



## **RMD-22-01: Risk management document – proposed amendments to risk management of light brown apple moth (*Epiphyas postvittana*)**

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### **Preface**

As described by the International Plant Protection Convention (IPPC), Pest Risk Analysis (PRA) includes three stages: initiation, pest risk assessment and pest risk management. Initiating the PRA process involves identifying pests and pathways of concern and defining the PRA area. Pest risk assessment provides the scientific basis for the overall management of risk. Pest risk management is the process of identifying and evaluating potential mitigation measures which may be applied to reduce the identified pest risk to acceptable levels and selecting appropriate measures.

This Risk Management Document (RMD) includes a summary of the findings of a pest risk assessment and records the pest risk management process for the identified issue. It is consistent with the principles, terminology and guidelines provided in the [IPPC standards for pest risk analysis](#).

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## Executive summary

*Epiphyas postvittana*, commonly referred to as light brown apple moth (LBAM), is a regulated pest in Canada. In 2007, the Canadian Food Inspection Agency (CFIA) introduced an import program for *E. postvittana* that included phytosanitary requirements for host articles from countries where the pest occurred. Plant protection directive [D-07-03: Phytosanitary Import Requirements to Prevent the Entry of \*Epiphyas postvittana\* \(light brown apple moth\)](#) remains in effect, and the pest is absent from Canada.

In December of 2021, the United States Department of Agriculture’s Animal and Plant Health Inspection Service (USDA-APHIS) announced the deregulation of *E. postvittana*. In response to USDA-APHIS’ action

to deregulate *E. postvittana*, the CFIA committed to analyzing the risk posed by the pest, including the phytosanitary requirements intended to prevent its introduction to Canada.

An important pest in its native eastern Australian range, *E. postvittana* has successfully invaded and established in new areas, including New Zealand, Hawaii, the United Kingdom and most recently the State of California, United States. Once established, the impact of *E. postvittana* has varied. In New Zealand and the United Kingdom, *E. postvittana* has become one of the most abundant micro-lepidopteran species. In California, the pest is reported to be controlled using standard pest management practices targeting routine pests of crops. In contrast, the United Kingdom reports damage in commercial cherry and plum production where insecticides are not available, or not used for control of related pests.

CFIA pest risk assessments conclude that establishment of the pest in parts of British Columbia is highly probable. Introduction of the pest to British Columbia may lead to economic consequences for producers of fresh fruit, vegetables and ornamentals, as well as disruption to trade in those commodities. Urban landscape plants are also expected to be impacted by larval feeding.

Two options for managing the risk to Canada posed by *E. postvittana* were considered practicable and the approach recommended by the CFIA is to continue regulating the pest by applying phytosanitary import requirements to commodities that present the greatest risk of introducing the pest to Canada. The CFIA's recommended approach is intended to delay the introduction of the pest to Canada.

## Purpose

The purpose of this document is to communicate pest risk management considerations for *E. postvittana* and present proposals for managing that risk in Canada.

## Scope

This risk management proposal includes a summary of the CFIA's pest risk assessments on *E. postvittana* and presents two proposals for managing the risk associated with the pest in Canada under the authority of the *Plant Protection Act*.

Information pertaining to import requirements for specific plants or plant products may be obtained from the [Automated Import Reference System](#).

## Definitions, abbreviations and acronyms

Definitions of terms used in this document can be found in the [International Standard for Phytosanitary Measures 5: Glossary of phytosanitary terms](#) or [Plant Health Glossary of Terms](#).

*Epiphyas postvittana* is commonly referred to as light brown apple moth, apple leaf roller, Australian leaf roller and pyrale brun pâle de la pomme (in French).

## Background

*Epiphyas postvittana* was first detected on the North American continent in Berkeley, California, United States in 2006. The first findings were of two male moths in a blacklight trap placed in an urban area. USDA-APHIS confirmed detections of the pest in 2007 (Brown et al. 2010). Later that year, APHIS and the California Department of Food and Agriculture (CDFA) began an eradication program intended to eradicate the pest from California and prevent further spread (USDA-APHIS 2021).

