# Tomato pinworm

# *Keiferia lycopersicella*

PLANT PEST FACTSHEET


**Figure 1. Larva of *Keiferia lycopersicella* showing indistinct dorsal markings. Larvae reach a maximum length of 8 mm.**
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## Background

The tomato pinworm, *Keiferia lycopersicella* (Walsingham) (Lepidoptera, Gelechiidae) is a pest of tomatoes in North America. It has caused foliage and fruit damage to crops in the United States, with reports of up to 80% of fruit in infested fields damaged over the growing season. In 2008, *K. lycopersicella* was found for the first time in Europe, in Italy, where it was causing severe damage to a crop of tomatoes along with another introduced gelechiid pest, *Tuta absoluta* (the South American tomato moth). *Keiferia lycopersicella* has not been intercepted in the UK to date.

## Geographical Distribution

*Keiferia lycopersicella* is native to North America, where the species was first described. It is found in Mexico and southern states in the USA, as well as on the islands of Cuba, Haiti, the Bahamas and Hawaii. Outbreaks of the pest under glass have been reported from more northerly states in the USA, including Delaware and Pennsylvania, and from regions in Canada, including Ontario. *Keiferia lycopersicella* was reported from a site near Genova in Italy in November 2008. However, the Italian outbreak of *K. lycopersicella* was eradicated, and it is no longer considered to be present in Europe.

## Host Plants

The preferred host is tomato (*Lycopersicon esculentum*), on which the larvae initially mine the leaves, but may start to eat fruit or stems as they grow older. Larvae will also feed on the leaves of aubergine (*Solanum melongena*) and potato (*S. tuberosum*). Weeds in the Solanaceae are also eaten, with recorded hosts including the American species wild tomato (*Lycopersicon hirsutum*), purple nightshade (*Solanum xanti*), and blue witch nightshade (*S. umbelliferum*).

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**Figure 2. Pinned adult *Keiferia lycopersicella* showing the brown wings with black speckling and the striped brown and black antennae. The maximum wingspan is around 12 mm.**
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**Figure 3. Blotch leaf mines on tomato created by *Keiferia lycopersicella* larvae.**
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**Figure 4. Pinholes on tomato fruit caused by *Keiferia lycopersicella* larvae. Dark specks of frass are visible under the calyx.**
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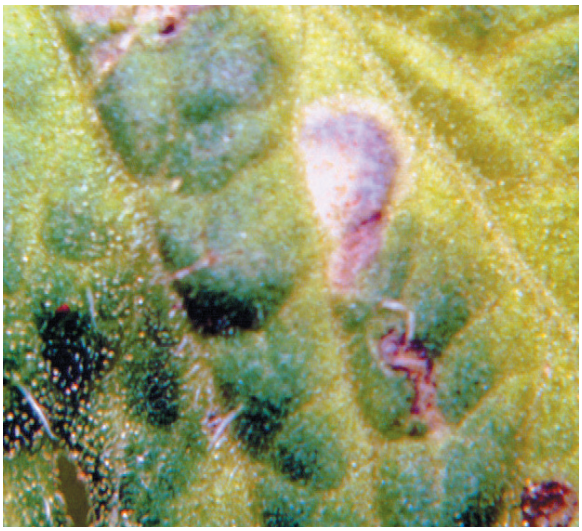

**Figure 5. Small leaf mines on tomato caused by early instar larvae of *Keiferia lycopersicella*.**
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## Description

Oval eggs are laid on leaves of suitable hosts, singly or in small clusters, and change colour from pale yellow to orange as they approach hatching. They are less than 0.5 mm on the longest axis, and are unlikely to be seen.

Newly hatched larvae are a yellow or cream colour with a black or brown head. Older larvae reach a maximum length of 8 mm, and develop markings that are very variable in extent (Fig. 1). The ground colour of the body is usually green and the darker markings are often purple or brown, and mostly include a dark interrupted dorsal line and further elongated spots on the sides of the larva, giving the impression of three longitudinal lines along much of the body. The head is usually pale brown in colour. The prothoracic shield just behind the head is also pale brown with a thin black line along the

posterior border. The bicoloured prothoracic shield is also found in larvae of *T. absoluta*, another pest of tomatoes with similar larval feeding habits.

Adult moths are small, reaching a maximum of 8 mm in length when the wings are wrapped around the body in the natural resting posture. The wings have a ground colour of brown or silver, with some ill-defined black streaks and speckling (Fig. 2). The antennae and legs are brown ringed with black. Identification to species requires examination by a specialist.

