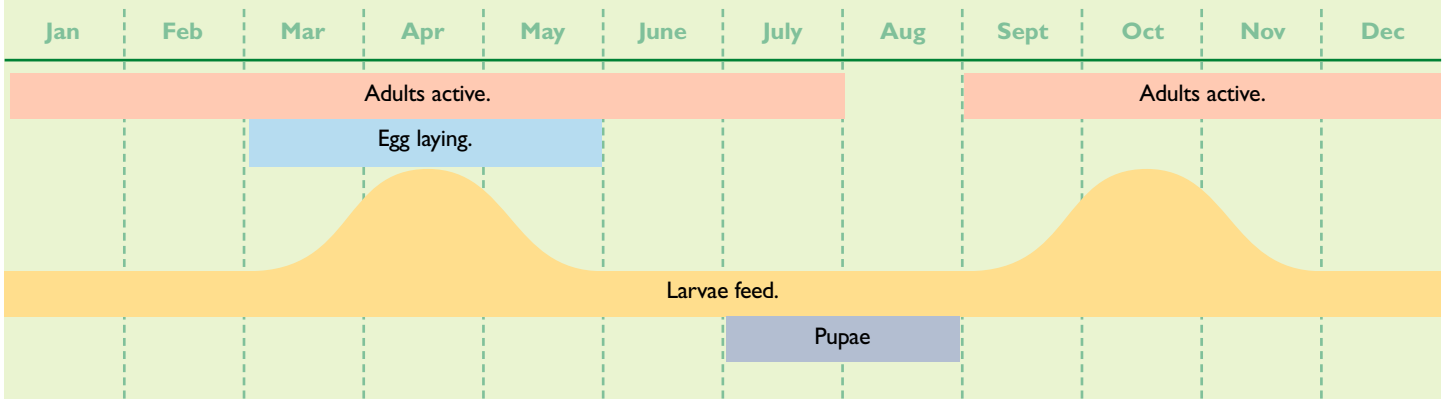
### Action thresholds

Populations can be very patchy so estimating numbers is difficult. Examining soil cores in the field for larger wireworms or in the laboratory for smaller ones is costly and rarely justified.

- Use a seed treatment if wireworms exceed the threshold of 750,000/ha. Some residual damage is likely if numbers exceed 1.25 M/ha.

## Life cycle

Wireworms have a 4–5 year life cycle.




Adult click beetles cause no economic damage. They live for about a year and lay eggs in grass fields. Larvae then feed for five years before pupating in the spring. Numbers increase over the years; highest populations occur in old permanent pastures. Wireworms feed in ploughed-down turf for about six months before moving to the surface to damage the next two crops.

# Leatherjackets

*Tipula paludosa*
*Tipula oleracea*

**Leatherjackets (grey, legless larvae of cranefly, or daddy longlegs) feed below the soil surface making stems at the surface appear ragged. Stems break and keel over. Wireworms and other minor pests cause similar effects.**

## Economic importance

Yield losses can range up to total crop loss at the highest infestation levels. Loss depends mainly on September rainfall.

## Risk factors

Attacks on all cereals and oilseeds frequently occur following grass, where populations build up. Adults do not fly far and infestations take some years to develop. Larvae continue feeding in ploughed down turf. When it rots they move to feed on the new crop. This leads to damage suddenly appearing some weeks after crops emerge.

Dry September weather can reduce numbers considerably as eggs and young leatherjackets are vulnerable to desiccation.

## Natural enemies

A range of viral, bacterial and protozoan diseases attack leatherjackets. Rooks are attracted to patches of leatherjacket damage and may indicate infestations. Predatory soil insects, eg ground beetles, eat eggs and young larvae.

## Cultural control

- Plough early before most eggs are laid to reduce carry-over.

## Chemical control

Chlorpyrifos is the only approved chemical.