At the time of the first detection of *E. postvittana* in California available science indicated that the pest would have a significant economic impact on North American agriculture. The west coast of North America, including British Columbia, as well as much of the southwest, southern and eastern US up to 40-42°N, were considered suitable for establishment of the pest (Lozier and Mills 2011).

Effective June 25, 2007, the CFIA implemented a phytosanitary import program, plant protection directive [D-07-03: Phytosanitary Import Requirements to Prevent the Entry of \*Epiphyas postvittana\* \(light brown apple moth\)](#), intended to prevent the introduction of the pest to Canada from the State of California and other origins where *E. postvittana* occurred at the time (CFIA 2007). Prior to the publication of directive [D-07-03](#), phytosanitary import requirements were applied to some fresh fruit commodities from countries where *E. postvittana* had been reported.

Evidence of *E. postvittana* spread by commercial trade is available in international interception records. Establishment of populations in new areas is thought to have resulted from trade in infested nursery stock, providing additional technical justification for the phytosanitary measures that were applied by Canada.

In the years that followed, the impact of the pest in California began to diverge from the impact predictions that had been developed based on available science. USDA-APHIS began to exempt commodities from the scope of their regulatory program as new science on the pest's impact in California became available. Subsequent exemptions of commodities culminated in the reclassification of *E. postvittana* as a non-quarantine pest for the United States in December, 2021 (USDA-APHIS 2021). Since the original publication of plant protection directive [D-07-03](#) in 2007, the CFIA has published 10 revisions with the intention of minimizing the impact of the phytosanitary import requirements, while also maintaining an appropriate level of risk mitigation for a pest regulated by Canada.

In addition to the import requirements applied to the United States to prevent the introduction of *E. postvittana*, the CFIA also regulates commodities imported into Canada from other origins where the pest occurs.

## **Pest risk assessment summary**

The CFIA conducted multiple assessments on various aspects of *E. postvittana* biology, pathways for introduction and potential impact over the past 25 years (1997-20, 2007-013, 2007-016, 2007-023, 2008-024, 2010-005, 2011-054, 2014-045, 2015-013, 2017-042, 2018-043, 2018-120, 2021-111). The following subsections summarize the findings of those assessments with emphasis placed on the most up-to-date information.

Biology and ecology

*Epiphyas postvittana* is a species of moth belonging to the lepidopteran family Tortricidae, commonly known as tortix or leafroller moths. Larval (caterpillar) stages of *E. postvittana* feed on a wide variety of plants by constructing nests with webbing that incorporate plant tissue which the developing larvae feed on. Older larvae may form their feeding niches by binding various plant parts, including clusters of fruit, together with webbing to create nests. Damage to fruit is typically visible to the naked eye due to the presence of webbing and the accumulation of frass. Less frequently, damage may be inconspicuous, such as when larvae bore into the calyx end of apples and pears or the stem end of citrus fruits.

The number of annual generations of *E. postvittana* varies with latitude within its range in New Zealand. There is considerable overlap between generations, with development driven by temperature and the larval host plant. In northern New Zealand four generations are completed annually, while only two generations are completed on the southern end of the North Island. In Australia, the number of generations varies from three to four, with three occurring in most areas. In the United Kingdom, there are two generations per year, with more generations expected in future years as a result of climate change. Larval development has five to six instar stages. There is no winter resting stage (diapause), although overwintering larvae tend to develop slowly, with a lower threshold of development for all stages of 7.5°C and an upper threshold of 31°C. Larvae overwinter in prolonged phases of the second, third and fourth instars typically feeding on herbaceous plants and shrubs. Pupation takes place within or near the last nest.

#### Pathways for introduction and spread

*Epiphyas postvittana* is highly polyphagous. Any above-ground plant part originating from an area where the pest occurs could theoretically carry eggs, larvae and pupae in international trade. The pest's broad host range has likely contributed to it becoming one of the most abundant micro-lepidopteran species in New Zealand and the United Kingdom.

