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Box Tree Moth (*Cydalima perspectalis*)

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Introduction

The box tree moth (BTM), *Cydalima perspectalis* (Walker) (Lepidoptera: Crambidae), is an invasive pest of boxwood (*Buxus* spp.) causing severe damage to these popular ornamental plants. These plants are popular for their low maintenance, deer resistance, and evergreen foliage. It is a shrub common to almost all landscape environments in the United States. The box tree moth is native to East Asia. It was discovered in Europe in 2007, and since then it has spread rapidly across the continent. In 2018, box tree moth was first detected in North America in Ontario, Canada and in July 2021, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) confirmed the presence of the moth in Niagara County, NY, near the Canadian border. Subsequently, the presence of BTM was confirmed by APHIS in Lenawee County, Michigan, in November 2022, and Hamilton County, Ohio, in June 2023. Box tree moth is not known to be established in the US, but the risk of introduction is high.

While boxwood is the primary host plant, the larvae of box tree moth may also infest other plants, including holly (*Ilex* sp.), euonymus (*Euonymus* sp.), and mock orange (*Murraya paniculata*). Signs and symptoms of BTM damage to host plants include skeletonized leaves, heavy defoliation, and desiccation, leading to the death of plants. Other signs include green-black excrement (frass) and webbing.

Identification

Egg: BTM eggs are pale yellow with an average size of 0.04 inches (1 mm). They are laid singly or in clusters of about 5-20 overlapping eggs (Fig. 1A).

Larva: Larvae are about 0.5 inches (1.2 cm) long. Newly hatched larvae are green to yellow with shiny black heads. As they age, dark brown stripes develop on the body and are covered in small hairs (Fig. 1B).

Pupa: Pupae develop inside a silk cocoon and are 0.6 to 0.8 inches (1.5 to 2.0 cm) long. They are initially green with black stripes on the back and turn brown as they mature (Fig. 1C).

Adult: Adult box tree moths have white bodies with brown head and abdomen. Their wings are white with an irregular thick brown border and a wingspan of about 1.5 to 1.75 inches (3.8 to 4.5 cm) (Fig. 1D). Occasionally a dark color morph with brown wings is observed (Fig. 2). Both color forms have small white comma-shaped spots on each forewing.

