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## Pest risk evaluation of propagative material for light brown apple moth (LBAM): can they be exempted?

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## **BACKGROUND**

From the time light brown apple moth, *Epiphyas postvittana*, was discovered in California in 2006, APHIS and the California Department of Food and Agriculture (CDFA) have taken steps to prevent its spread by implementing the *E. postvittana* Federal Domestic Quarantine Order (APHIS, 2007). This Federal Order defines quarantine areas and restricts the movement of numerous agricultural commodities.

For some of the regulated articles, the likelihood of spreading *E. postvittana* may be sufficiently low to justify exempting these articles from the quarantine based the nature of the article and specific industry practices.

Previous Plant Protection and Quarantine (PPQ) documents (APHIS, 2012a, 2012b, 2013) have led to the exemption of several commodities from the Light Brown Apple Moth (LBAM) program requirements. The current document is in response to a request from the California Association of Nurseries and Garden Centers to exempt propagative material from all intrastate regulatory requirements contained in Title 3, Division 4, Chap. 3, Sect. 3434 *E. postvittana* Interior Quarantine (CANGC, 2015).

## **SCOPE**

The request for exemption defines propagative material as commercially produced:

seedlings, bulbs, divisions, unrooted cuttings, rooted cuttings or plants in tissue culture that are produced for the sole purpose of selling to nurseries for growing on to a larger size

The request also indicates that cuttings are from 6-10 cm in size. This assessment only applies to propagative material as defined above and not greater than 10 cm in height. Therefore, any exemptions resulting from this risk assessment should apply to only material that meet the above definition, and not to all plants grown for retail sale.

It has already been established that the consequences of introducing LBAM to new areas of the United States may be unacceptable, so this document will focus only on the likelihood of introduction. This document considers the critical points for noticing and taking action against light brown apple moth in its developmental stages, and investigates the potential for this pest to move with commercially produced propagative material to nurseries, taking into account standard nursery practices.

## **ANALYSIS**

Light brown apple moth females deposit eggs in a mass on the upper surfaces of all smooth-leaved host plants. Each egg mass may contain an average of 35 eggs, overlapping like fish scales, arranged in an oval shape less than 1 cm in diameter lengthwise. Egg masses are light green when first deposited and can be easily overlooked on green leaves. As the embryos develop over 5-7 days, the eggs take on an orange hue and the head capsules of larvae can be seen as a black dot inside of each egg. After hatching, the egg mass appears white and is much more easily noticed on a leaf (Danthanarayana, 1975).

After hatching, larvae move away from the egg mass by crawling and often by spinning down on a silken thread to reach other leaves on the same plant or be carried on drafts to other plants. Once they have settled, larvae create a silken nest, usually on the underside

of the leaf or near a leaf midrib (Danthanarayana, 1975). The first instar larvae are small and can easily go unnoticed unless a careful inspection is being carried out. At temperatures from 18-22<sup>o</sup> C, total larval development can take from 20-30 days (Danthanarayana, 1975). Larger larvae are much easier to detect because of their habit of folding leaves or webbing leaves together, and also through plant damage.

Pupation generally occurs inside of the nests (folded leaf, cluster of leaves webbed together, or leaf webbed to fruit), and generally takes from 7-30 days depending on host and temperature (Danthanarayana, 1975). The leaf shelters would be easy to notice on small plants. Adult moths emerge from the pupae, mate, and then the cycle repeats.

The key factors limiting the risk of light brown apple moth from moving with propagative material as defined in the scope of this document are a) moth prevalence in the growing plants, b) integrated pest management practices in place, and c) the diligence of producers in checking that no larvae are present on plants being shipped.

**Moth prevalence in the growing plants** - Screened facilities prevent moths from ovipositing on plant material. Many plants are grown exclusively in screened facilities and would be at low risk for light brown apple moth. Plant material with leaves that are grown outside offer moths a target on which to oviposit. Caterpillars and beetles are very infrequent pests in propagative nurseries, but can be a problem at certain times of the year. For example, leafrollers are rarely encountered except on chrysanthemums and petunias in the spring (Wright, 2016, personal communication). Among leafrollers, light brown apple moth appears to be expanding the area in which it is present in California, but populations themselves are either declining or staying the same (Bürgi et al., 2011) and are being controlled to some extent by predators or parasites (Bürgi and Mills, 2014).

