13 Moths and butterflies (Lepidoptera)

Many moths and some butterflies are significant plant pests. It is the larval stage (or caterpillar) which usually causes plant damage. However, in the case of fruitpiercing moths, adults cause problems by feeding on fruit.

Adult moths and butterflies are covered with fine scales, and, except for a few wingless species, have two pairs of wings. The scales of many butterflies, and of some moths, are brightly coloured.

Adults have well-developed eyes, long antennae, and well-developed legs. The adult mouthparts are modified to form a long, coiled tube, designed to suck up liquid food.

Monitoring

The following points apply to the monitoring of all moths and butterflies and their natural enemies:

- The number of trees from which samples are taken depends on block size (see chapter 25 for details).
- Additional care should be taken when monitoring blocks that have a history of economic damage.

Citrus leafminer

Phyllocnistis citrella Stainton, Lepidoptera: Gracillariidae

Figure 13.1 Importance and distribution of citrus leafminer.

Plate 13.1 Adult citrus leafminer.

Description

General appearance

Adult citrus leafminers are small, delicate moths with narrow paired forewings, and hindwings fringed with long hairs. At rest, the moths are about 2 mm long. In flight, their wingspan is about 4 mm.

Because adults are nocturnal, they are rarely seen, except in heavy infestations. They may also be seen flying out when foliage is disturbed.

Distinguishing features

Distorted foliage and silver mining trails are the most obvious signs of citrus leafminer activity.

Citrus leafminer is the only leafminer that attacks citrus in Australia.

Life cycle

Under favourable summer and autumn conditions, the complete life cycle takes 14–17 days. In late autumn, winter and spring it can take two or three times longer.

Adults emerge from pupae during the early morning hours. Mating occurs at dusk and in the early evening.

Most adults live for less than a week, but some can live for up to 160 days.

Female moths start laying eggs about 24 hours after mating. Eggs are laid at night. A female can lay more than 50 eggs during her life, and as many as 20 per night.

The flat, slightly oval eggs are about 0.3 mm long. They are translucent, and look like tiny water droplets on the leaves.

Eggs are deposited singly, on the undersides of leaves near the midrib, usually at the base of the leaf. Young leaves 10–20 mm in length are preferred sites for egg laying.

Hatching can occur within a day in summer, and the young larva immediately burrows under the leaf surface.

There are three larval stages, a pre-pupa and a pupa. Larvae feed on sap from epidermal cells ruptured by their blade-like, finely-toothed mouthparts.

Each pale-green larva tunnels a characteristic, sinuous, silvery mine in the leaf, with a raised parchment-like skin lined centrally with dark excreta. Larvae never leave their mines to form other mines or move between lower and upper sides of leaves.

Plate 13.2 The egg of citrus leafminer resembles a small drop of water (top right). A newly hatched transparent larva can be seen (middle left), and also the brownish empty egg shell from which the larva has hatched.

Plate 13.3 Second and third instar larvae of citrus leafminer.

Plate 13.4 Pupa of citrus leafminer.

Development of the first three stages takes about 5–6 days in summer. Mature third instar larvae are about 3 mm long.

The fourth stage (the pre-pupa) is yellowish brown and resembles the third-stage larva, but it does not feed. This stage lasts for about one day in summer.

The pre-pupa uses silk produced from its mouthparts to form a pupal chamber, which is usually sheltered within the rolled-over edge of the leaf. Transformation into a pupa occurs within the chamber.

The yellowish brown pupae are about 2.5 mm long. After about 6 days, adults emerge. The cast pupal skins are usually left protruding from the chambers.

Seasonal history

There are up to 15 generations per year.

Habits

Severe infestations usually occur only in late summer and autumn, and are often related to low levels of activity of natural enemies. Severe infestations do not normally occur in spring because leafminer numbers are low after winter.

In Queensland, where citrus leafminer has been established for 30 years, significant activity begins in early October after the major spring growth flush has hardened. In southern states, significant activity begins a few weeks later.

Leafminer activity increases during December–January on early summer growth flushes, and peaks in February–March. Populations drop off rapidly from late April, due to a lack of suitable new growth, to increased parasitism and to the cooler conditions. A few active mines can usually be found where there is a growth flush, even in June–July, but the pest is very scarce during August–September.

Hosts

Citrus is the only known host of citrus leafminer in Australia.

Origin and distribution

Originally from South-East Asia, citrus leafminer is now found almost throughout the world, following its rapid spread since 1990.

