

APHIS Animal and Plant Health Inspection Service

Cydalima perspectalis Box Tree Moth - An APHIS Overview

Ms. Judith Macias

USDA APHIS Plant Protection and Quarantine

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Agenda

❖ Biology

- Background
 - Scientific name
 - Key characteristics
- Distribution - world; North America
- Life Cycles (egg, larva, pupa, adult)
- Generations and flight
- Hosts
- Dormancy
- Development
- Damage
- Resources

❖ Box Tree Moth in Canada

❖ U.S. Regulatory Status of Box Tree Moth and²Hosts



Box Tree Moth (a.k.a. Box Tree Caterpillar)

- Scientific name: *Cydalima perspectalis*
- Older names: *Glyphodes perspectalis*, *Diaphania perspectalis*
- (Member of the grass-moth family, Crambidae)

Characteristics: 1-1/2” wingspan; body length - 3/4 inch; active after dark

- Adults have two color forms



Light form, common

Didier Descouens [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/)
Cydalima perspectalis MHNT
Imago.jpg



Brown form, 10 - 30% of moths

World Distribution

Native to temperate and subtropical regions of eastern Asia, including China, Japan, and the Korean peninsula

Present in the Russian Far East, likely spread with imported box trees

Invaded most European countries over the past 15 years; first detected in Germany and The Netherlands in 2007, but may have invaded those countries in 2005

Detected in Toronto, Ontario, Canada in 2018



World distribution in 2017

Box Tree Moth



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Life Cycle - Egg

- Eggs are laid at night in flat clusters of 10 - 30 on the underside of leaves.
- Yellow when fresh, developing brown stipples as the embryos develop.
- The black head becomes visible in the egg about a day before the caterpillar hatches.
- Eggs hatch in 3 - 6 days.



Colette Walter, www.schmetterling-raupe.de/art/perspectalis



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 Franie Bird RHS, www.ebts.org/box-moth-and-caterpillar
 W. Schön, www.schmetterling-raupe.de

Life Cycle - Caterpillar (larva)

- Larvae grow for in 2 - 3 weeks in spring and summer.
- Caterpillars spin webs around their feeding areas.
- Small larvae eat the underside of leaves, larger ones eat the leaf blades; the bark is eaten if leaves are gone.



Life Cycle *continued*

Caterpillar (larva)

- When fully grown (1.5" long), the larva spins a silk cocoon among leaves and becomes a pupa.
- In autumn, shorter day length and cooling causes caterpillars to become dormant.
- Larvae resume feeding in spring.



Life Cycle - Pupa

- The larva spins a white silk cocoon among leaves, and turns into a pupa, 1/2 - 3/4" long.
- At first, the pupa is green, tan, & black; it then turns brown, and lastly, the color of the adult moth shows through the skin.
- The adult emerges after 10 - 14 days.



Life Cycle - Adult

- Moths emerge and fly in spring, summer, and fall (typically, May to September in Europe).
- They fly, mate, and lay eggs during the night.
- Mating starts when moths are about a day old.
- Mating was reported in China to occur only once in a lifetime (this is unusual for moths & needs confirmation).
- Females begin laying eggs at age 2 - 3 days.
- A female can lay up to 450 eggs in her lifetime.
- Female life span is about 14 days, males live about 7 days.



Qflieger, *Cydalima perspectalis*
011997.jpg Wikimedia Commons

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Generations and flight

- Flight peaks in temperate climates occur around May, July, and August-September.
- These vary by climate. The first peak of adults is the overwintering generation.
- The next 2 or more generations have less distinct peaks because overlapping life stages are present.
- Up to 5 generations are possible in subtropical climate.

Reported Hosts



I, KENPEI CC BY-SA 3.0, Wiki

Holly plant family



Rainer Burkard CC BY-SA 3.0, Wiki

Boxwood plant family

Buxus spp.
(boxwoods)

*Ilex purpurea**
(purple-leaved holly)

*Euonymus japonicus**
(Japanese spindle plant)

*Euonymus alatus**
(burning bush)

*Confirmation needed

Euonymus plant family



Chris Barton/Gif absarnt CC BY-SA 3.0, Wiki



MPF CC BY-SA 3.0, Wiki

Other Potential Host Plants

Plant	Common name	Plant family	Species or relatives in N. America
<i>Rubus</i> species	Blackberries	Rose	Wild & cultivated
<i>Ruscus fruticosus</i> <i>Ruscus colchicus</i>	Butcher's broom	Asparagus	Wild & cultivated
<i>Smilax excelsa</i>	Green-briar, cat-briar	Smilax	Wild
<i>Murraya paniculata</i>	Orange jessamine	Citrus	Cultivated, a few wild
<i>Pachysandra terminalis</i>	Carpet box, Japanese spurge	Boxwood	Cultivated, a few wild
<i>Euonymus</i> spp.	Spindle tree	Bittersweet, Staff vine	Wild & cultivated
<i>Ilex</i> spp.	Holly	Hollies	Wild & cultivated

These are reported food plants but the ability of box tree moth to grow and complete its life cycle on these plants warrants further study.

