



Nantucket Pine Tip Moth

Don Arnold
Survey Entomologist

Tom Royer
Extension Entomologist

Jonathan Edelson
Professor of Entomology

The Nantucket pine tip moth [*Rhyacionia frustrana* (Comstock)] lives throughout the pine forests of the southern and eastern United States. It ranges from Massachusetts south to Florida and southwest to Oklahoma and Texas, and it has been reported as far west as southern California. This pest can be very damaging to ornamental pines, plantations of susceptible species of pine, and to wild seedlings in open areas. Although trees are seldom killed by its attacks, repeated infestations reduce the growth rate, deform the main stem, lower wood quality, and give the trees a bushy appearance. In Oklahoma, it is a serious pest of ornamental pines and Christmas tree plantings.

Description

The adult moth has a gray body with a wingspan of 1/2 inch (Figure 1). The forewings are covered with brick-red and copper-colored patches separated by irregular bands of gray. The hindwings are gray-brown. The eggs are approximately 1/32 inch in diameter. They are light green when laid, but turn yellow to orange after a few days. Newly hatched larvae are cream colored with a black head. Mature larvae are orange to light brown and about 3/8 inch long (Figure 2). The pupae are light to dark brown and approximately 1/4 inch long (Figure 3).



Figure 1. Adult Nantucket pine tip moth.

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are also available on our website at:
<http://osufacts.okstate.edu>



Figure 2. Nantucket pine tip moth larva.

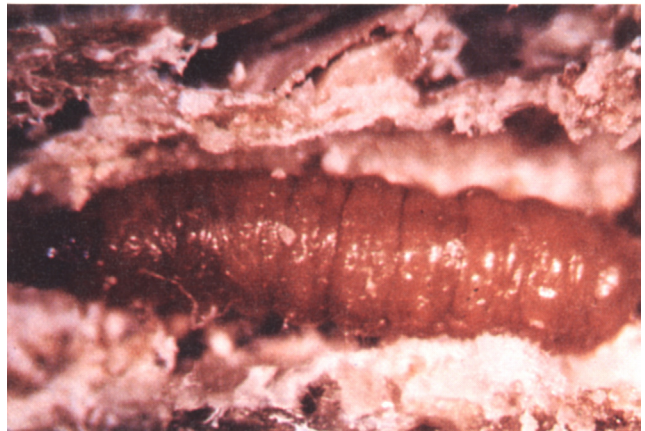


Figure 3. Nantucket pine tip moth pupa.

Biology

The Nantucket pine tip moth overwinters as pupae in the damaged branch terminals of infested pine trees. Adults emerge in March and April and then mate. Moths are active from early evening until dusk, spending the day at rest on trees. Females begin laying eggs about two days after emergence. Studies in Georgia have found that first generation females lay an average of 54 eggs per female and second generation females lay an average of 26 eggs. Eggs are laid

on the needles or occasionally on the buds or twigs near the tips of the branches. The eggs may take as long as 30 days to hatch if cool weather follows egg laying in the spring, but in warm weather they hatch in five to ten days.

Newly hatched larvae construct a small silken web in the axil formed by a needle and the stem. The larvae feed for a few days on the base of the needles and on the surface of the stem. Resin and frass accumulate on and around the web as they feed. Later, they migrate to the shoot tips, construct a new protective web, and tunnel into the stem or bud. Larvae continue to feed inside the stem until fully grown, a period lasting two to four weeks. They pupate within the cavities, and begin to emerge as adults in about 10 days.

There are four or more generations per year in Oklahoma. In southeastern Oklahoma, the overwintered adults normally emerge between March 10 and April 15, first generation adults between May 20 and June 20, second generation adults between July 7 and 30, and third generation adults between August 5 and September 10. Generations often overlap by mid-summer with moths present and laying eggs continuously from late July until cold weather.

