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Controlling Forest Tent Caterpillars in Limited-Acreage Maple-Producing Woodlots

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Previous New York State Outbreaks:

1887
1896-1901
1923-1924
1935-1940
1951-1955
1980-1982
1991-1993

The Hard Facts on Forest Tent Caterpillar

The Forest Tent Caterpillar (*Malacosoma disstria)* is an indigenous species in North America. Its population fluctuates between extremes on a somewhat regular schedule, periodically reaching outbreak proportions about every six to sixteen years. Outbreaks usually subside after two to four years of heavy defoliation, but have persisted for up to six years.

Tree dieback is generally minimal during an outbreak, but severe and repeated defoliation can cause significant mortality and/or reduced growth. Of note to maple producers, quantity and quality of sugar maple sap is greatly reduced as a result of defoliation.

"Forest Tent" is somewhat of a misnomer, as the larvae do not actually spin tents, but spin silk mats on trunks and branches. They congregate in large bunches on these mats to molt or rest after feeding.

The Nature of the Beast: Biology

There is one generation of Forest Tent Caterpillar (FTC) each year. Young larvae appear when leaves are beginning to unfold. Newly hatched larvae are **uniformly black**, are **less than 1/8 of an inch (3mm) long**, and bear **conspicuous hairs**. Colonies stay together and move about in single file, following silk trails laid down by leaders. With each successive molt, markings of **pale blue lines** along the sides of a **brownish body** and a row of **keyhole-shaped, white spots on a black background** become more evident. When full grown, caterpillars are about **2-2.5 inches (50-64mm) long**.

Larvae usually go through five "instars," or developmental stages between molts. When there is a high population and heavy defoliation, the fourth and fifth instars move around a great deal in search of food and for suitable sites to spin their cocoons.

Five to six weeks after hatching, the larvae spin cocoons of yellow, powdery silk between folded leaves, bark crevices, and any other sheltered places that can be located. Moths emerge ten to fourteen days later,

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The Nature of the Beast…Continued

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and live for only a few days; during this time they mate and females lay the eggs. They do not eat. They are **stout bodied**, **buff colored**, and have a **wing span of 1 to 1.5 inches (25-38mm)**. The **forewings** have **two darker oblique lines near the middle**. Great numbers are attracted to lights at night. Strong winds can carry the moths for miles, spreading the FTC outbreak next year.

http://mothphotographersgroup.msstate.edu/Files/Live/JH/J

Moths lay their eggs on upper crown branches, masses of 100-350 encircling small twigs in bands of up to one inch. Each cylindrical mass is cemented together and coated with a hard, glossy substance called spumaline. Within three weeks the embryos develop into larvae that overwinter in the eggs and hatch in the spring.

Predator and Prey: Natural Controls

These Forest Tent Caterpillars have recently succumbed to Nuclear Polyhedral Virus (NPV). Note the inverted V shape of the lower left hand FTC and the emaciated look of the others.

Furia crustosa *has attacked these caterpillars. The near FTC at left is in the beginning stages of infection, while at far right, the mycelium has completely engulfed the FTC body.*

At the three observation sites monitored this summer, several natural predators contributed to population decline. These included:

***Nuclear Polyhedral Virus*, or *NPV*.**
Larvae infected with NPV are completely taken over by the pathogen. The body turns into a liquid mass of viruses that spill from the cadaver when the cuticle eventually ruptures. Caterpillars killed by NPV are typically found hanging in place by their midsection, appearing like an inverted V. Infected larvae appear sluggish, emaciated, and upon dying, turn darker in color and wilt.

***Furia crustosa*, a fungus.**
Caterpillars come into contact with infectious *furia* spores when they disperse over the ground. The mycelium eventually grows to fill the body cavity, and after the caterpillar dies (typically within 4-5 days after first contacting the spores), the hyphae emerge and the mycelium grows over the outside of the body, completely covering it with a brown, crusty covering. The disease can spread from caterpillar to caterpillar, and the predator fly *S. aldrichi* may contribute to the spread.

***Calosoma sycophanta*, a beetle.**
This beetle is a colorful metallic green, 23-30mm. They grasp their caterpillar prey at the middle and cut it in half with sharp mandibles. They actually injure more caterpillars than they eat. They also tear open cocoons and attack they pupae.

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Predator and Prey: Natural Controls…Cont.

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***Sarcophoga aldrichi*, or "Friendly flies."**
This fly emerges in late May, and is at once a great pest and a great boon to humans. They are one of the most effective predators of FTCs. By late June, the female adults larviposit eggs on the cocoon of the caterpillar, and after working its way through the silk the maggots burrow into the pupa, feeding on the pupa and leaving only a dark mush behind. The maggot remains in the cocoon an average of 10-12 days. They are called Friendly flies because of their large numbers and tendency to swarm humans, but they do not bite.