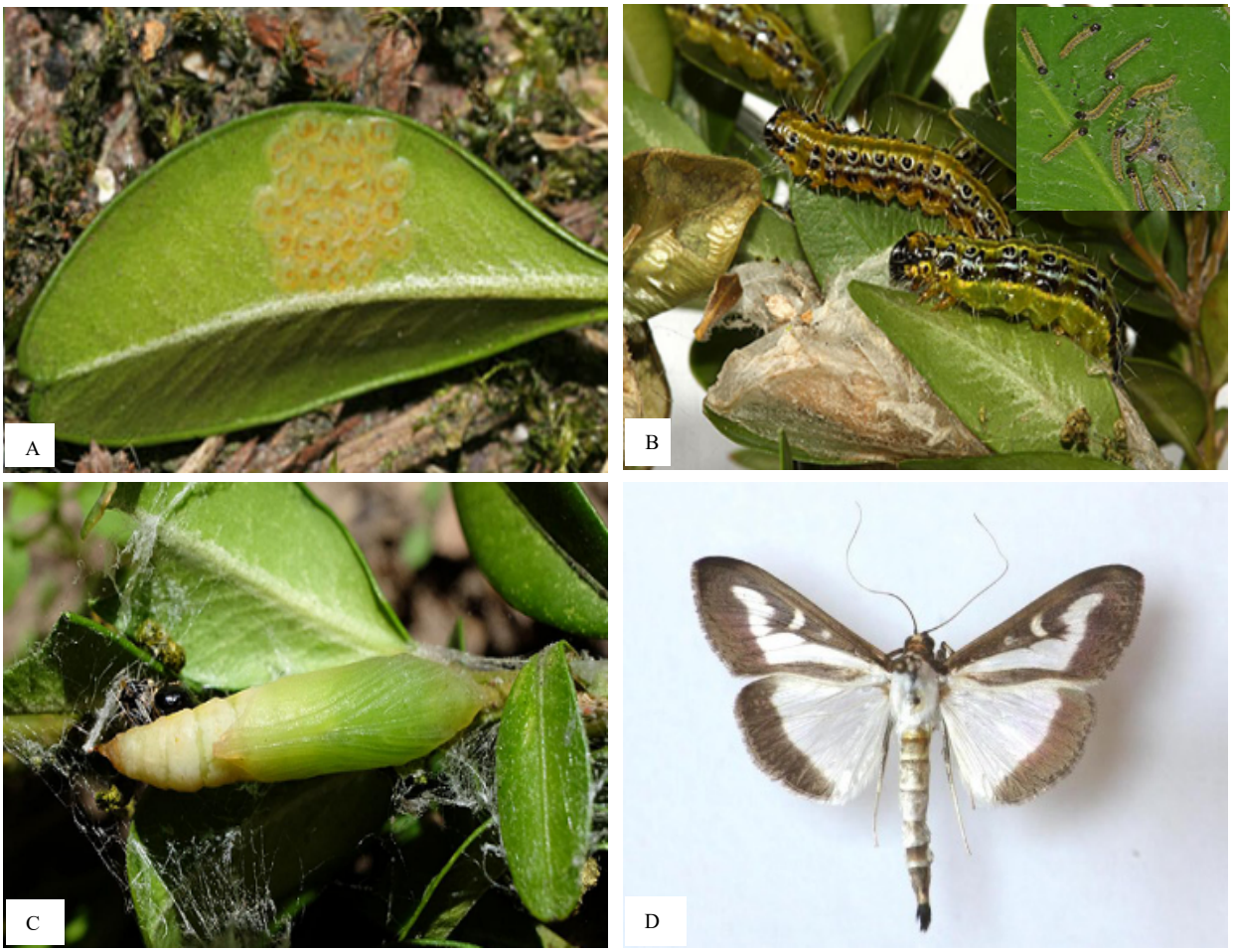

Figure 1. Box tree moth life stages A) Egg mass under the leaves; B) Young and older larvae, and webbing; C) Pupa; D) Adult moth. Photos by A) Walter Schön B) Matteo Maspero and Andrea Tantardini C) Ilya Mityushev, Department of Plant protection of the Russian State Agrarian University-Moscow Timiryazev Agricultural Academy D) Alison Morris, Bugwood.org.

Figure 2. Dark form of adult box tree moth. Note the distinct white marking in the middle of the forewing. Photo by Szabolcs Sáfián, University of West Hungary, Bugwood.org

Life Cycle

Box tree moths have multiple generations, typically ranging from 2 to 5 generations per year in their native range. The total life cycle (from eggs hatching to adults laying eggs) is between 33 and 44 days depending on temperature. Box tree moths overwinter as larvae and undergo five to seven instars based upon the temperature and host plant. Young larvae feed on the lower sides of the leaves (Fig. 3A). Older larvae consume entire leaves except for the midrib and hard leaf structures (Fig. 3B). After defoliating a plant, larvae will consume the bark of the branches which can lead to girdling and dieback of branches or entire plants (Fig. 4). Pupation occurs on the host leaves in silk cocoons and complete pupation over a period of 10 days. Pupae typically start to emerge in April or May and will be present continuously through the summer and into the fall, contingent on the local climate and timing of generations. New adult moths emerge from overwintering pupae between April and July, depending on climate and temperature. Adult moths lay eggs on the underside of the leaves, beginning in early to mid-summer. Females can lay eggs singly or in clusters of 20 or more. A female can lay more than 42 egg masses in her lifetime. It takes 4-6 days for the development and emergence of BTM larvae from egg mass. Subsequent generations are active between June and October. Adult moths have a lifespan of approximately two weeks, and they can travel long distances. During the daytime, they typically rest on boxwoods or surrounding plants.

Figure 3. A) Damage to *Buxus* spp. leaves caused by early-instar BTM larvae where the adaxial leaf surface is consumed; B) Damage to *Buxus* spp. leaves caused by mature BTM larvae where the entire leaf, except for leaf veins or margins are consumed. Photos by Abigail Wiesner.

Figure 4. Healthy *Buxus* spp. plant (left) and *Buxus* spp. plant dying from box tree moth caterpillar damage (right). Photos by Ignacio Baez (left) and Mafalda Weldon (right).