## Pest Biology, Dispersal and Detection

Newly hatched larvae spin a silk shelter and begin to feed on the leaf from this shelter, excavating a mine. Initially, the mine is linear, but as they grow older, they enlarge the mine and it becomes an irregular blotch, which is highly visible (Fig. 3). The frass is usually clumped in one spot in the mine, and is never left in linear trails. As they grow, some larvae continue to feed on the leaves, emerging from the mine and creating new shelters from the leaf by folding it and spinning the two sides together. They may also spin two separate leaves together. However, other larvae move from the mines into the stems or fruit, where they usually burrow inside just underneath the calyx (Fig. 4). Pupation usually takes place just under the surface of the soil, but can also be inside fruit or the spun folds in the leaves. From hatching of the egg to adult moth can take as little as 4 weeks, with overlapping generations possible in favourable conditions. The pest can complete its development between 11 and 35$^{o}$C. Adult moths are not active in daylight, and are unlikely to be seen flying about.

Older larvae of *K. lycopersicella* may burrow into the fruit. As the entry hole is usually very close to the calyx, infested fruit is difficult to detect and larvae could be transported with infested consignments of fruit. As the larvae often leave the fruit or stems to pupate, they could also be transported on empty packing materials. There have been outbreaks in the United States, which have been linked to the supply of infested young plants for propagation: early leaf mines are small and difficult to detect (Fig. 5). The distance which adult moths are capable of dispersal by flying is unknown. However, adults are nocturnal and spend the day hidden between leaves or in other enclosed spaces, and so may hitchhike on items such as packing crates.

## Economic Importance and Damage

Most damage to tomato plants is to the leaves, as these are the preferred food of the larvae. Heavy infestations will affect the growth and yield of the plant. If the larvae cause even minor feeding damage to the fruit, this makes it unsuitable for marketing. Secondary rot can also occur in the wounds, making the fruit unsuitable for consumption. The UK grows about 150 ha of tomatoes commercially, and this includes many premium crops (e.g., vine tomatoes), where any blemish is unacceptable. In protected cultivation, several overlapping generations of moths can occur in a year, allowing the pest numbers to build up to damaging levels.

## Prevention and control measures

In common with *T. absoluta*, *K. lycopersicella* can be moved in infested fruit, in tomato plant debris or as contaminants in packing cases and also on infested plants. To reduce the risk of introducing the pest into tomato / aubergine crops the following measures can be taken:

1) Whenever possible, source tomatoes from areas free of the pest (the pest is believed to be absent from Europe and North Africa at present).
2) Train staff on packing lines to look out for symptoms of the pest.
3) If fruit are found with suspected infestations of a non-indigenous pest, alert the PHSI.
4) Keep areas around packing stations and production sites for tomatoes and aubergines free of solanaceous weeds.
5) Ensure that suppliers deliver tomatoes and aubergines in clean packing cases and that packing cases are cleaned before entering production areas.
6) Tomato production sites with neighbouring packing stations are at particular risk. Pheromone traps would help to detect low levels of the pest arriving in imports and would be especially appropriate if produce is received from countries where *K. lycopersicella* is present. Although there do not appear to be any UK suppliers of these traps, they can be obtained from overseas and used for monitoring purposes.

The life cycle of *K. lycopersicella* makes them very difficult to control with insecticides. Once infestations have become established they are very difficult to bring under control; therefore, early detection is imperative. Experience of controlling the pest in North America provides the following control advice:

1) Monitoring with pheromone traps.
2) Physical removal of infested leaves from growing plants. In addition, within season cleaning of material underneath growing plants should remove some pupae.
3) Biological control with egg parastioid wasps has been found to be effective in Canada. However, the species that have been found to be most effective (*Trichogramma pretiosum* followed by *Trichogramma brassicae*) are yet to registered for use in the UK. Field populations of *K. lycopersicella* in Florida have been shown to be susceptible to toxins of *Bacillus thuringiensis* var. *kurstaki* and products containing this pathogen (e.g., Dipel DF) have been used within IPM programmes for *K. lycopersicella*.
4) Mating disruption – sex pheromones can be applied to foliage as a spray to confuse male moths and disrupt mating. This can be effective when *K. lycopersicella* numbers are low. The use of pheromones for pest control, as opposed to their use for monitoring, would need to be approved before they could be used in the UK.
5) Light traps – both sexes are attracted to light.
6) Chemical treatments – the following compounds, that are currently approved (via on or off-label) for applications to protected tomato crops in the UK, have been found to be effective against *K. lycopersicella*: abamectin (e.g., Dynamec), indoxacarb (Steward) and spinosad (e.g., Conserve).
7) Hygiene measures – a thorough clean up of infested crops should minimise the risk of carryover to succeeding crops.

## Advisory Information

Suspected outbreaks of *K. lycopersicella* or any other non-native plant pest should be reported to your local Fera Plant Health and Seeds Inspector, or:
Tel: 01904 465625
Email: planthealth.info@fera.gsi.gov.uk
Web: www.defra.gov.uk/fera/plants/plantHealth

## Authors

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## Selected references

The information presented here has been collated from a number of sources, and a selection of useful references are listed below.

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