

THE PINE TIP MOTH

(Nantucket Pine Moth - - *Rhyacionia frustrana* Comst.)

How to Recognize and Control It



. . . during period of rapid growth, first sign of pine tip moth infestation is bending of the tips of branches.

By
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and
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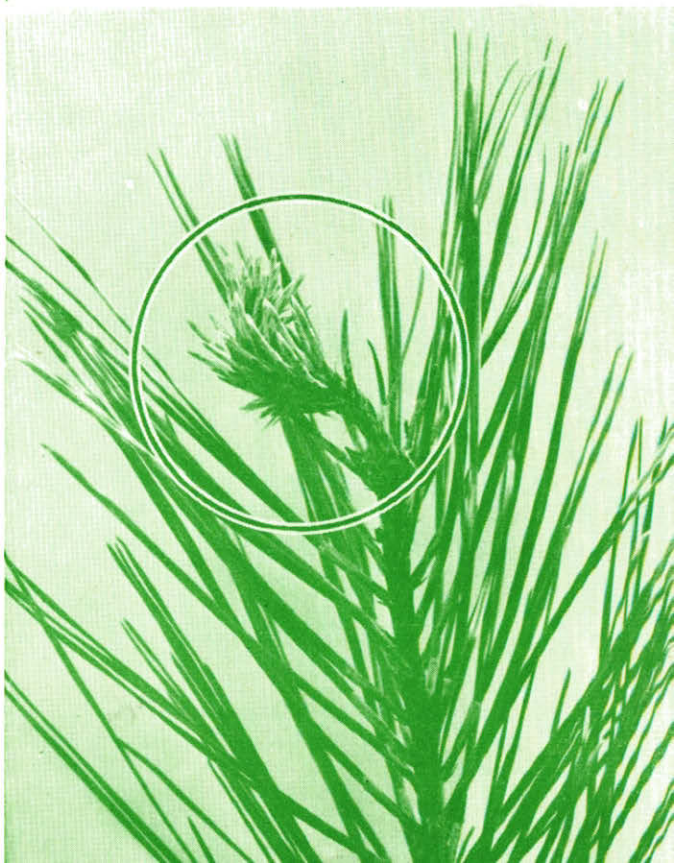
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S U M M A R Y

The pine tip moth can be controlled by applying DDT spray at the proper time. Spray mixtures and methods of timing are described on page 10. Knowledge of the habits of this insect is necessary for successful control; see page 5.

Once the insect has established itself in any locality, even on one tree, the chances of its spreading and infesting most or all pines in the neighborhood are very great.

The successful growing of pines calls for constant care and timely application of insecticides, the same as is required for successful growing of fruit and shade trees, or shrubs and flowers.

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THE PINE TIP MOTH

(Nantucket Pine Moth — *Rhyacionia frustrana* Comst.)

How to Recognize and Control It

By MICHEL AFANASIEV AND DONALD ASHDOWN*

The Nantucket pine moth, which is commonly known as the pine tip moth, has caused considerable damage to some species of pines in Oklahoma in recent years. It reduces the value of commercial trees by retarding growth, and by causing multiple, branched, and crooked stems. Ornamental plantings attacked by this insect present an unsightly appearance. Continuous reinfestation by the moth from year to year may completely ruin otherwise fine stands of pure pine.

Experiments in pine plantations near Stillwater during the past several years have indicated that the damage done by this pest can be considerably reduced, if not eliminated. This bulletin is based on results of those experiments.**

The Insect and Its Habits

The moth goes through four life stages: egg, larva, pupa, and adult moth. It is the larva, a small, light-brown worm, which damages pine trees.