Possibly, Spiders
Numerous spiders were noted in the presence of FTCs on the boles of trees, but none were observed to prey on the caterpillars. Literature states that spiders are known caterpillar predators.

Additional FTC predators include ants, birds, frogs, mice, skunks, 75 species of Hymenoptera (bees and wasps), 52 species of Diptera (gnats, mosquitoes, and flies), 9 species of Coleoptera (beetles), and 1 species of Dermaptera (earwig).

Other natural controls include unseasonably low temperatures in the winter and spring (such as a late or hard freeze following larval emergence), extremely high temperatures in the late spring (reducing mating success and viability of offspring), and outbreak collapse due to exhaustion of food supplies.

The EXPERIMENTS

FTCs are currently a serious defoliator in many places in New York State. Even though the pest is usually a major problem for just 2-4 years in a given woodlot, maple producers must limit defoliation in order to continue tapping trees, due to the reduced quantity and quality of sap during an outbreak.

Commonly, it is recommended not to tap trees that have been severely defoliated the previous summer. But not tapping for just one year can jeopardize a producer's market in future years, harming a small farm's income and livelihood.

Many maple producers operate woodlots of less than the 15 acre size normally required to treat FTC with aerial pesticide spraying. At that size and smaller, spraying is not economical. Producers need proven alternative techniques to limit defoliation due to FTCs to avoid losing syrup production and markets.

This summer we trialed several methods of reducing defoliation in woods where serious defoliation was expected. Our goal was to keep defoliation at 50% or less, or to encourage re-foliation through fertilization following damage.

1. Tanglefoot Traps

Literature suggests that use of "sticky traps" and "tree aprons" may provide some control of caterpillar defoliation, but these methods had not been tested on individual trees in a small woodlot setting.

We chose Tanglefoot, a sticky anti-pest paste of castor oil, resin, and wax, as the sticky trap and burlap for the apron.

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FTC Host Trees at the Arnot:

Sugar maple
Beech
Ash
Elm
Birch
White Oak
Pink Oak
Aspen
Basswood
Red Maple
Hemlock
(even Goldenrod)

Conifers, Red Maple, and Sycamore are not typically considered FTC host trees.

Other NY State host trees include cherry. Apple, and alder.

Above, FTCs mass below a Tanglefoot band. Below, a double band application with burlap apron, at the St. Lawrence County Learning Farm site.

1. Tanglefoot Traps…continued

Applications were made at 3 locations: the Arnot Research Forest, at a participating woodlot near Skaneateles Lake, and at CCE of St. Lawrence County Learning Farm.

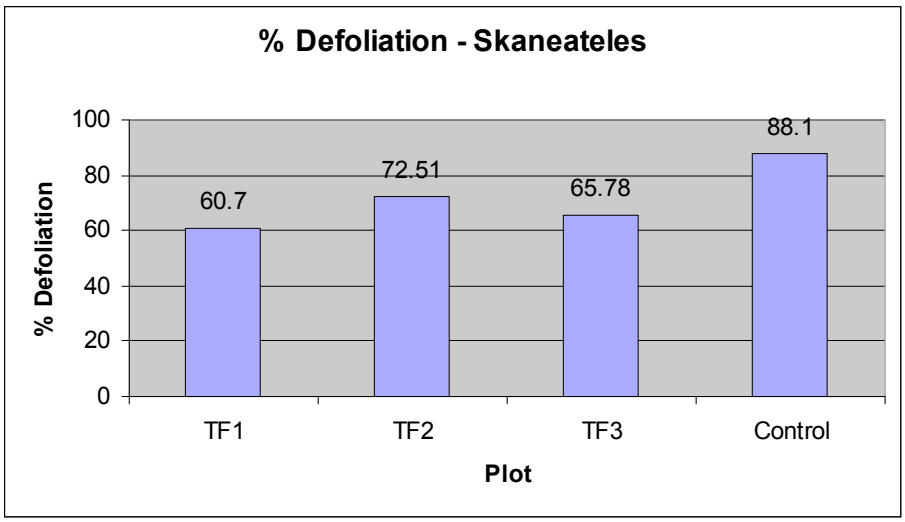
What did we find?

Tanglefoot seems to do a good job of disrupting FTC movement. FTCs are gregarious foragers that move about looking for feeding sites, following pheromone lines laid down by the most active among them. The sticky bands seem to restrict their free movement up and down the boles of the trees. While we expected the caterpillars to actually get stuck in the Tanglefoot, they prefer to avoid touching the substance if possible. When they do get stuck in it, they become mired in it and die.

Only one of the three sites provided reliable data. Despite their high initial population, FTCs at the St. Lawrence County site died off at an early instar for an unknown reason, before they were able to do any significant defoliation. The small sample size here at the Arnot left fluctuations in the data set. At the site on Skaneateles Lake, however, the results were notable. Here, three plots of between 8-10 trees were treated with Tanglefoot, and one control plot received no treatment.