Environmental Effects on Winter Dormancy

- When day length decreases in the fall to about 13.5 hours, and temperature falls below 68° F, caterpillars enter winter dormancy (diapause).
 - They spin a thick web between leaves and cease feeding.
 - During dormancy, they can withstand temperatures down to -22° F.
 - They must stay cold for 1.5 - 3.5 months to end the dormancy.
- In spring, caterpillars begin feeding again and complete their life cycle.
- (Moths in southern China may not require a cold period, but this needs to be confirmed)

Temperature Effects on Development and Activity

- Temperatures most suitable for survival: about 60 - 80° F
- Development stops below these thresholds:
 - Egg 52° F
 - Caterpillar 48° F
 - Pupa 53° F
- Above 86° F, the heat becomes detrimental to caterpillars, and development slows; death occurs at around 95° F.
- Lowest temperature for adult moth activity is unknown.

Damage

Caterpillars eat the leaf blades, leaving the hair-like mid-vein.

Continuous feeding during the growing season destroys new leaf growth and eventually kills the box tree.

After defoliating the plant, caterpillars will feed on the bark of branches and trunk, which further weakens the plant and provides entry for fungal infection.





Cydalima perspectalis (DPHNPE) - <https://gd.eppo.int>

Means of Long Distance Spread

- The female can fly up to 6 miles in her lifetime.
- However, the main means of spread is through movement of boxwood stock.



Online sources of information on Box Tree Moth

- <https://www.ebts.org/box-moth-and-caterpillar/> summarizes the biology and spread in Europe, and suggests some control methods
- <https://www.inspection.gc.ca/plant-health/plant-pests-invasive-species/insects/box-tree-moth/fact-sheet/eng/1552914498593/1552914498889>
- <https://www.cabi.org/isc/datasheet/118433>
- <https://landscapeontario.com/box-tree-moth-webinar-and-online-discussion>
provides an educational webinar led by a specialist with the Ontario Ministry of Agriculture, Food and Rural Affairs

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Box Tree Moth in Canada

- ▶ Box tree moth was first reported in Canada in 2018 in the Toronto neighborhood of Etobicoke, Ontario
- ▶ In 2019, a cooperative survey was conducted to determine the distribution of the pest
- ▶ The only positive detections of box tree moth were in the City of Toronto

Box Tree Moth in Canada

- ▶ Current detections have been restricted to established plants in the landscape
- ▶ Box tree moth has not been detected in commercial nursery settings
- ▶ Continued surveillance and monitoring are planned for 2020

Box Tree Moth in Canada

- ▶ It is our understanding that the Canadian Food Inspection Agency (CFIA) (Canada's National Plant Protection Organization) is still evaluating the situation and considering next steps

Regulatory Status of Box Tree Moth

- ▶ Box Tree Moth (*Cydalima perspectalis*) is not known to occur in the United States
- ▶ It is a regulated (or quarantine) pest
- ▶ If any live life stage of box tree moth is detected during the port of entry inspection of an imported commodity, a regulatory action would be required to mitigate the pest risk.

- ▶ Regulatory actions for shipments found to have live quarantine pests typically include:
 - ▶ Treatment of the shipment (if an approved regulatory treatment is available)
 - ▶ Re-export of the shipment
 - ▶ Destruction of the shipment

Import Status of Confirmed Hosts

- ▶ Importation to the U.S. of all propagules of *Buxus* spp., a confirmed host, is only allowed from Canada
- ▶ Importation to the U.S. of all propagules (except seeds) of *Buxus* spp. from other countries is prohibited under the category of Not Authorized Pending Pest Risk Analysis (NAPPRA).

U.S. Import Status of Reported/Unconfirmed Hosts

- ▶ The importation to the U.S. of all propagules, except seeds, of:
 - ▶ *Ilex* spp. from all countries except Canada and the Netherlands is prohibited under NAPPRA.
 - ▶ *Euonymus* spp. from Europe is prohibited under NAPPRA. Post entry quarantine is required for shipments from all other countries except Canada and Japan.
 - ▶ *Murraya* spp. from all countries is prohibited under NAPPRA.

Possible Regulatory Actions

- ▶ Like CFIA, APHIS is still evaluating the situation and considering next steps
- ▶ One option that APHIS is considering is the drafting of a Federal Order for box tree moth, which would potentially amend the U.S. import requirements for *Buxus* spp., *Euonymus* spp., *Ilex* spp., and *Murraya* spp. plants for planting produced in Canada.
- ▶ However, at this time a final decision has not been made regarding next steps.

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