Pest interception data from a variety of international sources indicates that the pest has been detected in association with cut flowers, live plants, as well as fresh fruit and vegetables (including, but not limited to apples, blueberries, grapes, peaches, pears and strawberries) moving in international trade. The United States reports that the main source of interceptions of *E. postvittana* was personal effects of international airline passengers. Introductions of the pest to new areas, for example New Zealand and the United Kingdom, are reported to have resulted from nursery stock moving in international trade (CABI 2022).

Once established in a new area, local spread has been documented, although the rate of that spread is relatively low. The natural rate of spread of *E. postvittana* appears to be less than 1 km per generation due to the limited flight abilities of females (Suckling et al. 2014). Larvae may also disperse by ballooning. For example, it took many decades for *E. postvittana* to spread throughout the UK and for signs of damage to be recognized. Similarly, 15 years after first being reported in California, *E. postvittana* has not invaded neighbouring states that, based on modeling, have climates suitable for establishment of the pest. However, the efforts of regulatory bodies to manage the pest, especially in California, have likely impacted the rate of natural and human-mediated spread. In the absence of any regulatory controls now that the pest has been deregulated in the United States, *E. postvittana* is expected to disperse naturally to the states of Oregon and Washington, and eventually the province of British Columbia. The establishment of new populations of *E. postvittana* in the United States closer to British Columbia's border would serve to accelerate the timeline for introduction to Canada. For

example, *E. postvittana* was first reported from Polk County, Oregon in 2010, with additional trap captures in 2015 and 2016. Murray and Jepson report that an eradication program is underway in Oregon (Murray and Jepson 2019).

### Suitability of the environment and availability of hosts

Based on the results of modeling, CFIA's most recent risk assessments predict that establishment of *E. postvittana* is highly probable along the entire western coast of British Columbia, including Vancouver Island. The pest is currently expected to be able to establish in the lower two-thirds of the Fraser River Valley, and will likely be able to extend its range to cover the entire valley. Climate matching models indicate that other parts of Canada, including the Avalon Peninsula of Newfoundland, southern Nova Scotia, as well as the interior valleys of British Columbia are potentially suitable for establishment. However, models that take into consideration the biological characteristics of the pest suggest that those areas may not be suitable.

The availability of suitable host plants throughout the year along the entire west coast of British Columbia further supports that British Columbia is most obviously at risk of establishment.

Greenhouses and other protected environments throughout Canada are also at risk of invasion by *E. postvittana*. Biosecurity measures employed by growers and propagators, including scouting, removal of infested plant parts, release of beneficial insects and the application of pesticides are effective against the pest. Those interventions could help to reduce the impact of *E. postvittana* in a greenhouse, but they may be impractical, costly, or disruptive.

### Potential economic and environmental consequences

Economic damage to crops results from feeding by the larval stages of *E. postvittana* which may destroy, stunt or deform young seedlings; spoil the appearance of ornamental plants; and injure deciduous fruit-tree crops, citrus and grapes. Damage to fruit is typically superficial, although larvae will sometimes tunnel into fruit. Both types of damage are typically considered defects reducing the value of the fruit. Severe damage has been reported in grape production when larval feeding damage allows rot organisms to infect berries.

As of 2007, losses in Australia due to *E. postvittana* were estimated to be of the order of AU\$21M per annum across a range of industries. A pest profile for *E. postvittana* published on the CDFA's website, which is assumed to have been published in the mid-2000's, reports that lost production and control costs in California alone could be \$133 million annually (CDFA 2022). More recently, USDA-APHIS reports in Federal Order DA-2021-29 that "the moth's impact was not as significant as expected."

