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Light brown apple moth in citrus

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Introduction

Light brown apple moth (LBAM), *Epiphyas postvittana*, is a pest of economic importance in many fruit crops in Australia, including apple, apricot, citrus and grape crops. In citrus, LBAM causes fruit drop and a 'halo' type scar around the stem end of the fruit (Fig. 1). It threatens Australian orange exports to the US and Asia. LBAM distribution in Australia is centred in the southern states of New South Wales, Victoria and South Australia.

Figure 1. 'Halo' scar caused by LBAM

Description

LBAM eggs are pale green and are laid in flat, overlapping masses that resemble fish scales (Fig. 2). The preferred egg-laying sites in citrus are the leaves, although eggs can occasionally be found on fruit and young stems.

After hatching, the larva passes through six stages, reaching a maximal size of about 18 mm before pupating. Young larvae are pale yellow-green, while the mature larvae are pale green (Fig. 3).

Figure 2. LBAM egg batch

Figure 3. A near-mature larva on a citrus leaf. Note the webbing on the leaf. Inset: Young LBAM larva on the stem end of a young fruit. Note the feeding damage around the stem end, which will later appear as 'halo' scar on the mature fruit.

Larval selection of feeding sites in orange trees varies with the season:

- When **young fruitlets** (<10 mm) are abundant, most larvae establish feeding sites in the clusters of fruit, amongst leaves and in flower remnants.
- During the **young fruit stage** (<40 mm), most larvae feed under the calyces of individual fruit.
- When only **mature fruit** are available, most larvae are found in amongst young leaves.

Larvae of all ages construct silken shelters at the feeding site. When disturbed, the larva will wriggle vigorously backwards.

Pupation takes place inside the silken feeding shelters. Pupae are red-brown and 10–12 mm long (Fig. 4).

Figure 4. LBAM pupa

Adults are light brown and appear bell-shaped. Female moths have a wingspan of about 18 mm, but male moths are much smaller. Female moths can also be distinguished by the presence of a dark spot in the centre-front of the folded wings. Males have a dark band across their folded wings (Fig. 5).

Figure 5. LBAM adults: male (left) and female (right)

Development and survival

LBAM is able to complete its lifecycle by feeding exclusively on young orange leaves, mature orange leaves, young orange fruit or mature orange fruit. However, citrus trees do not appear to be the optimal hosts of LBAM. Survival rate of LBAM from egg to adult in orange trees is less than 20% and is generally higher on young leaves and young fruit than on other tissues. Most mortality occurs as a result of failure to establish suitable feeding sites soon after hatching.

LBAM development on orange leaves and fruit is slower than on apple and other favourable hosts of LBAM. Completion of the entire lifecycle in orange trees requires a minimum of 776 degree-days above 7.5°C. In the southern citrus region of Australia, this equates to four or five generations per year. An online LBAM development calculator [1] is available to help with the estimation of development durations for all LBAM stages at given temperature ranges.

Seasonal patterns

Seasonal patterns of LBAM populations in southern citrus regions of Australia are characterised by the presence of summer troughs (Fig. 6). Depending on the year, the troughs start between late November and late January, and end in April. They correspond to periods of high temperature.

Annual LBAM peaks can occur in other months. While spring peaks may be enhanced by the prevalence of young fruit and leaves, winter peaks may be a result of migration of adult moths from adjacent vineyards following grape harvest in late autumn.

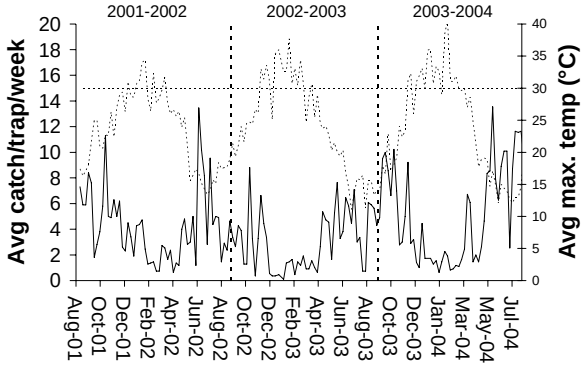

Figure 6. Weekly catches (shown by the solid lines in the graph) of LBAM females from pheromone traps in citrus orchard in the Riverina during the period August 2001 to July 2004. Dotted lines show the average maximum daily temperature.