Management

Eggs, larvae, and pupae can be inadvertently transported on infested plants, so scouting of plant material is recommended. Infestations can also be identified by the white webbing spun by caterpillars and characteristic feeding damage to leaves. It can be difficult to detect early larval stages or eggs of moths, so monitoring and surveillance of adult moths is achieved using UV-light and pheromone traps. In smaller areas, manual removal of the larvae by gently hand-shaking foliage or water-spraying infested plants has been suggested as an option to reduce damage from box tree moth.

There are a number of commercially available pesticides that are labeled for caterpillar control, but few have been tested directly on box tree moth (Table 1). Some biological insecticides based on neem (active ingredient azadirachtin) and other laboratory studies found two entomopathogenic nematode species (*Steinernema carpocapsae* and *Heterorhabditis bacteriophora*) produced significant mortality of box tree moth larvae. Products containing *Bacillus thuringiensis* var. *kurstaki* (Btk) were also effective against young *C. perspectalis* caterpillars. Bt is a bacterium that kills insects when ingested with treated leaves. Chemical insecticides such as carbaryl, spinosad, deltamethrin, chlorantraniliprole, and diflubenzuron are labeled for the control of caterpillars in nurseries and landscapes. The application of contact insecticides should be timed with a first-generation egg hatch to prevent defoliation of boxwood and multiple generations. There is limited efficacy data currently available on insecticides for box tree moth. Current recommendations for growers are available online and ongoing research provides growers with up-to-date recommendations.

For more information on box tree moth or if you suspect a plant is infested with this pest, contact Tennessee Department of Agriculture Plant Certification Office (615-837-5137; plant.certification@tn.gov) and the APHIS State Plant Heath Director (615-907-3357).

Table 1. Chemical and biological insecticides tested on Box tree moth (BTM) for use in nursery.

Chemical Insecticides				
IRAC#[1]	**Active Ingredient**	**Trade Names[2]**	**Efficacy[3]**	**References**
1B	Dimethoate	Dimethoate 4E, 4EC	E	Raspudić et al., 2018
	Chlorpyrifos	Dursban 50W, DuraGuard ME	E	Somsai et al., 2019
3A	Lambda-cyhalothrin	Scimitar GC, Lambda-Cy	E	Fora et al., 2016; Stan and Mitrea, 2019
	Beta-cyfluthrin	Tempo SC	E	Qian et al., 2018
	Tau-fluvalinate	Mavrik Aquaflow	E	Stan and Mitrea, 2019
5	Spinosad	Conserve, Entrust	E	Somsai et al., 2019
6	Abamectin	Aracinate TM, Abamectin 0.15 EC	E	Somsai et al., 2019
18	Methoxyfenozide	Intrepid 2F	E	Somsai et al., 2019
28	Chlorantraniliprole	Acelepryn	E	Somsai et al., 2019
Biological Insecticides				
11	*Bacillus thuringiensis kurstaki*	Dipel Pro DF	G	Göttig and Herz, 2018; Burjanadze et al., 2019; Usta, 2022
Unclassified Extract	Azadirachtin A	Azatin O, Azatin XL, Azatrol EC	G	Göttig and Herz, 2018

Unclassified Fungal	*Beauveria bassiana*	Naturalis-L	G	Burjanadze et al., 2019
Unclassified Nematodes	*Steinernema carpocapsae* and	Millenium, Nematac C, Capsanem	G	Harry, 1991; Göttig and Herz, 2018; Ghavamabad et al., 2021
Unclassified Nematodes	*Heterorhabditis bacteriophora*	NemaSeek, Nemasys, Larvanem	G	Harry, 1991; Göttig and Herz, 2018; Ghavamabad et al., 2021

[1]IRAC = Insecticide Resistance Action Committee. [2]Trade Names are provided as examples only and should not be considered a complete list of products available. [3]E = Excellent (90-100%); G = Good (60-100%).

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For additional information, contact your local nursery specialist at:

Tennessee State University, Otis L. Floyd Nursery Research Center

472 Cadillac Lane McMinnville, TN 37110
http://www.tnstate.edu/agriculture/nrc/
931-668-3023

Precautionary Statement

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store or dispose of a pesticide. According to laws regulating pesticides, they must be used only as directed by the label.

Disclaimer

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication. Use of trade, brand, or active ingredient names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar and suitable composition, nor does it guarantee or warrant the standard of the product. The author(s) and Tennessee State University assume no liability resulting from the use of these recommendations.