

Biological Control of Winter Moth in Massachusetts

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The winter moth (*Operophtera brumata* L, Geometridae: Lepidoptera), a leaf-feeding inchworm caterpillar native to Europe, invaded eastern Massachusetts a little over a decade ago and has caused widespread defoliation.

Prior to the current invasion by winter moth to Massachusetts, there had been two previous invasions to North America—to Nova Scotia prior to 1950 and to British Columbia in the 1970s. Both prior invasions have been suppressed by the introduction of parasitic insects from Europe, in particular the tachinid fly *Cyzenis albicans*, and low-density populations of winter moth now persist indefinitely in these regions, similar to those that exist in most of Europe.

We have introduced many thousand *C. albicans* distributed across 41 sites in eastern Massachusetts, Rhode Island, Connecticut and Maine, and so far have established the fly at 21 of those sites. As occurred in Nova Scotia in the 1950s, it typically takes 3 to 5 years before we recover any *C. albicans* at our release sites. Since there is only one generation per year of both the fly and the winter moth, it takes several years for the 1500–2000 flies we release at a site to catch up with the millions of winter moths that exist at that site.

We have now recovered the fly at all 17 of the sites where we released prior to 2012. At several of those sites, we only documented establishment of *C. albicans* for the first time in 2016. So we expect it will soon be established at all, or most, of the 41 release sites.

Many people wonder if releasing this fly will create problems of its own. Will we be inundated by flies? The answer is no. *Cyzenis albicans* is a specialist on winter moth. It does not attack other species of caterpillars, including other inchworms. So when winter moth densities decline, so will densities of the fly. Even when winter moth densities are still high, the fly will spend its time searching for winter

moth caterpillars in the canopy of trees. It will not come into your house like a housefly. No one will notice its presence.

Prior to 2015, we collected *C. albicans* for release in New England from sites on Vancouver Island in British Columbia, where it had been established in an invasive population

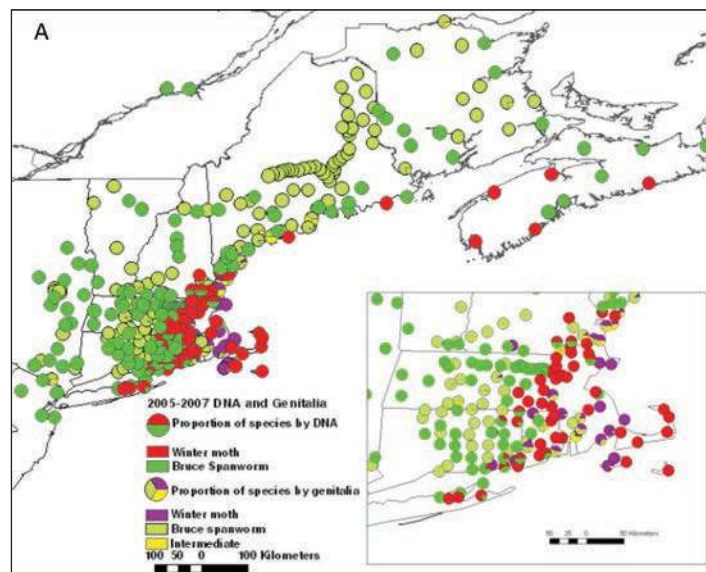
of winter moths in the 1970s. Starting in 2015, however, we switched our collection efforts to Wellesley, Massachusetts, given that we have documented high levels of parasitism all across that town and in surrounding towns. Parasitism there is comparable to what we encountered in British Columbia, and it is considerably simpler and cheaper to collect from Massachusetts than from British Columbia. Furthermore, the flies we collect in Wellesley are presumably better adapted to New England climatic conditions, in contrast to

those from Vancouver Island, British Columbia, where, for example, it rarely freezes in winter.

We collect the fly by collecting late-instar winter moth larvae at sites where parasitism by *C. albicans* is high. We then rear the larvae to the pupal stage. *Cyzenis albicans* pupates inside the winter moth pupae. We rear the fly puparia over the winter and release the adult flies the following spring.