A recent study by Mills (2021) using *E. postvittana* as a model correlates CLIMEX model output with larval density in a given area. The findings of the study suggest that the levels of harm, which are assumed to be proportional to larval abundance, seen in California are not typical of the moth. Harm levels are expected to increase as the moth spreads northwards through the Pacific Northwest into British Columbia, where environmental conditions are more favourable. When the methodologies employed by Mills are applied to southern British Columbia, population levels and the resulting harm caused by *E. postvittana* is expected to exceed that seen in California by a measurable margin. In the United Kingdom where predicted levels of harm are greater than those predicted for southern British

Columbia, the pest is reported to be a “sporadic pest” of apples, that can generally be controlled by insecticidal sprays targeting codling moth and other tortricid pests. The pest more often causes damage to cherry and plum because insecticides that are active against other caterpillar pests are not used on cherry and plum in the United Kingdom (Agriculture and Horticulture Development Board 2021).

There is no potential for the moth to degrade the environment, to alter the composition of ecosystems, to cause human or animal health problems, or to have an adverse sociological impact; none of these things has happened where this insect occurs, including areas where *E. postvittana* has been introduced.

In New Zealand, where *E. postvittana* is common in gardens and unsprayed horticultural crops, it also feeds on many escaped or weedy host plants, including gorse (*Ulex europaeus*) and broom (*Cytisus scoparius*). Both gorse and broom are considered invasive species in southern, coastal British Columbia after being introduced as landscaping plants. *E. postvittana* is expected to be a pest of urban landscape plants in the at-risk areas of British Columbia.

Overall, the impact resulting from the introduction of *E. postvittana* to Canada are considered low, but not negligible.

## Risk management considerations

### Standards of the International Plant Protection Convention

International Standard for Phytosanitary Measures 5 (ISPM 5) defines a quarantine pest as a pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled (IPPC 2022a). *E. postvittana* has never been reported from Canada. Specific and general surveillance performed by the CFIA has not detected the pest. Further, community science platforms contain no records of *E. postvittana* detections in Canada.

*Epiphyas postvittana* satisfies the criteria of being not present in Canada and being of potential economic importance.

International Standard for Phytosanitary Measures 1 (ISPM 1) describes phytosanitary principles for plant protection that are embodied in the International Plant Protection Convention (IPPC 2016). Among the principles listed in the standard are managed risk, minimal impact, and technical justification. These principles necessitate regular review of import programs based on new information about pests and their potential impact.

### Potential for management of the pest

Belonging to the family Tortricidae, *E. postvittana* is one of many leafroller moths that threaten Canada’s resource base. Both native leafrollers, such as *Grapholita packardi* (cherry fruitworm), and exotic (introduced) leafrollers, such as *Cydia pomonella* (codling moth), are present in Canada and require management under certain circumstances to prevent damage to growing points and directly to fruit. The presence of other leafroller species in Canada may create direct competition for *E. postvittana*, serving to limit its impact. However, the establishment of *E. postvittana* in Canada may serve to complicate, or render ineffective, efforts to control important pests that are already present.

One such example of a management program for a plant pest is the Okanagan-Kootenay Sterile Insect Release (OKSIR) Program. Established in 1992, the OKSIR program is reported to have achieved a 90% reduction in overall codling moth levels. As a result of reducing codling moth populations in this important fruit-producing area, the SIR program reports a 96% reduction in the amount of pesticide used against codling moth (OKSIR 2022b). Should *E. postvittana* be introduced to this area, the result could be an increased need for the application of insecticides.

### Feasibility of eradication

Eradication of a polyphagous leafroller is generally considered a difficult and costly undertaking. There are examples of successful eradications of leafrollers from North America, for example the eradication of Oriental fruit moth (*Grapholita molesta*) from BC in 1960 (OKSIR 2022a). However, a more recent attempt at eradicating *E. postvittana* from the State of California was not successful. Due to the cost and difficulty of eradication, it is most effective to prevent the introduction of *E. postvittana* by applying technically justified phytosanitary measures.

### Natural enemies

At the time of establishing the CFIA's *E. postvittana* import program, it was noted that no natural enemies of the pest were known to occur in North America (CFIA 2007). Studies conducted in California following the introduction of *E. postvittana* identified a variety of parasitoids of *E. postvittana* eggs, larvae, and pupae, as well as predators of all life stages (Hogg et al. 2013; Wang et al. 2012). Continued research on this topic supports that parasitoids and predators that are already present in North America may suppress *E. postvittana* populations, but nonetheless did not prevent establishment of the pest or eradicate it completely.

