

Light Brown Apple Moth in Colorado - Identification of Insects and Damage of Similar Appearance

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Figure 1, 2, and 3. Light brown apple moth adults. These figures highlight the color variation among moths. *Photos courtesy of Natasha Wright*

The light brown apple moth (LBAM), *Epiphyas postvittana* (Lepidoptera: Tortricidae), is an insect native to Australia that has been accidentally introduced into several countries. The first United States detection of light brown apple moth was confirmed in Alameda County, California in March 2007. This led to more expanded sampling and it was later found in 10 other California counties (Contra Costa, Los Angeles, Marin, Monterey, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz and Solano). Following the confirmed detection of LBAM in California, officials initiated an emergency control program, including domestic and international quarantines and inspection programs. Monitoring in Colorado was also initiated to determine if it has spread to this state.

The caterpillar stage of the light brown apple moth is a type of leafroller that chews on leaves and developing fruit. It has an extremely wide host range, being recorded to feed on over 1000 different plant species. It attacks nearly all types of fruit crops, ornamentals, vegetables, glasshouse crops, and occasionally even young pine seedlings. Some woody plant hosts it may feed on that occur in Colorado are apple, peach, cherry, rose, grape, oak, willow, walnut, poplar, and cottonwood. Among the herbaceous hosts are corn, pepper, tomato, pumpkin, beans, cabbage, alfalfa, and clover. It was estimated that in Australia LBAM causes AU\$21.1 million annually in lost production and control costs, or about 1.3% of gross fruit value, for apples, pears, oranges and grapes.

Because of its potential pest importance many countries have specific regulations to prevent LBAM introduction. As a regulated pest, many plant products grown in LBAM-infested areas are restricted or prohibited in certain commerce. Were the light brown apple moths to become established in Colorado other states would likely impose restrictions on the movement of potentially infested fruits, vegetables and nursery stock. These restrictions could seriously impact the marketing of agricultural products from Colorado.

A primary purpose of light brown apple moth monitoring is to determine if the moth is - or is not - present in Colorado. If populations are detected then targeted efforts to eradicate it may be implemented.

Methods to Monitor Light Brown Apple Moth in Colorado

The primary method used to detect light brown apple moth involves a sticky trap with a pheromone lure attractant. The specific lure used for LBAM is a 95:5 mixture of (E)-11-tetradecenyl acetate: (E,E)-9, 11-tetradecadienyl acetate, which mimics the sex pheromone produced by the female. Males, but not females, are strongly attracted to this lure.

Identification of Light Brown Apple Moth

(Largely extracted directly from <http://www.hortnet.co.nz/key/keys/info/lifecycle/lba-desc.htm>)

Light brown apple moth adults (Figures 1, 2 and 3) have varied body coloration and can be difficult to separate from other leafrollers and similar species. LBAM male adults have a forewing length of 6-10 mm. Coloration varies from a uniform light brown, with almost no distinguishing markings, to the typical oblique markings of the male coloration. These appear as a light-brown area at the wing base distinguishable from a much darker, red-brown area at the tip. This marking is not always present in males and females are uniformly light brown. Females are slightly larger with a forewing length of 7-13 mm. Hindwings of both sexes are a uniform or mottled, pale brown, but are hidden beneath the folded forewings when the adult is at rest. The length of the resting moth is about half the wingspan.

Eggs of all leafroller species are laid in rafts or batches of 2-170, usually on the upper surface of host plant leaves. The eggs are flat, and with a pebbled surface. They overlap each other within the raft to form a smooth mass. This makes it difficult to distinguish the eggs from the surrounding leaf surface. Eggs of light brown apple moth are approximately 0.7 mm by 1.0 mm. They are initially white to pale green and change to a paler yellow green as they develop. Prior to hatching the dark head of the developing caterpillar is visible through the egg wall, giving the egg batches a blotchy or speckled appearance.

Larvae (caterpillars) of the light brown apple moth (Figure 4) are difficult to distinguish from the leafroller caterpillars found in Colorado. Newly hatch larvae are only about 1.5 to 2.0 mm long with a dark brown head. Older caterpillars have light fawn-colored head and dark area (prothoracic plate) behind the head. The final stage caterpillars range from 10 to 18 mm in length. The body of a mature larva is medium green with a darker green central stripe and two side stripes. This green longitudinal striping may be helpful in distinguishing light brown apple moth caterpillars from the other (native) leafrollers.



Figure 4. Light brown apple moth larva. Photo courtesy of USDA

Diagnosis of Light Brown Apple Moth Injury

Light brown apple moth is a typical member of the leafroller family (Lepidoptera: Tortricidae). Damage is caused by the caterpillar stage that chews leaves, buds, and developing fruit. The developing caterpillars characteristically web together the area around where they feed often making a shelter of folded leaves held together with silk.

The type of injury depends on where the caterpillars settle to feed. Young stages often feed on leaves and produce injuries that may not extend completely through the leaf (i.e., skeletonizing or window pane injuries). More generalized leaf feeding occurs with later stage

larvae. Leaf bud feeding can damage several leaves prior to emergence; flower bud feeding may result in bud abortion. Chewing on developing fruit will produce gouging that later result in surface scars. Some silk will be visible around the feeding site where caterpillars are active. Several leafrollers already established in Colorado cause similar injuries.

Colorado Insects of Habits and Appearance Similar to Light Brown Apple Moth

The light brown apple moth is most likely to be mistaken for another leafroller species and there are scores of leafrollers (Lepidoptera: Tortricidae) present in Colorado. It is yet unknown whether any of these are likely to be attracted to a pheromone trap baited with the lure incorporating the LBAM sex pheromone, although there likely may be attraction with some. Consequently, any captures of leafroller moths in such traps that have a generally similar appearance to Figures 1-3 should be forwarded through Colorado State Extension offices for further identification.