Each year we try to collect 500 late instar winter moth larvae from each of the now 41 previous release sites. These are reared to the pupal stage and dissected in mid-summer in order to document establishment of *C. albicans* and to measure percent parasitism. Collecting samples from each of these sites becomes more and more expensive and challenging with each successive year. Just a few years ago we had six release sites to follow.

With 41 sites spread from southeast Connecticut to mid-coastal Maine, sampling requires a much bigger effort and a much bigger crew. To accomplish this task, we have enlisted



Distribution of winter moth (and Bruce spanworm) in pheromone-baited traps in northeastern North America in 2005-2007

the help of volunteers to help us collect. This year we had a total of 10 crews and 38 people assembled to collect the parasitized winter moth larvae at 115 sites across four states (60 + sites near Wellesley). The collections must be accomplished within a two week period in mid-May; it is a major logistical undertaking.

We have perfected the technique of providing each crew with the rearing materials and instructions for how to collect and rear. This is the only way that we can collect the numbers we need in so short a time. In 2016, we collected more than 76,000 winter moth larvae and reared the vast majority of them to the pupal stage. To document percent parasitism, we dissected all pupae to determine what fraction of them had *C. albicans* inside them.

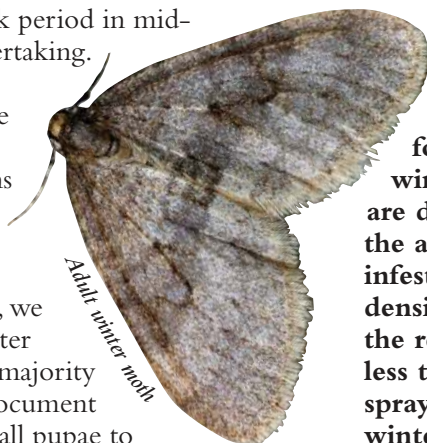
Parasitism at the central release site in Wellesley has fluctuated between 15 and 40% over the past 4 years. In 2016, both defoliation and the densities of winter moth pupae remained low at that site. This suggests we are on the verge of converting winter moth into a non-pest in the areas where *C. albicans* is established.

In 2015 we launched an ambitious effort to document the spread of *C. albicans* along transects extending in six directions over 6 miles from Wellesley, including one that extends into Newton. We collected up to 500 larvae at 60 points along these transects totaling more than 25,000 larvae. In 2015 we found larvae infested with *C. albicans* at various locations up to 5 miles away along these transects. Levels of parasitism fell way off, however, beyond 2 miles.

In 2016, we sampled these transect points again. In one year *C. albicans* had spread noticeably farther than in 2015, extending to the end of five of the six 6-mile transects.

Cyzenis albicans has now spread over much of the western suburbs of Boston, where winter moth densities are at outbreak levels. We are thus confident that *C. albicans* is now well established in Newton.

We would like to appeal to the residents of Newton and surrounding towns and to the tree-care community to hold off on spraying for winter moth this coming spring. Spraying for winter moth will also kill the larval *C. albicans* that are developing inside winter moth caterpillars or else the adult flies that are laying eggs on winter moth infested foliage. Our data suggest that winter moth densities have already declined significantly across the region. So we think that defoliation will be much less than in previous years. Let's take a break from spraying and see if we can let *C. albicans* control winter moth densities this year and into the future.



Larva of winter moth

If you would like to volunteer to help us collect winter moth caterpillars during the third or fourth week of May 2017, we could certainly use your help. For the past two years we have gathered each morning at a meeting site on Wellesley College campus. Crew leaders then travel to various collection sites with several volunteers. We then collect the caterpillars by spreading ground cloths beneath low hanging branches of oaks and maple trees and beating the branches with a pole. The caterpillars come raining down. We gather them into 5-gallon buckets, where we rear them on sprigs of foliage until they pupate about a week later. It is a very simple process. If you would like to join us for one or more days next May, please contact me at elkinton@ent.umass.edu ■

PHOTO ABOVE LEFT: ADULT WINTER MOTH: WIKIMEDIA COMMONS @ENTOMART

3 Views of a recent visitor to a Newton Highlands backyard featured on our website... A Barred Owl!