### Risk of introduction

Introduction of a pest is defined as entry of a pest to an area where it is not present and leading to establishment. Establishment is further defined as perpetuation of a pest for the foreseeable future. Due to the biology of *E. postvittana*, plants for planting are the most likely pathway to lead to establishment. While it is also possible for *E. postvittana* to enter all areas of Canada in association with fresh fruits or vegetables for consumption, or fresh cut flowers for decorative purposes, it is less likely that *E. postvittana* would be able to establish in Canada via this pathway.

### Trade and economic impacts

*Epiphyas postvittana* is considered a quarantine pest for several countries (IPPC 2022b). Among those countries are trading partners where Canada has market access for horticultural commodities. The introduction of *E. postvittana* to Canada has the potential to impact export markets due to trading partners imposing phytosanitary requirements. In the United States where the pest is now considered non-quarantine at the federal level, no export impacts are anticipated. Further, no US state plant pest regulatory authorities have indicated that they intend to regulate *E. postvittana* in their territory.

Direct and indirect economic impacts of the introduction of *E. postvittana* are difficult to predict. If introduced, federal and provincial resources would be required to investigate the infestation, and

develop and communicate control strategies. These activities may be necessary to ensure continued access to export markets. Producers of horticultural commodities could also be directly impacted when implementing pest management strategies.

## Pest risk management proposals

Two pest risk management proposals for *E. postvittana* are presented below. Both proposals include a description of how the CFIA's current *E. postvittana* import program would be modified, as well as associated pros and cons. Stakeholders will have an opportunity to provide comments on the proposals, which will be taken into consideration by the CFIA when making a risk management decision. Once a risk management decision has been finalized, this document will be revised to include information related to the decision and any resulting next steps for changes to import programs.

### Proposal 1 – Deregulation

Under this option *E. postvittana* would be removed from the list of pests regulated by Canada. All existing phytosanitary import requirements specific to *E. postvittana* would be removed.

#### Pros:

- no phytosanitary import requirements specific to *E. postvittana* would be applied to regulated host articles

#### Cons:

- increased likelihood of *E. postvittana* being introduced to Canada earlier than would be expected through natural spread alone

### Proposal 2 – Redesign import program to focus on highest risk pathways

Under this option the CFIA would undertake a thorough revision of the existing import program for *E. postvittana*. This option differs from proposal 1 in that the CFIA would continue to regulate the pest, and all imports to Canada would be required to be free from the pest. Specific phytosanitary measures would be applied to commodity classes that present the greatest risk of introducing the pest to Canada. Phytosanitary import requirements would continue to be applied to commodities intended for planting, growing or propagation.

#### Pros:

- phytosanitary import requirements would provide a technically justified level of pest risk mitigation against *E. postvittana*
- phytosanitary import requirements would be aligned with the plant protection principles of minimal impact, technical justification, and equivalence, as outlined in ISPM 1
- phytosanitary import requirements would be applied consistently across all origins where the pest occurs

#### Cons:

- imported consignments would continue to be required to meet phytosanitary import requirements, for example a phytosanitary certificate or other documentation. However, there would be a reduction in the scope of requirements applied to imported articles compared to those currently described in [D-07-03](#)

## Recommended approach

*Epiphyas postvittana* is currently absent from Canada. If introduced to Canada, *E. postvittana* is expected to cause economic impacts that could otherwise be delayed using the regulatory tools afforded by Canada's *Plant Protection Act* and *Regulations*. While the CFIA's plant protection directive [D-07-03](#) has successfully contributed to preventing the pest from establishing in Canada, the level of pest risk mitigation may not be aligned with plant protection principles of minimal impact and technical justification. The CFIA recommends proceeding with Proposal 2 – Redesign import program to focus on highest risk pathways.