Ornamental plants are grown for their aesthetic value to consumers who have a minimal tolerance for pest and disease damage (Li et al., 2011). Growers are aware of pest risk and practice integrated pest management where necessary to keep pest populations at a minimum (Wright, 2016, personal communication). Until egg masses hatch, they are difficult to see and would likely go undetected in many cases. Once the egg masses hatch, they are white and are easily detected. The presence of a hatched egg mass would signal producers to look more closely for larvae and take appropriate action. Larvae in the first week of development are very small and feed chiefly on the underside of leaves (Danthanarayana, 1975). First instar mortality ranges from ca. 8 to 90 percent (Danthanarayana, 1983).

**Larval presence on the shipped commodity** –All plants are examined individually as they are packed for shipping (Wright, 2016, personal communication). The smaller the plant, the easier it is to notice the signs of larval presence. The request specified that cuttings are quite small (6 - 10 cm) (CANGC, 2015) and a visual search would likely reveal feeding larvae. Plants without leaves such as bulbs are not at risk for larvae at all.

**Establishment of new populations** – Field populations are typically low or non-existent in nursery production (Wright, 2016, personal communication) and the plants are small and inspected at packing (CANGC, 2015) so the potential number of infested plants that would be shipped is quite low. For a population to become established through the movement of propagative material, multiple larvae would have to be moved to the same

place, grow to adulthood and mate to begin a new generation. While not impossible, this scenario is highly unlikely in commercial production.

## RECOMMENDATION

Because of low incidence of leafrollers in commercial nursery operations and the high quality demanded of the industry, it is unlikely that populations of light brown apple moth would be moved with small commercial propagative cuttings. We recommend exempting all bulbs and tissue cultivated plantlets as defined in this assessment (see Appendix) from all intrastate regulatory requirements contained in Title 3, Division 4, Chap. 3, Sect. 3434 *E. postvittana* Interior Quarantine. We further recommend exempting callused vegetative cuttings, seedlings, divisions, unrooted vegetative cuttings, callused vegetative cuttings, rooted vegetative cuttings, as described in the Appendix of this document, from the quarantine, under condition that the plants do not exceed 12 cm in height.

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## APPENDIX

### Propagative material considered for exemption

**Bulbs:** a resting stage of a plant (such as lily, onion, hyacinth, or tulip) that is usually formed underground and consists of a short stem base bearing one or more buds enclosed in overlapping membranous or fleshy scales. Bulblike structures include corms, rhizomes, tubers and tuberous roots. Bulbs normally ship in a dormant stage.

**Callused vegetative cuttings are:** unrooted cuttings grown in a rooting medium long enough for the root callus to begin growing, then removed from the rooting medium, packaged and shipped. Root callus formation can take between five days and four weeks, depending on the type of plant and the growing conditions.

**Tissue cultured plantlets are:** vegetative plant cell tissue or meristematic tissue, produced under sterile and sealed conditions in a liquid or gel agar medium. This process may take between two and six months to produce a stage 3 plantlet. These sterile plantlets are then planted into a liner tray for another six to twelve weeks before they are ready to be shipped.

**Seedlings:** a young plant sporophyte that develops out of a plant embryo from a seed. This process may take between two weeks and six months before the young plants are ready for shipping.

**Divisions:** produced from clumping types of plants that are manually separated into individual plants, cleaned and trimmed. Roots and leaves are normally still attached but trimmed short. Flowers are usually removed. A division may be planted in rooting medium and allowed to grow for three to twelve weeks before shipping or it may be packed and shipped immediately as a bare root division.

**Unrooted vegetative cuttings may be:** whole or partial leaves; stems with or without leaves attached; stems with or without the new growing points attached. Flowers are normally removed from vegetative cuttings. These cuttings may be freshly harvested just before shipping or stored for several days or several weeks in a cool and dry environment before shipping.

**Callused vegetative cuttings are:** unrooted cuttings grown in a rooting medium long enough for the root callus to begin growing, then removed from the rooting medium, packaged and shipped. Root callus formation can take between five days and four weeks, depending on the type of plant and the growing conditions.

**Rooted vegetative cuttings are:** unrooted cuttings that are grown in a rooting medium long enough for new roots to grow and support the young plant and fill the container that it is growing in. The time to grow a mature rooted cutting can range from three weeks to twelve weeks, depending on the type of plant and the cultural conditions.