Emergence periods in north central Oklahoma are usually five to ten days later for each generation. At least in northern Oklahoma, part of the third generation larvae pupate and produce third generation moths and fourth generation larvae. The rest of these larvae do not pupate until October when the fourth generation larvae are pupating. Therefore, the overwintering pupae are derived from both generations of larvae.

Hosts

The Nantucket pine tip moth attacks virtually all species of two- and three-needle pines grown in the eastern part of the United States. The only exception is longleaf pine. Slash pine is quite resistant but is occasionally attacked. Eastern white pine (a five-needle pine) is also highly resistant. Preferred hosts include loblolly and shortleaf pine (two common native species in Oklahoma), Virginia and Scotch pine (which are usually planted for Christmas trees), and mugo and Japanese black pine (commonly planted landscape trees).

Damage

The first sign of damage is the browning and dying of a few needles at the tips of the branches (Figure 4). As the larvae burrow into the stems, the branch tips die and turn brown. With additional feeding, this dead area may extend up to eight inches down the twig, especially if more than one larva infests a shoot. New shoots sprout from the twig below the damaged area and become infested by later generations of larvae.

While trees may be killed in severe and prolonged infestations. The loss or retardation of height, growth, and the deformation of the main stem are the most important aesthetic and economic injuries. Where tree vigor is poor, deformations such as stem crooking and forking may also occur. In seed orchards, cone and seed production may be reduced through destruction of shoots containing flower buds or conelets.

Most severe damage occurs on susceptible species of pines that are less than 15 feet tall and growing in open areas. Larger trees are less susceptible to attack but are sometimes heavily damaged. Shaded trees are often not as heavily damaged as those growing in open areas.



Figure 4. Nantucket pine tip moth damage.

Prevention

Tip moth damage can be reduced by using certain cultural practices. Maintenance of high tree vigor by fertilization and irrigation is an effective method of reducing damage. This also promotes rapid growth of the tree through the first six to eight years, when it is most susceptible to injury.

Highly susceptible pine species should be planted only on sites to which they are well adapted. On poorer sites, pine species more resistant to tip moth attack should be substituted if possible. Practices such as close spacing and planting under the canopy of older trees may also help reduce tip moth populations and subsequent damage.

Chemical Control

Use of insecticides is not a cost effective method of control in commercial forest situations. However, it is economically justifiable for ornamental pine tree and Christmas tree plantations. Insecticides are an effective method for managing pine tip moths when applied in a timely manner.

Any and all applications of insecticides should be based on knowledge of presence of the Nantucket pine tip moth. The following survey methods are recommended for determining timing of insecticide applications.

Survey Methods

Pheromone trap surveys: Pheromones are chemicals that insects use to communicate with one another. The female pine tip moth releases a sex pheromone to attract males. Synthetic forms of the pheromone are available through various insect management supply companies and are provided as encapsulated forms or on strips of material. The pheromone units are suspended inside either sticky- or bucket-traps and the traps are located around or in the orchard. Figure 5 shows an example of a company's wing trap (pheromone is placed inside the trap and the interior is covered with sticky

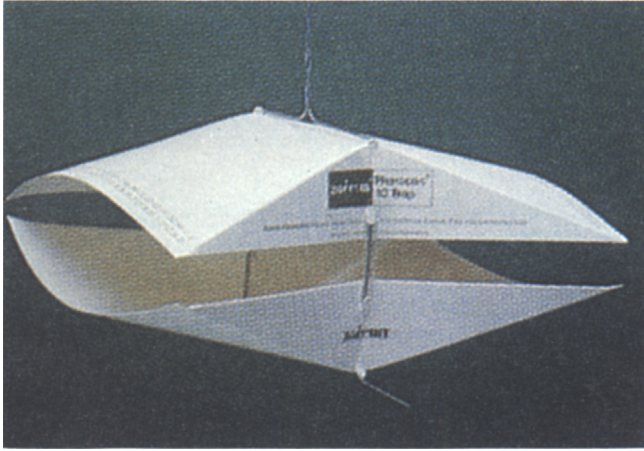


Figure 5. Pheromone trap.

material to catch attracted moths). The most effective method of determining presence and occurrence of peak numbers of moths is by placing a minimum of one trap per acre or two traps around small orchards by March 1 of each growing season. Sources of traps and pheromone lures are noted at the end of this publication.