Monitoring

Pheromone traps can be used to indicate the timing of high LBAM moth activity, which in turn can be used to predict the timing of high LBAM larvae numbers. A minimum of four traps should be placed in each monitoring block. The traps should be monitored weekly from September to December and again from May to August. Following the detection of local population peaks, trees should be inspected for LBAM eggs and larvae:

- For inspection of trees that have an abundance of **young fruit**, four fruit-bearing branch terminals from each of 20 randomly selected

[1] www.agric.nsw.gov.au/ reader/citrus-pests-diseases/cit-lbamcalc.htm

trees in each block should be checked. Webbed clusters of young fruitlets, flowers and leaves, and the calyces of individual fruit, should be opened to check for LBAM larvae.

- For inspection of trees with predominantly **mature fruit**, check 10 fruit from each of 20 randomly selected trees in each block. Touching fruit and leaves should be separated, and any boring holes on the fruit should be opened to check for the presence of LBAM larvae. Webbed young leaves, when sighted, should also be inspected. Also look for white to pale-green overlapping masses of LBAM eggs on leaves.

When pheromone traps are not used, regular orchard inspections are strongly recommended. If labour permits, this should be done fortnightly from September to December for young fruit, and from May to November for mature fruit.

If a citrus farm which is growing export oranges is located next to a vineyard, orchard inspection is especially important following grape harvest, as there may be a large influx of LBAM from the vineyard to the citrus blocks.

Management

Natural enemies

LBAM populations in citrus orchards are normally kept at low levels by a combination of biological and environmental factors. Chemical intervention is often not needed. Biological factors include the relatively low suitability of citrus trees to the development and survival of LBAM, and the natural enemies of the insect.

- Natural enemies of the eggs include the tiny parasitic *Trichogramma* wasps.
- Natural enemies of the larvae include:
  - parasitic wasps *Dolichogenidea arisanus* and *Xanthopimpla* spp.;
  - parasitic flies *Goniozus* spp. and *Zosteromyia* spp.;
  - predatory bug *Ochalia shellembergii*;
  - lacewings;
  - spiders;
  - various pathogens.

Spiders are abundant in citrus orchards and may play an important role in regulating LBAM populations.

Mating disruption

Mating disruption is an effective technique for managing LBAM in citrus. By flooding the target area with synthetic copies of the female sex pheromone (via ‘mating disruption dispensers’), the success rate of males in finding local females is greatly reduced. This results in females producing lower numbers of viable eggs, which leads to a reduction in local populations.

For the technique to be effective, as large an area as possible should be treated, with no untreated pockets remaining inside the area. For protection against feeding damage to young fruit, mating disruption dispensers should be put out in August. Mating disruption dispensers LBAM Plus® will usually remain effective until February the following year.

For protection of export oranges, a second application of the dispensers may be needed in early autumn.

Chemical control

If orchard inspection indicates an unacceptable level of LBAM eggs and larvae, soft chemicals may be used. Currently one biological insecticide, Mimic®, is registered for LBAM control in citrus. Mimic® is a growth regulator and has minimal impact on beneficial insects. It is best used to target young larvae.

Cultural practices

Fallen fruit and broadleaf weeds may also harbour LBAM. Removing these from the orchard will help reduce LBAM populations. Thinning fruit also helps control of LBAM by reducing potential feeding sites and leaf-to-fruit and fruit-to-fruit contact. Since LBAM larvae prefer young foliage, practices that reduce the amount of autumn flush on trees are also beneficial.

References

Mo, J 2004, *Development of IPM strategies to manage lightbrown apple moth in citrus*, Horticulture Australia Ltd, Sydney.

Mo J, Glover M, Munro S and Beattie GAC 2006, ‘Development of Epiphyas postvittana (Walker) (*Lepidoptera: Tortricidae*) on leaves and fruit of orange trees’, *Journal of Economic Entomology*, 99: 1321–6.

Mo J, Glover M, Munro S and Beattie GAC 2006, ‘Evaluation of mating disruption for control of lightbrown apple moth (*Lepidoptera: Tortricidae*) in citrus’, *Journal of Economic Entomology*, 99: 421–6.

Smith D, Beattie GAC and Broadley R (Eds) 1997, *Citrus pests and their natural enemies—integrated pest management in Australia*, Queensland Department of Primary Industries, Brisbane.

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