

CCOF Organic Management of the Light Brown Apple Moth (LBAM)



Organic growers should be proactive in their approach to the Light Brown Apple Moth (LBAM). This will help demonstrate compliance with the quarantine regulations as well as help convince buyers and consumers that efforts are being made on a farm level to control this high-profile pest.

All of the techniques and suggestions mentioned here are already likely to be in an Organic System Plan and therefore do not involve additional work by growers, other than efforts to properly identify this particular insect. If an LBAM is found on a farm, particular focus on control will be necessary to avoid extended quarantine of crops.

1). General Pest Prevention

- Sanitation - the LBAM does not travel far in each generation by flying (typically approximately 100 meters), but is more likely to spread in the larval stage by moving on infested nursery stock and containers. Make sure that new plant material brought onto the farm is free of leaf rollers and check or sterilize all pots and other containers before re-use.

- Biodiversity - Efforts to bring habitat for beneficial insects into the farming system will benefit the biological control of LBAM. Hedgerows, flower strips on edges of fields or ends of rows, establishing bluebird and bat boxes, and interplanting flowering crops with food crops all serve provide habitat for the beneficial insects and birds who feed on moths in general, with LBAM among them.

- Cultural Practices - removing crop residues in a timely way will help break pest life cycles if they are trying to get established on a crop. Pruning trees in a way to allow in more light and air will only help create a healthy environment for the tree and more access to the pests for predators. Control weeds around fields of annuals can reduce survival and overwintering of larvae. However maintaining vegetation around perennial crops can increase the activity of predators and parasites.

2). Identification and Characteristics of Light Brown Apple Moth (*Epiphyas postvittana*)

The LBAM is a leafroller in the family Tortricidae. The adult is about 0.4 inch (10mm) long, with a 0.75 inch (18mm) wingspan. This moth is yellowish brown, with forewings darker brown

towards the outer edges. It stays sheltered in the foliage during the day, and flies after sunset and before daybreak. The eggs are pale white to light green and are laid slightly overlapping each other as an egg mass or a raft on the upper surface of the foliage. Egg masses are occasionally deposited on fruit. Newly hatched larvae are pale yellow-green. Mature larvae are light green with a light brown head. The larvae are active, and grow to 0.6-0.75 inch (15-18mm) in length at maturity. They wriggle violently when disturbed. After emerging, the larva builds a silken shelter by rolling a leaf lengthways and webbing its edges together. Leaves may also be webbed together or joined to fruit. The larvae feed within these shelters, and they may feed on fruit when it touches a leaf. A larva is most likely to be found near the calyx or in the endocarp. The light brown apple moth does not have a diapause, and will most likely overwinter as a larva in leaf litter and other plant material.

They are superficially similar to other native tortricid larvae and DNA analysis is necessary to confirm their identity. Development is continuous, with no true dormancy. In Australia, this moth typically has 3 generations per year and over-winters as a larva. It has not been studied in the US yet to know how many generations it might have per year. LBAM has been associated with many plants representing 290 genera and over 2000 species. In its native range, LBAM does not do well at high temperatures but thrives in cooler areas with mild summers.

Pictures of the LBAM and more information on the life cycle are available on these websites:

http://www.cdffa.ca.gov/phpps/PDEP/target_pest_disease_profiles/LBAM_PestProfile.html

http://www.aphis.usda.gov/plant_health/plant_pest_info/lba_moth/index.shtml

<http://www.ipm.ucdavis.edu/EXOTIC/lightbrownapplemoth.html>

3). Monitoring

- Start with careful inspection of growing areas and plants. Examine leaves for leafroller egg masses and larvae, especially the characteristic webbing together of leaf surfaces. Destroy any fruit with evidence of larval feeding. Also inspect all incoming plant material and containers.
- Once you report suspicious looking larvae or adults, you can expect increased inspection and major quarantine. In the meantime, you should implement appropriate organic control methods discussed below.
- The LBAM pheromone is now available in both delta traps for monitoring, and twist ties for control by confusion of males. Pheromone traps to detect and monitor the male moths are deployed at one per 5 acres, with at least one in every field no matter how small. Twist ties will be discussed below under "Control".
- Check traps regularly and keep written results of pests found and what the host crops are. If necessary use a trained scout or trained employee.
- If any LBAMs at all are found, proceed to one or more of the control measures below. Control will always be more worthwhile than the effects of a quarantine.