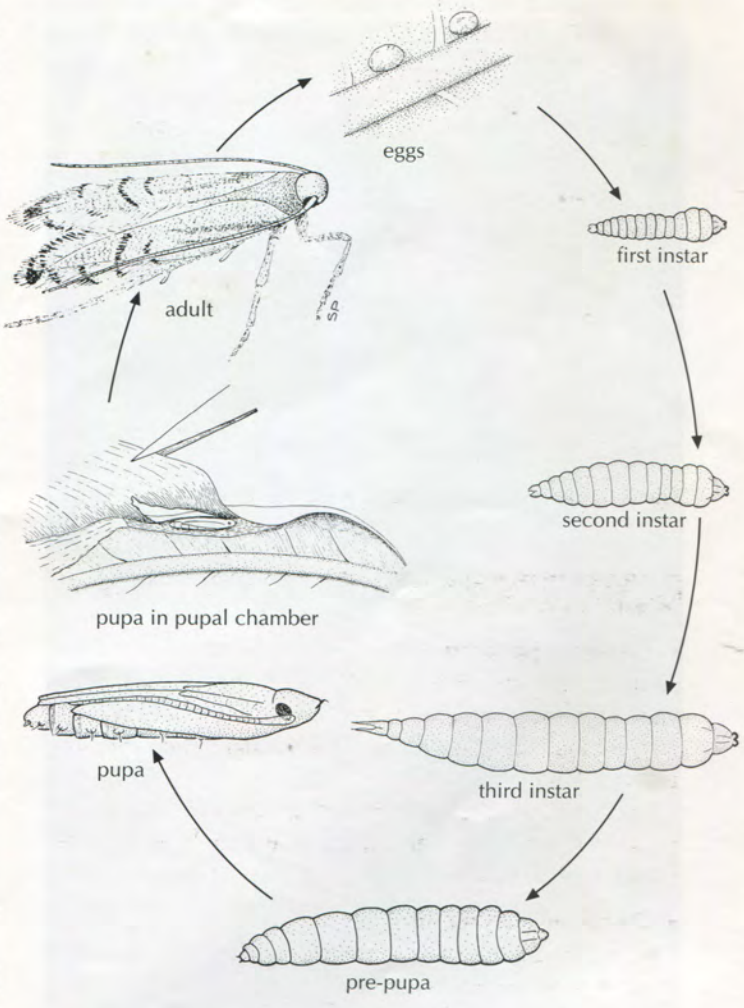

Figure 13.2 Life cycle of citrus leafminer.

Damage

Fruit
Mining on the fruit (but this is very uncommon).

Leaves
Twisted and curled young leaves; retarded growth if there is continual damage to flushes of nursery trees and young trees.

Twigs
Mining on green twigs in heavy infestations and at high humidities.

Damage is caused by the larvae as they mine immature foliage. Twisted and curled leaves are generally the first symptoms noticed.

Severe infestations (an average of 2 or more mines per leaf) can retard the growth of nursery and newly planted trees, but their effect on trees older than 5 years is usually insignificant.

Varieties attacked

All citrus varieties are attacked.

Plate 13.5 Autumn leaf flush damaged by citrus leafminer.

Plate 13.6 Close-up of citrus leafminer damage. Note the curling and distortion of leaves, the mines with their dark excrement trail, the larva within a mine (lower left), and brown pupae within folds near the edges of the leaves.

Natural enemies

Parasites

The most effective wasp parasites of citrus leafminer are *Ageniaspis citricola* and *Cirrospilus quadristriatus* (both introduced from South-East Asia in 1990–92) and *Semielacher petiolatus*, an indigenous species. Parasitism by other wasps native to Australia (*Cirrospilus* near *ingenuus*, *Sympiesis* sp., and *Zaommomentedon brevipetiolatus*) has also been observed.

In the Murrumbidgee Irrigation Area, the Sunraysia and the Riverland, *S. petiolatus* is the major parasite. Parasitism levels are generally below 20% of all larvae in January–February, but build up to 50% or more in March–May.

In Queensland, the levels of parasitism of larvae by *A. citricola* reach 90% by February–March, but *S. petiolatus* and *C. quadristriatus* are also important.

Predators

Predators include lacewings, which are generally associated with heavy infestations.

Plate 13.7 The wasp Ageniaspis citricola, *a parasite of citrus leafminer: bottom, pupae; top, adult.*

Plate 13.8 The wasp Cirrospilus quadristriatus, *a parasite of citrus leafminer: bottom, pupa; top, adult.*

Plate 13.9 Larva of citrus leafminer within its mine. It is being attacked by the wasps Ageniaspis citricola *(see the two barrel-shaped pupae, centre left, inside the leafminer larva) and* Cirrospilus quadristriatus *(the larva of which (see top arrow) feeds externally on the citrus leafminer larva). There is also a parasite egg at middle left (bottom arrow).*

Management

Monitoring

- Citrus leafminer occurs on all varieties.
- From January to mid-March, monitor production of significant growth flushes (more than 25% of trees flushing) on blocks of young trees less than 5 years old. It is important to detect the flush at a very early stage, when shoots are less than 20 mm long, especially if planning to use a petroleum spray oil to control leafminer. Examine at least 20 advanced shoots (i.e. shoots that have emerged ahead of the main flush) for active mines.
- Recently hedged trees may also need monitoring.

Plate 13.10 The wasp Semielacher petiolatus, *a parasite of citrus leafminer: bottom, pupa; top, adult.*

- Because spring growth on which fruit is borne is not attacked to any extent, and because summer and autumn flushing on mature trees is not usually vigorous, monitoring of mature trees is generally not warranted.

Action level

Action is based on plant flushing cycles as well as infestation levels, because the initial stages of leafminer infestations are very difficult to detect, and infestations develop extremely quickly.

There are two action levels. The action level for larvicides is 25% of the block flushing, and 50% of the more advanced flushes infested with active leafminer.

The action level for petroleum spray oil is 25% of the block flushing, and 10% of the more advanced flushes infested.

Appropriate action

Apply a larvicide or petroleum spray oil (250–500 mL oil per 100 L water, see chapter 27). Petroleum spray oil reduces the number of eggs laid by adult female leafminers because they do not like laying their eggs on sprayed surfaces. Petroleum spray oil is therefore preventative rather than curative.

Apply oil every 6–10 days until the youngest leaves on the majority of flushes within each cycle are 40 mm long. Approximately 2–4 sprays per flush are required.

Additional management notes

Effective control of citrus leafminer using larvicides can be difficult because larvae and pupae are protected within the leaf. Some larvicides, e.g. synthetic pyrethroids, are effective, but disrupt the activity of natural enemies of leafminer and other citrus pests, and are not recommended.

Because infestations are restricted to flush growth, particularly in late summer and autumn, their severity can be reduced by:

- fertilising in late winter to promote flush growth in spring when the pest is either absent or relatively scarce
- limiting flush growth in late summer and autumn by not fertilising and irrigating during summer and autumn in excess of the amount needed for normal growth
- not hedging trees in summer and autumn.