## References

- Agriculture and Horticulture Development Board. 2021.** Apple Best Practice Guide. [Online] Available: <https://apples.ahdb.org.uk/light-brown-apple-moth/> [May 5, 2022].
- Brown, J. W., Epstein, M. E., Gilligan, T. M., Passoa, S. C. and Powell, J. A. 2010.** Biology, Identification, and History of the Light Brown Apple Moth, *Epiphyas postvittana* (Walker) (Lepidoptera: Tortricidae: Archipini) in California: An Example of the Importance of Local Faunal Surveys to Document the Establishment of Exotic Insects. *American Entomologist* 56(1):34-43.
- CABI. 2022.** Crop Protection Compendium. [Online] Available: <https://www.cabi.org/cpc>.
- CDFA. 2022.** Light Brown Apple Moth Pest Profile. [Online] Available: [https://www.cdfa.ca.gov/plant/pdep/target\\_pest\\_disease\\_profiles/LBAM\\_PestProfile.html](https://www.cdfa.ca.gov/plant/pdep/target_pest_disease_profiles/LBAM_PestProfile.html) [May 5, 2022].
- CFIA. 2007.** Canadian Food Inspection Agency Introduces New Regulatory Controls to Prevent the Introduction of Light Brown Apple Moth. [Online] Available: <https://www.canada.ca/en/news/archive/2007/06/canadian-food-inspection-agency-introduces-new-regulatory-controls-prevent-introduction-light-brown-apple-moth.html> [December 16, 2021].
- Hogg, B. N., Wang, X.-G., Levy, K., Mills, N. J. and Daane, K. M. 2013.** Complementary effects of resident natural enemies on the suppression of the introduced moth *Epiphyas postvittana*. *Biological Control* 64(2):125-131.
- IPPC. 2016.** ISPM 1 Phytosanitary principles for the protection of plants and the application of phytosanitary measures in international trade. FAO, Rome.
- IPPC. 2022a.** ISPM 5 Glossary of phytosanitary terms. FAO, Rome.
- IPPC. 2022b.** List of Regulated Pests. [Online] Available: <https://www.ippc.int/en/countries/all/regulatedpests/> [May 6, 2022].
- Lozier, J. D. and Mills, N. J. 2011.** Predicting the potential invasive range of light brown apple moth (*Epiphyas postvittana*) using biologically informed and correlative species distribution models. *Biological Invasions* 13(10):2409-2421.
- Mills, N. J. 2021.** Abundance–suitability relationships for invasive species: *Epiphyas postvittana* as a case study. *Biological Invasions* 23(7):2205-2220.
- Murray, K. and Jepson, P.** An Integrated Pest Management Strategic Plan for Hazelnuts in Oregon and Washington. [Online] Available: <https://catalog.extension.oregonstate.edu/em9223> [June 6, 2022].
- OKSIR. 2022a.** Pest Watchlist. [Online] Available: <https://www.oksir.org/the-pests/pest-watchlist/> [May 5, 2022].
- OKSIR. 2022b.** Program Benefits. [Online] Available: <https://www.oksir.org/the-program/program-benefits/>.

- Suckling, D. M., Stringer, L. D., Baird, D. B., Butler, R. C., Sullivan, T. E. S., Lance, D. R. and Simmons, G. S. 2014.** Light brown apple moth (*Epiphyas postvittana*) (Lepidoptera: Tortricidae) colonization of California. *Biological Invasions* 16(9):1851-1863.
- USDA-APHIS. 2021.** Federal Order Removal of the Domestic Quarantine for Light Brown Apple Moth DA-2021-29. [Online] Available: <https://www.aphis.usda.gov/aphis/newsroom/stakeholder-info/stakeholder-messages/plant-health-news/lbam-deregulation-spro-fo> [December 16, 2021].
- Wang, X.-G., Levy, K., Mills, N. J. and Daane, K. M. 2012.** Light Brown Apple Moth in California: A Diversity of Host Plants and Indigenous Parasitoids. *Environmental Entomology* 41(1):81-90.