4). Management and Control

- Beneficial insect releases - There is evidence that trichogramma wasps will do a satisfactory job of feeding on LBAM eggs. Regular release of trichogramma should be considered because of the continuous generational nature of the pest, hopefully accompanied by enough diversity for them to establish themselves on flowering plants in the vicinity of crop plants. Planting buckwheat 30-45 days prior to releasing the wasps increases reproduction of the trichogramma. There are formulations of "Predator Feeds" (sugar and wheat) that keep the parasites multiplying if there are insufficient flowers for their reproduction. Leafrollers in

general are controlled by several predators such as lacewings, spiders, minute pirate bugs, damsel bugs, and bigeyed bugs, and by several other parasitic wasps. Since predators are generalists, they will feed on LBAM, but specific studies have not yet been done on these predators on LBAM in California.

- *Pheromone Mating Disruption* - unlike the controversy surrounding aerial spraying of pheromones on populated areas, the twist ties with impregnated pheromones are now available for LBAM, are well established as approved for organic farmers, and the inert ingredients stay on the physical part of the twist tie. Twist ties will last a whole growing season and are used at a rate of 200-300 per acre. Because LBAM does not have discreet generations and therefore may have a continuous presence, pheromones may have to be replaced during the season. This control measure is the least disruptive to the rest of the environment other than biological control.

- *Bacillus thuringiensis (Bt)* - there are numerous formulations that are approved for organic use. It has low toxicity for mammals and a relatively short life in the field. In general Bt will affect all members of the Lepidoptera order. While most other Lepidopterans are pests, there are a few, such as Monarch butterfly, that could be affected negatively and so care should be used around sensitive areas. Because Bt must be ingested by the larvae, the leaf-rolling or leaf-tying behavior of the insect may help protect the larva from this material. Spraying is most effective after eggs have hatched, but before caterpillars build feeding shelters. To be most effective Bt should be sprayed at night and combined with a feeding stimulate to encourage the LBAM to ingest more Bt. It should be sprayed on the crop area as well as border vegetation as the LBAM may be in the other plants as well. Bt will require weekly or bi weekly applications to reduce LBAM larva. Time the applications with the activity of the pheromone trap and visual inspection of the crop. Can be combined with trichogramma for improved control.

- *Spinosad* - like Bt, this microbial derived material affects the larvae and must reach them when they are fairly young before building their feeding shelters. Although generally safe for predators, it may impact hymenopteran parasitoids (wasps) that are useful biological control agents. It also can negatively impact bees. The only brand approved for organic use in this way is Entrust.

- *Horticultural Oils* - While not yet researched specifically for LBAM, there is evidence that horticultural oils such as JMS Stylet Oil, Jojoba Oil, and others will suffocate Lepidoptera eggs and small larvae. This may be most useful in the winter as a suffocating oil to try and reach overwintering eggs.

One of the keys in reducing the impacts of a quarantine is demonstrating to the inspectors that a well-planned and executed Integrated Pest Management plan is in place. The above guidelines give the basics of such a plan for organic farmers. When adopting this plan for LBAM, make sure that all the components are included within the operation's central Organic System Plan and that CCOF is notified of any new materials used in control of LBAM (or any other pest) before their use. It is up to all growers in the LBAM areas to keep this potential pest from spreading, and organic growers are in a position to be at the forefront of a comprehensive management program.

References and Resources

California Department of Food and Agriculture Light Brown Apple Moth Project
http://www.cdffa.ca.gov/phpps/PDEP/lbam/lbam_main.html

California Strawberry Commission, Production Guidelines, "Identifying Leafrollers Including the Light Brown Apple Moth", by Frank G. Zalom, May 2007.

<http://www.calstrawberry.com/>

National Organic Program Federal Rule

<http://www.ams.usda.gov/nop/>, then select “Regulations”

University of California Statewide Integrated Pest Management Program - UC IPM Online

<http://www.ipm.ucdavis.edu/EXOTIC/lightbrownapplemoth.html>

USDA Animal and Plant Health Inspection Service (APHIS)

http://www.aphis.usda.gov/plant_health/plant_pest_info/lba_moth/index.shtml

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