Traps should be examined at least three to four times per week and numbers of moths captured noted. Insecticide applications are targeted to kill the newly hatched larvae and moths. The greatest number of larvae will be affected if the insecticide application is made five to ten days after the peak number of moths is recorded as captured in the traps. The timing should be five days when temperatures are high in summer and increased to ten days during cool periods in the spring and fall. Applications may have to be repeated if rain occurs within 24 hours of an application. Applications made before or long after the peak moth flight will not impact the largest number of larvae. Thereafter, the larvae may enter the stems and no longer be exposed to and killed by the insecticide.

Other survey techniques: Monitoring surveys conducted using pheromone traps have proven to be the most effective method to determine moth flight and activity. However, producers may also survey orchards by dissecting previously infested terminals and stems to determine the life stage of larvae. Select ten to 20 dead and infested stems at two- to three-day intervals and dissect them so that the larvae or pupae are located. Empty pupal cases indicate that moths have emerged and should provide a reference for determining the beginning of moth flights. Remember, moths begin laying eggs within several days of emergence and eggs hatch several days after being laid.

Most emergence can be tracked by collecting dead and infested stems or terminals, removing them from the tree, and emerging the basal end in a cup of water. Place the cup with stems in a cage in an outdoor, shaded location and examine them for moth emergence daily.

Heat unit models to predict applications: Research conducted in other southern states has indicated that heat units (maximum daily temperature + minimum daily temperature divided by two) accumulated from time of peak moth occurrence based on pheromone traps can be used to time insecticide applications.

HEAT UNIT MODELS HAVE NOT BEEN VERIFIED TO DATE IN OKLAHOMA AND THEREFORE CANNOT BE RECOMMENDED AT THIS TIME.

Control Measures

Any control measure, and especially the application of an insecticide, will cost money. The producer must determine when control measure expenses will provide a benefit greater than the cost. Therefore, Christmas tree producers must base any control decision on past history of their customers' requirements for tree uniformity and quality. In a highly competitive market, or when customers have strict standards regarding tree shape and size, the producer will need to adhere to stringent control procedures and maintain very low levels of damage. However, these standards vary from location to location and on the marketing of the trees. Thus, there are no standard recommended thresholds for making an insecticide application to control the pine tip moth.

Insecticide Selection

Insecticide availability and registration for use changes from year to year. Growers should consult labels or County Agricultural Extension Agents for current recommendations.

ALWAYS CONSULT LABELS FOR APPLICATION RATES AND PROPER USE OF INSECTICIDES.

Application of Insecticides

Timing applications based on trap captures and surveys and proper selection of an effective insecticide are important. However, it must be followed by the effective application of the insecticide. Moths rest on trees throughout the day and primarily move around and lay eggs during the evening hours. Eggs are laid in the terminals of stems, and newly emerged larvae feed primarily on the new growth. Therefore, spray patterns and spray volume should be adjusted to provide complete coverage of the trees, especially those areas of new growth. Water-sensitive survey cards can be purchased from agrichemical supply houses and placed within tree canopies during the spray application to provide an indication of spray coverage.

List of Pheromone Suppliers

Trécé Inc. 7569 Highway 28 West Adair, OK 74330 Tel: 866-785-3063	Insects Ltd. 16950 Westfield Park Rd. Westfield, IN 46074 Tel: 317-896-9300
Gemplers P.O. Box 44993 1210 Fourier Dr., Suite 150 Madison, WI 53774-4993 Tel: 800-382-8473	Scentry Biologicals, Inc. 610 Central Avenue Billings, MT 93102 Tel: 800-735-5323
Great Lakes IPM 10220 Church Rd. Vestaburg, MI 48891-9746 Tel: 989-268-5693	

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