Adults of all the leafrollers are roughly similar in size and have a similar shape to the wings, with a rather broad forewing. Wing patterning does vary among species and the majority of Colorado leafrollers have markings that are clearly different from LBAM. However, many species have patterning that is not greatly different and markings of all moths become difficult to distinguish when scales are rubbed off or the moths remain for long periods in a sticky trap.

All have caterpillar stages that produce some silk around the feeding site and many cause injury to the same plants. All have a dark head and dark area behind the head, but in many the head color is darker than that of light brown apple moth caterpillars. Patterning on the body of the larvae may be useful to distinguish some caterpillars.

Some of the more common leafrollers present in Colorado include the following:

Obliquebanded leafroller (*Choristoneura rosaceana*). Probably the most likely leafroller to be captured in pheromone traps with the LBAM pheromone is the obliquebanded leafroller (Figure 5 – adult and Figure 6 – larva). It is a common insect in Colorado and the pheromones are fairly similar, so there may be significant cross-attraction. Adults have reddish-brown forewings that are crossed by 3 oblique, chocolate-brown bands; this feature should allow it to be distinguished from LBAM. The hind wings of both sexes, which are not visible when the moth is at rest, are pale yellow. Members of the rose family are preferred hosts for the obliquebanded leafroller larvae including apple, pear, cherry, plum, peach, rose, raspberry, blueberry, gooseberry, currant and strawberry.



Figure 5. Obliquebanded leafroller. Photo courtesy of Cheryl Moorehead



Figure 6. Obliquebanded leafroller larva. Photo courtesy of the Ken Gray collection

Fruittree leafroller (*Archips argyrospila*). Fruittree leafroller (Figure 7 – adult and Figure 8 – larva) is usually the most common leafroller found in yards and gardens in Colorado. It has a very wide host range that include not only most fruit but also many commonly grown ornamental trees and shrubs. (These include apple, apricot, cherry, pear, plum, prune, raspberry, currant, English walnut, ash, boxelder, elm, locust, oak, poplar, willow and rose.). The adult is 13-20 mm long with a wing span ranging from 19 to 23 mm (females) to 14 to 19 mm (males). The front wings are rusty brown or fawn in color and mottled with silver-gray or pale gold. Usually these form two large patches on the front margin of each wing and a prominent light triangular spot on the outside edge of the wing. Wing marking features should be sufficient to distinguish fruittree leafroller from light brown apple moth.



Figure 7. Fruittree leafroller. Photo courtesy of the Ken Gray collection



Figure 8. Fruittree leafroller larva. Photo courtesy of the Ken Gray collection

Uglynest caterpillar (*Archips cerasivorana*). Unlike most leafrollers - and LBAM - the caterpillars of *A. cerasivorana* feed in groups, producing a fairly large messy nest of silk mixed with bits of leaves and insect frass (Figure 9). The adult *A. cerasivorana* moth has dull orange-colored wings that are marked with irregular dark brownish spots and may contain faint bluish bands. The hindwing, which is not seen when the moth is at rest, is yellow with some orangish shading. Chokecherry is the most common host of this insect in Colorado.



Figure 9. Uglynest caterpillar.

Oak leafroller (*Archips semiferrana*). The oak leafroller mines buds then ties together leaves of Gambel oak and some other shrubs in Colorado, occasionally occurring in outbreak numbers. The adult moth is 12-13 mm long and has a wingspan of 18-22 mm. The basic color is brown mottled with dark brown markings. However, the forewing may vary in color and range from creamy brown at the base to gray at the tip. Midway down the wing is a distinct dark brown or gray oblique band across the wing.



Figure 10. Oak leafroller adult. Photo courtesy of James Hanson.

***Xenotemna pallorana*.** *Xenotemna pallorana* (no common name) is a native leafroller moth that usually feeds on herbaceous perennials. Adults are 15-17 mm long and dull yellow (straw) in color. Primary hosts of *X. pallorana* are legumes (alfalfa, sweetclover) but it is occasionally recorded to feed on various fruit trees.

Western spruce budworm (*Choristoneura occidentalis*). *Choristoneura occidentalis* is considered to be the most broadly distributed and destructive defoliator of coniferous forests in Western North America. Adult moths (Figure 12) are slightly larger than LBAM (12-13 mm). Both sexes of *C. occidentalis* can fly and are similar in appearance. Western spruce budworm adults normally are small, mottled, rusty-brown moths, but color can vary from tan to almost



Figure 11. Western spruce budworm adult. Photo courtesy of USDA-FS.

black. They generally have a prominent white dot on the wing margin. In Colorado, they are present from late June to early August and Douglas-fir is their preferred host. It is covered in Colorado State Extension Fact Sheet 5.543. (The link to this sheet is <http://www.ext.colostate.edu/PUBS/INSECT/05543.html>).

Ponderosa pine budworm/Sugar-pine tortrix (*Choristoneura lambertiana*).

Choristoneura lambertiana is a common pest of ponderosa pine in Colorado. It is closely related to the western spruce budworm and is known to some foresters as the sugar-pine tortrix and/or pine budworm. *C.*

lambertiana adults are small moths, mostly golden, with wingspans of about 19 mm (Figure 12). This moth is restricted to pine forest areas and is covered in Colorado State Extension Fact Sheet 5.567. (The link to this sheet is

<http://www.ext.colostate.edu/PUBS/INSECT/05567.html>).



Figure 12. Ponderosa pine budworm adult. Photo courtesy of Bernard Raimo.