### Action thresholds

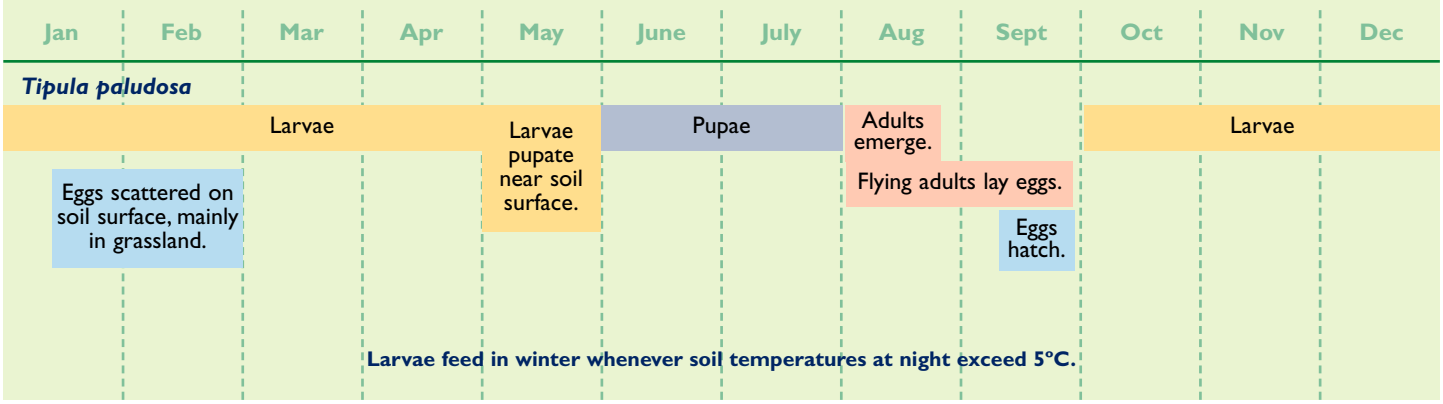
- Assess leatherjacket numbers, before ploughing, by examining soil samples or flooding plastic pipes, driven into the ground, filled with brine. Proprietary brine-based testing kits are available.
- Assess leatherjacket numbers, in established crops if damage is seen, by scratching soil either side of crop rows.
- Treat with chlorpyrifos if:
  - over 50 leatherjackets/m$^2$ for spring cereals (5 in 12 pipes)
  - 5 leatherjackets/m of row in spring cereals.

Lower levels may cause significant damage in spring oilseed rape and linseed.

**A plastic pipe driven in the ground is filled with brine.**

## Life cycle

Two species cause economic damage.



# Summer aphids

## Grain aphid

*Sitobion avenae*

**The aphids may be green, red or brown.**

### Life cycle

The grain aphid spends all year on cereals and grasses and may overwinter on winter cereals (see BYDV vectors). Fresh migrations infest crops from April onwards.

Colonies overwintering on crops tend to be infested by parasitoids. Grain aphid numbers may rise initially, but the parasitoids limit further population increase. Outbreaks tend to occur after colder winters which reduce natural enemies more than the more cold-hardy aphids.

Initially, grain aphids feed on leaves. During grain filling they move up to ears and feed from the phloem supply to grain.

Numbers increase most rapidly during settled, dry weather. They will increase until checked by crop senescence, unless reduced by heavy rainfall or natural enemies.

## Rose-grain aphid

*Metopolophium dirhodum*

**The aphids are green with a dark green strip along the body.**

### Life cycle

The rose-grain aphid overwinters as very frost hardy eggs on roses. It migrates to crops in spring.

Rose-grain aphids are susceptible to all grain aphids' natural enemies, so do not thrive in crops already colonised by grain aphids. After hard winters when both grain aphid and natural enemies are scarce, rose-grain aphid may cause problems.

These aphids remain on the leaves and do not move up to the ear.

## Both species

### Economic importance

Yield losses can reach 4 t/ha, but losses of 0.25–1 t/ha are more usual where populations exceed threshold levels. Only very severe infestations produce visible symptoms in crops.

### Risk factors

All cereals are at risk. Winter barley is less affected due to its earlier senescence. Impact is greater where soluble stem carbohydrate reserves are low, eg drought-affected crops or crops damaged by other pests and diseases. Dry settled weather during early grain filling increases the risk.

### Chemical control

Pyrethroids are the main choice to control ear infestations, but are less effective on earlier infestations on the undersides of leaves. Pirimicarb provides more selective control of aphids. Additionally, it has a vapour action which penetrates further into the crop.