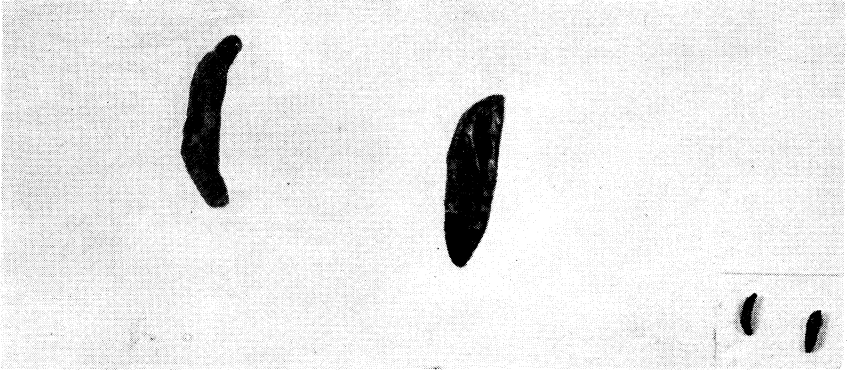
After hatching from the egg, the larva eats its way into the stem or a branch, usually at the base of the tip bud. Then it burrows downward through the center of the stem for a distance of one-half to three inches, eventually killing the bud and the adjacent portion of the stem. It feeds for a few weeks, transforming into the pupal stage in which it remains within the plant. The adult moth emerges from the stem and after a few days it deposits a number of eggs near the base of the pine needles. In due time a new generation of

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**For technical reports of this research, see:

Afanasiev, M. and F. A. Fenton. Pine Tip Moth and Its Control in Oklahoma, Jour. of Forestry 45 (2): 127-128, 1947.

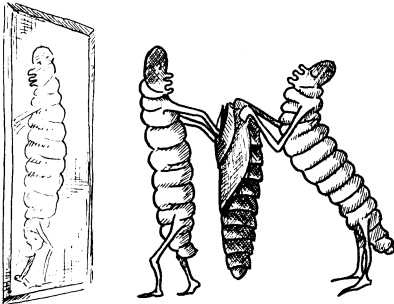
Fenton, F. A. and M. Afanasiev. Seasonal Cycle and Control of the Pine Tip Moth, Jour. of Econ. Entomology 39 (6): 818, 1947.



...it is the larva (left), a small, brown worm which does the damage to the tree... pupa, (right), resembles a brown grain of wheat...in lower right-hand corner, larva and pupa are shown in actual size...

larvae hatches, and the worms work their way into the tree again.

The newly-hatched worm does not immediately enter the pithy center of the stem, but spends the early part of its life feeding at the surfaces. It is during this time that a spray can be most effective.



... the larva changes into the pupal stage.

In its natural environment the adult form of the insect is difficult to see. It is a small, gray moth

about a quarter of an inch in length. Due to its size and color, the moth is inconspicuous on the background of foliage and branches. The presence of the insect is usually noted, not by actually seeing the moth, but by the damage it causes to the tree.

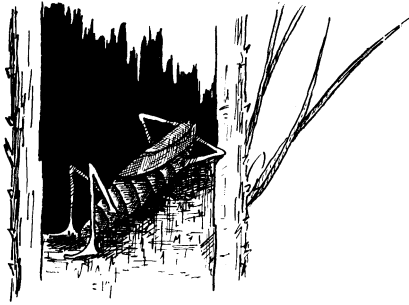
The complete cycle, through larva, pupa adult moth and egg, is repeated in Oklahoma at least three and often four times during the growing season.

Species of Pines Attacked

Practically every species of pine grown in Oklahoma, both native and imported, is susceptible to injury by the Nantucket tip moth. Yet there are pronounced differences in the degree usually suffered by various kinds of pine.

Shortleaf and loblolly pines, both native to Oklahoma, seem to be

particularly attractive to the moth. These two pines are followed in order of susceptibility by Japanese



... the pupa remains within the plant for several weeks, or over winter...

red, Austrian, Scotch, Japanese black, and western yellow pines.

There might be some question about the relative susceptibility among the few last-named pines, but there is no question about the shortleaf, loblolly, and Japanese red pines being definitely preferred by the moth. These three have thin, soft, flexible needles, whereas the other species have stiffer, more rigid foliage. The susceptibility may also be associated with the shortleaf pine's habit of putting on new growth in a series of stages, rather than a single rapidly-formed growth produced in a relatively short time. Thus shortleaf pines present new, tender shoots later in the season when other kinds have hardened.

In mixed plantings of pine, where several species are present, the insect may attack one species

and leave the other less desirable species almost entirely free of injury. If the most susceptible species is protected against the insect, or if this species is entirely absent, the moths will concentrate their activities on one or two less favored species, leaving the less "tasty" kinds alone. The selectivity by the moth was clearly illustrated one summer at this station when shortleaf pine, which up to that time suffered most, was sprayed with DDT. The following generation of the moth turned its attention to the Japanese red pine but left the others free of injury. When both shortleaf and Japanese red were sprayed, the least susceptible species (Austrian, Scotch, Japanese black) became infested.

