Winter Moth

Operophtera brumata

Figure 1. Winter moth larva. Photo: Gilles San Martin

Winter moth is an invasive defoliator from Europe that was first detected in Massachusetts in the early 2000's. In eastern North America, winter moth can be found throughout Long Island, New York, southeastern Connecticut, Rhode Island, Massachusetts, coastal areas of New Hampshire and Maine, and Nova Scotia. The larvae (caterpillars) of winter moth feed on the leaves of deciduous trees in early spring. Previous outbreaks have led to high levels of defoliation in New England. Heavily defoliated trees may try to put out a second flush of leaf growth in response to stress, however, multiple years of heavy defoliation can lead to branch dieback and mortality.

HOSTS

Winter moth feed on the leaves of many deciduous trees and shrubs. Preferred hosts include maple, oak, birch, apple, and blueberry.

LIFE CYCLE AND DESCRIPTION

Figure 2. (a) Winter moth adult male, (b) female. Photos: B. Zamba and N. Sherman.

Larval hatch occurs in early spring when temperatures reach ~55°F, timed similarly to when red maple blooms. Larvae are lime green with creamy-yellow stripes running lengthwise along each side of the body (Figure 1). Young caterpillars are ~¼ inch in length while late-stage caterpillars are ~½ inch in length. Due to the way they move, they are one of many species commonly referred to as "loopers" or "inchworms". Larvae form cocoons in mid- to late- May and pupae remain in the soil over the summer. Adults (Figures 2a & b) emerge in late November and are active through January whenever the temperature is above freezing. Male moths have a wingspan of ~¾ inch and are tannish brown with light black bands running across the forewings. Females are gray and flightless with reduced wings. Females climb up tree boles and lay small clusters of tiny eggs in bark crevices. Eggs are orange but will turn dark blue just prior to hatching. Magnification is needed to properly see eggs.

DAMAGE

Young larvae feed within the leaf and flower buds of their hosts and are often difficult to spot at this stage (Figure 3a). Later stage larvae will become more visible, feeding on the expanding foliage. At high densities, larvae will strip the foliage down to the veins (Figure 3b). Lighter defoliation will produce tattered leaves with a sieve-like appearance (figure 3c). Understanding the timing of winter moth feeding will aid in differentiating between winter moth and other later spring defoliators (such as spongy moth and tent caterpillars). Winter moth larvae are one of the earliest spring defoliators, feeding between mid-April and mid-May. However, winter moth feeding overlaps with native species such as Bruce spanworm (*Operophtera bruceata*) and fall cankerworm (*Alsophila pometaria*), although these native species rarely cause widespread damage.

Figure 3. (a) Young larvae and frass in an apple bud, (b) heavy late-stage defoliation, (c) moderate late-stage defoliation. Photos: H. Faubert, H. Lemme, and A. Russell.

MANAGEMENT

Biological control

A biological control program to control winter moth with the specialist parasitoid fly *Cyzenis albicans* (Tachinidae) (Figure 4) was initiated in 2005, following widely successful winter moth biocontrol efforts in Nova Scotia with *C. albicans*. Releases have been conducted throughout Massachusetts, Rhode Island, Maine, and Connecticut. Parasitoids were found established at almost all release sites throughout the region. Levels of defoliation have declined in the 15 years since initial releases, indicating a successful biocontrol program. While winter moth populations may still spike from year to year, established populations of *C. albicans* are expected to build in response to winter moth levels and keep populations in check over time.

Figure 4. Adult Cyzenis albicans, a biological control agent of winter moth. Photo: N. Condor.

Insecticides

PESTICIDE/INSECTICIDE PRECAUTIONARY STATEMENT
Pesticides/Insecticides used improperly can be injurious to humans, animals, and plants. Follow directions and heed all precautions on the labels. Certain pesticides/insecticides have restrictions on their use.

There are different insecticidal treatments used to combat winter moth, depending on the life stage. Some can be applied by the homeowner, but others must be applied by a licensed pesticide applicator. The effectiveness of insecticide treatments varies with the insecticide type, and application timing is critical. When contacting companies for treatment with insecticides, ensure that the applicator has a valid Commercial Pesticide Applicator's License.

Figure 5. Winter moth eggs will turn from orange to blue just before hatching. Photo: H. Faubert.

Treatment of eggs:
The goal of treating eggs is to smother them before hatch (Figure 5). Horticultural oils can be applied to the eggs by the homeowner just before the eggs hatch, starting in mid- March, when temperatures are above 45°F. The effectiveness of horticultural oils is variable, because many eggs may be located in hard-to-reach areas or protected within bark crevasses. The use of physical barriers to concentrate eggs in an area more easily accessible to treatments may increase the effectiveness of this technique (see below).

Treatment of later-stage larvae:
Caterpillars which continue to feed on leaves after the buds have opened are in the "free feeding" stage (usually late April to late May). Insecticides should be applied after trees leaf-out but before excessive feeding damage has occurred, as it is more difficult to control winter moth in their later developmental stages. *Bacillus thuringiensis* (kurstaki), also commonly known as B.t.k, is a bacterium that is specific to moth and butterfly larvae. *Bacillus thuringiensis* (kurstaki) products are available and safe for homeowner purchase and use. Once B.t.k is ingested by a caterpillar, it will stop feeding and ultimately die. B.t.k. is most effective on younger caterpillars.

Another insecticide available for winter moth management is the bacterium derived Spinosad. Spinosad products work well on caterpillars of all ages by interfering with the insect nervous system. Although Spinosad products are relatively non-toxic to humans, they can be toxic to bees at the time of application. Care must be taken to follow the insecticide label and not spray when trees are in bloom and bees are foraging.

Physical barriers

Physical barriers such as tree bands placed around host tree trunks may restrict the movement of caterpillars or female moths climbing up the tree by trapping the insects on a sticky band (Figure 6). However, field observations do not necessarily support the effectiveness of tree bands for reducing winter moth populations when in high numbers. In a process known as "ballooning", newly hatched caterpillars will spin silken threads and be carried by air currents up into the canopy. Likewise, free feeding caterpillars will balloon down from the canopy of surrounding trees onto nearby plants, each method completely bypassing the barrier. **Note:** It is important to only use tree bands designed with the adhesive band facing inwards on the trees. Tree bands with adhesive facing outwards may entrap small wildlife such as birds and rodents.

Figure 6. Tree band used to restrict movement of winter moth and to monitoring eggs. Photo: H. Faubert.

Using tree bands to concentrate eggs
Tree bands could be used to concentrate eggs to parts of the tree that are more accessible for horticultural oil applications. Tree bands should be applied to trees in late October, before female winter moths begin crawling up trees to lay eggs. Barriers should encircle the tree about 5' above the ground. Just before anticipated egg hatch, (horticultural oil should be applied to eggs below the barrier to smother them.

LINKS

URI Winter Moth Updates:
https://web.uri.edu/ipm/2022-em/

UMass Winter Moth Identification and Management:
https://ag.umass.edu/landscape/fact-sheets/winter-moth-identification-management

CONTACT INFORMATION:

Forest Health Program
Division of Agriculture and Forestry
RI Department of Environmental Management
www.dem.ri.gov/programs/forestry/forest-health/index.php

Updated May 24, 2023