**Action thresholds**

Treatments should only be considered if aphid numbers are increasing. Spray when:

- 50% tillers infested before GS 61
- 66% tillers infested from GS 61 to two weeks before the end of grain filling.

### Cultural control

Measures, such as grass strips, proposed to increase natural enemies of crop pests, can provide harbourages for aphids. Wildflower strips with diverse grass mixture are less likely to harbour pests and will encourage parasitoids and hoverflies.

### Natural enemies

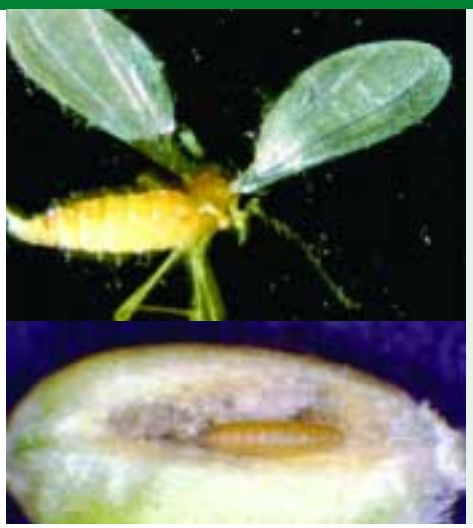
**Specific to aphids**

*Parasitic wasps, hoverflies, lacewings, ladybirds* are attracted to aphid infestations and can provide control of potentially damaging numbers.

Some *fungal diseases* are also specific to aphids.

**Polyphagous predators**

*Ground beetles, soldier beetles, rove beetles, spiders* may help to mop up low numbers early in the season, thus slowing development.



# Orange wheat blossom midge

*Sitodiplosis mosellana*

**The orange-coloured larvae feed on wheat, barley and rye grain during grain filling. Larvae are up to 3 mm long. They lack legs, but have a prominent head capsule. Adult midges, also orange, and about 3 mm long, are found during ear emergence. They rest at the crop base during the day and fly up to the ears in the evening to lay eggs.**

## Economic importance

Each larva reduces grain size by 30–50%. Pericarp damage allows easier water entry, often resulting in sprouting in the ear and reduced Hagberg falling number.

Damaged seeds are susceptible to attack by pathogenic fungi, especially *Fusarium graminearum*; they may fail to germinate or produce weak seedlings.

## Risk factors

Potentially damaging larval populations may be found in any field where wheat has been grown over the past five years. Higher soil populations are likely where wheat crops have been frequently grown during this period.

Crops growing in fields with high resident populations are more vulnerable to attack when weather conditions are marginal for flight.

Midges can fly half a mile or more in mild evening weather. They accumulate in the most sheltered fields at the vulnerable growth stage and attack new crops.

## Natural enemies

The most important natural enemies are small parasitic wasps, especially *Macroglenes penetrans*. During the day they search for and lay their eggs in midge eggs. This does not reduce crop damage, as the parasitoid larva does not develop until the midge larva has overwintered.

Parasitism levels can exceed 80% and give useful control. By not spraying below threshold levels, parasitoid numbers may increase and provide longer-term midge control.

Polyphagous predators also kill adults and can kill larvae dropping to the ground if dry soil prevents them burrowing to safety.

## Cultural control

- Reduce the frequency of wheat crops in the rotation in more sheltered fields.
- Grow resistant varieties, eg Welford.

## Chemical control

- Apply chlorpyrifos to wheat crops within a week of finding a threshold number of midges laying eggs on the ears.

Pyrethroid sprays applied for aphid control may give some control of the midge if the timing coincides with flight, but this control is unreliable and not a label recommendation.

### Action thresholds

Thresholds refer to numbers of midges laying eggs in the evening. The midges can be counted at night using a torch or in early morning. They fly off as temperatures rise.

If several nights are suitable during ear emergence, count midges each evening and use the average figure.

- For feed crops – 1 midge/3 ears.
- For milling and seed crops – 1 midge/6 ears.

Consider using yellow sticky traps hung at ear height at the start of ear emergence to monitor activity. In crops at the threshold levels, expect to catch about 10 midges in each trap through ear emergence.

Ignore midge activity after the start of flowering, as eggs laid after this stage do not develop properly.

## Life cycle