What Tip Moth Damage Looks Like

If the larva attacks a pine which is growing rapidly, the first sign of the injury will be a slight bending of the tips of the branches. At times when the tree is growing more slowly, the first indication of damage is the browning and drying of a few needles at the tips of the branches. In either case, browning and drying of the needles gradually spreads downward, away from the tip. This is followed or accompanied by the appearance of hardened masses of pitch near the base of the affected terminal bud.

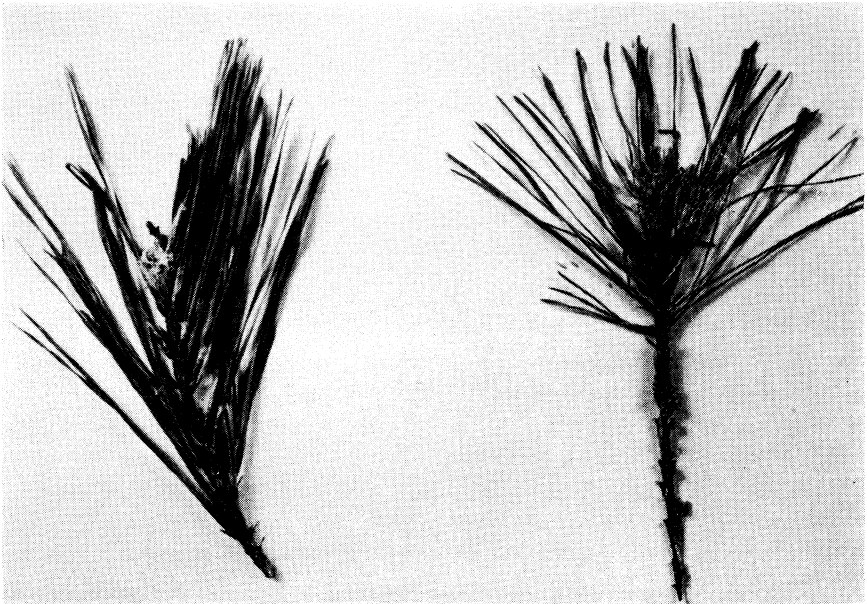
As time goes on and the larva burrows downward within the pith

of the branch, the deadened part of the branch is gradually extended farther and farther from the tip. A severely infested tree acquires a typical appearance of having a number of dead, brown tips. Noted from a distance, such trees may appear to have suffered from light fire or heavy winter freeze.

If the dry stem is broken in two just below the tip, or is sliced lengthwise, the hollow channel made by the feeding larva can be easily seen and the insect itself can be found, either as a larva or as a pupa. The latter resembles a brown grain of wheat.



...when infestation takes place during the period of rapid growth, the first sign of infestation is bending of the tips of branches.



...browning of the needles (left) is accompanied by the appearance of pitch near the base of the affected terminal bud... a dry, empty shell of the pupa has been dragged half way out of the stem by the emerging moth... sliced-off stem near the tip of a branch (right) shows the damage done by the feeding larva... the hollow space below the bud is still occupied by the pupa...

After the tip bud is killed, one of the auxiliary buds tends to form a new leader, thus making the stem or the branch crooked at that point. Reinfestation is likely to kill the tip bud of the new leader, thus causing another crook and another deformity of the stem.

The moth not only deforms the tree but, because it eliminates the leader, also slows down the growth of the tree in height. Repeated destruction of tip buds and new leaders often gives the heavily infested trees a broom-like appearance and completely cancels their upward growth.

Where Damage Is Most Likely

The most extensive and persistent damage to pines by the moth is usually found in ornamental plantings, on isolated specimens of pine, and in pure pine plantations. The injury to small pines is less serious in mixed forests.

In forests, injury normally is confined to a few individual seedlings and saplings, and seldom, if ever, found on large trees or on a large number of small trees in any one area. The writers have seen a young pine plantation in McCurtain county which was so severely infested it looked as if a fire had run through it. Yet just across the road, in a natural all-aged mixed forest, only a few isolated seedlings and saplings showed sign of infestation.