The percentage difference in defoliation between the control plot and the Tanglefoot application plots average was 21.8%. While clearly not the 50% reduction we were aiming for, this is a real reduction and worth noting. If only the Tanglefoot plots where burlap aprons were used, TF1 and TF3, are considered, the percentage difference between control and experimental plots improves to 24.9%.

It is possible that defoliation remained significant on the treated trees, though lower than on control trees, because while movement of FTCs was restricted, the Tanglefoot bands effectively kept FTCs locked into eating the leaves on the experimental trees. There was no flow of FTCs in or out of treated trees.



Plots TF1 and TF3 were also applied with burlap aprons between two bands of Tanglefoot. The percentage difference in defoliation between the control plot and the Tanglefoot plots average was 21.8%

2. Pheromone Lines

Recently much work has been done to develop synthetic FTC pheromones (chemicals produced by animals and insects to attract one another).

We wanted to investigate whether FTCs actually followed these synthetic pheromones. We used the pheromones in two different applications at the Arnot Research Forest.

In one application, lines were treated with different synthetic pheromone concentrations and strung from one tree to another in order to draw caterpillars away from desirable "source" maples to "sink" trees. In some cases, the sink trees were banded with Tanglefoot.

In another application, trails of synthetic pheromones were sprayed down the trunks of maples extending from the upper reaches of a tree down to chest height.

What did we find?

In observations, FTCs did not respond to the pheromone treatments. While they sometimes appeared on the pheromone lines, they seem to be irresponsive to pheromone concentration; for the handful of times they followed the 20 parts per million line, they equally followed the 0 parts per million line.

3. Light Nitrogen Applications

Defoliation causes trees to lose out on prime sugar storage time at the height of the summer. They will generally set a terminal bud and push out a second set of leaves later in the summer, but this is past peak sap-sugar production.

Since the timing of terminal bud set and cessation of caterpillar feeding are almost synchronous, fertilizing woodlots in May with low levels of nitrogen (25 and 50 lbs. per acre plots) may allow for immediate re-foliation from continued growth of the terminals.

Our hope was to encourage trees to re-foliate earlier, staving off the setting of terminal buds, and avoiding or reducing tree stress. In this way, leaves are pushed out right from the same shoots as the previous set of leaves.

Applications are at CCE of St. Lawrence County Learning Farm and the participating woodlot near Skaneateles Lake.

What did we find?

At the site near Skaneateles Lake, there is significant releafing; the continuation of the end shoot, from which the leaves 'pop' out. In the 50lb. nitrogen plot, there are more leaves, but no bigger than in the 25lb. nitrogen plot. In a control area, some trees have no releafing, but others seem to be releafing with the same vigor as the fertilized trees. Later in the summer a few trees in the woodlot will be cut and growth in their crowns will be measured so that specific conclusions can be made.

Bright new leaves can be seen springing out from the shoot above old, defoliated leaves.

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4. Adult Moth Traps

Pheromones are also used in traps for adult forest tent moths. We wanted to determine if these traps are successful at trapping moths in a small woodlot setting.

This application would not reduce defoliation until the following year, 2007.

What did we find?

The moth traps are only drawing marginal numbers of Forest Tent individuals, not enough to reduce the moth population.

However, these traps will be useful for correlating the number of trapped moths with an egg mass count in the winter. Perhaps a sugar maple producer will be able to put out these traps in their sugarbush, and from the number of moths they catch, expect a certain level of defoliation in the spring. They will thus be freed from the time-consuming job of conducting egg-mass counts to predict caterpillar populations.

The pheromone traps are hung at 11 various elevations and locations throughout the Arnot Forest and at 3 locations at the Skaneateles woodlot. There is also 1 trap at the St. Lawrence County Learning Farm.

Citations

Meeker, James R. "Common Name: Forest Tent Caterpillar." *Featured Creatures* Jan. 2001 <http://creatures.ifas.ufl.edu/trees/forest_tent_caterpillar.htm>

Batzer, Harold O. and Robert C. Morris "Forest Tent Caterpillar." *Forest Insect & Disease Leaflet 9.* U.S. Department of Agriculture and Forest Service. <http://ww.na.fs.fed.us/spfo/pubs/fidls/ftc/tentcat.htm>

Fitzgerald, Terrence D. The Tent Caterpillars. Ithaca: Cornell University Press, 1995.

Previous New York State outbreak data:
Kraus, Naja. "All you ever wanted to know about Forest Tent Caterpillars and much more…" *NYSDEC Division of Lands & Forests.* <http://www.dec.state.ny.us/website/dlf/privland/forprot/health/caterpillar/ftc02.pdf>

All photographs: Anna Barensfeld unless otherwise noted.