Failure of the insect to expand its activity to epidemic proportion in forests may be due to unfavorable environmental conditions, including the presence of natural enemies. On the other hand, the injury to young, pure stands of pine, both natural and planted, is often so extensive that practically every tree is stunted and deformed. It is a common observation with most forest insects that pure stands increase the amount of damage usually done by uncontrolled pests.

Controlling the Moth

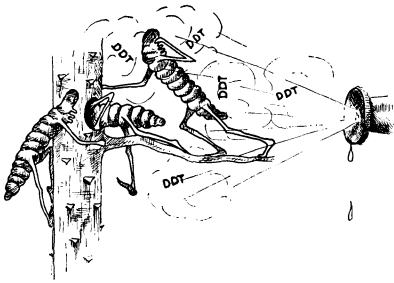
The life cycle of the moth, as described on page 5, makes it evident that throughout most of its life this insect is inside the tree, where it is not open to direct control. Insecticides, to be effective, must be applied during those rather short periods when the insect is



...once the larva has burrowed its way into the stem, it cannot be reached and thus is immune to the application of the insecticide...

either in the adult stage or in the form of a young larva. Once the larva burrows its way into the stem it cannot be reached, except by breaking the stem; and in that location it is immune to the application of insecticide. It is also immune in the pupal stage, which it spends within the stem and branches of the tree.

Timing the Spray.—Trial of several insecticides showed that DDT is very effective on the tip moth if applied when the insect is on or near the trees but not within the new shoots. No specific dates for application of DDT can be suggested. The time of moth emerg-



...DDT is very effective on the pine tip moth if applied at a time when the latter is found on the outside of the stem and the branches of a tree...

ence, laying eggs, and egg hatching may vary considerably from year to year.

One way to determine when the insecticide should be applied is to gather 10 to 15 infested tips, place

them in water in the same way a bouquet of flowers is kept in a vase, and cover all with a cage made of window screen mesh or with an inverted glass jar. When five or six adult moths have emerged, it is time to apply the insecticide.

A quick timing test which is accurate is actual inspection of twigs. When most of the adult moths have emerged, leaving the empty shell, but certainly before all have emerged, is the right time to spray. This is particularly true of the overwintering brood. In the summer broods, it often becomes more difficult to choose a time, because large and small larvae and pupae may all be present at the same time.

The following emergence dates at Stillwater, on which generations of the adult moths were observed during one year, may serve as a rough guide in setting emergence tests: First generation, March 19 to April 9; second, June 1 to June 10; third, July 10 to 24*; fourth, September 5.

Wettable DDT applied as a spray has a rather lengthy residual effect which increases the chance of killing the exposed insects even if it is applied somewhat earlier than necessary. On the other hand, DDT applied after the larvae have burrowed into the branches is entirely ineffective. Rain occurring

* In 1951, the peak of the emergence of the third generation of the adult moth was noted on the first of August.

between the time of application of the insecticide and the emergence of the adult moth will greatly reduce the effect of DDT.

Mixing and Applying Spray.—DDT is effective in concentration as low as one-half of one percent of the actual poison. Wettable DDT is often sold as a 50 percent DDT dust, and is commonly retailed in 4-pound bags. Such a bag would be sufficient for 50 gallons of spray. In small amounts, about one and one-third ounces, or $7\frac{1}{2}$ tablespoonfuls (level full, not heaping) per gallon should do the job. The spray should be applied with some force, so that the liquid will penetrate to the base of the buds and needles. Fortunately, most of the buds are located at or close to the outer surface of the tree crown, which makes a thorough application of DDT rather easy.

For best results, and particularly to take advantage of its preventive

value, DDT spray should be applied at the time of emergence of each generation of the adult moth. This is especially true where a large number of pines in the neighborhood show signs of infestation.

Control by Removal of Infested Tips.—When only one or a few small trees are infested, the dead tips containing the insects (larva or pupa) can be broken off and destroyed. This is effective only if all other pine trees in the neighborhood are similarly freed of the insect. However, this method is never fool-proof. Even a few insects missed during the clean-up will eventually reinfest all susceptible trees within their range of flight. On the other hand, DDT applied to the trees in proper time will not only kill the moths living on the treated trees but will also materially reduce reinfestation from other sources.

