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Nantucket Pine Tip Moth

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The Nantucket pine tip moth, *Rhyacionia frustrana* (Comstock),[4] is a major forest insect pest in the United States. Its range extends from Massachusetts to Florida and west to Texas. It was found in San Diego County, California, in 1971 and traced to infested pine seedlings shipped from Georgia in 1967. The moth has since spread north and east in California and is now found in San Diego, Orange, and Kern Counties (fig. 1).

The Nantucket pine tip moth is most damaging to pine plantations and to wild pine seedlings in open areas. It poses an ever-increasing problem because of forestry trends that favor the establishment of large areas of pine plantations. In such areas, Nantucket pine tip moth damage may be very common (fig. 2). Tip moths may also be particularly damaging to pine seed orchards because they kill female flowers and conelets.

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Two other species of *Rhyacionia* are found in the eastern range and often infest the same trees as the Nantucket pine tip moth. These are the pitch pine tip moth, *R. rigidana* (Fernald), and the subtropical pine tip moth, *R. subtropica* Miller. The pitch pine tip moth is the more prevalent and is difficult to distinguish from the Nantucket pine tip moth. The range of the subtropical pine moth is restricted to Florida and the southern parts of Georgia, Mississippi, and South Carolina. In California, the Nantucket pine tip moth attacks the same trees as the Monterey pine tip moth, *R. pasadenana* (Kearfott).

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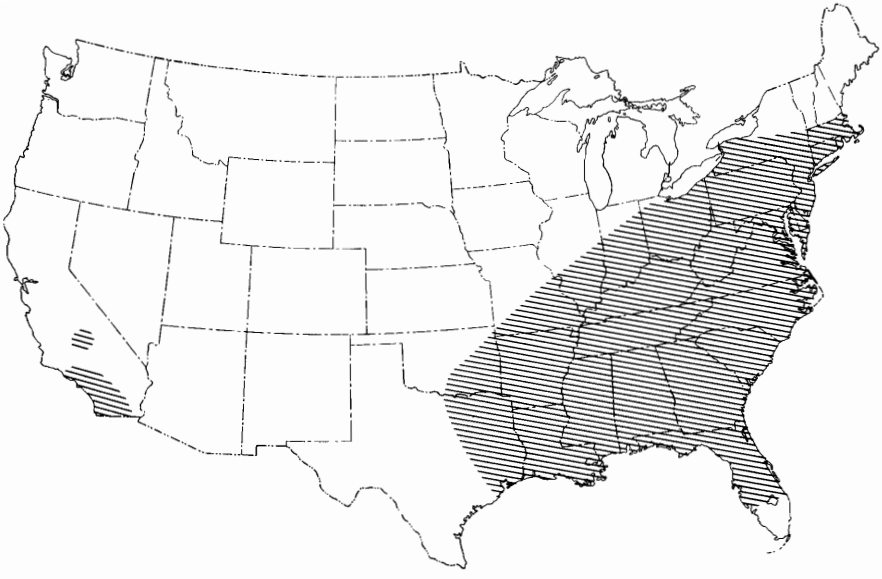

Figure 1.—Distribution of the Nantucket pine tip moth within the United States.

Figure 2.—Loblolly pine severely damaged by the Nantucket pine tip moth. F—702838

Hosts

Nearly all species of native and exotic pines that grow in the eastern half of the United States are attacked by the Nantucket pine tip moth. The only exceptions are longleaf and eastern white pine. Slash pine, although occasionally attacked, is quite resistant. In California, most hard pine species have been found to be suitable hosts.

Certain pine species are preferred by the Nantucket pine tip moth in different parts of the United States. In the South and Southeast, the favored hosts are loblolly and shortleaf pine. Pitch, Virginia, and Scotch pine appear to be favored in New England and the Middle Atlantic States. Shortleaf pine is favored in the Central States. In California the favored host is Monterey pine.

Pine species that have multinodal growth in a single season are especially favorable hosts because when shoots are killed by tip moth larvae the tree responds by producing new succulent shoots from the base of the dead shoot. When the adult moths emerge they find a new crop of shoots for egg laying. Repeated crops of new shoots can support an increasing population of tip moths throughout the spring and summer.

Evidence of Infestation

Early feeding is indicated by a small, delicate web constructed by early instar larvae. This web is found in the axil formed by the developing needle and the stem. Later, a more prominent indication of infestation is webbing at the shoot tips and accumulated resin and fecal material within this webbing. Soon, tips of infested shoots die and turn brown, becoming quite noticeable from a distance. First indications of Nantucket pine tip moth attack of conelets are the presence of boring frass on the conelet surface and the appearance of dead conelets.

The Nantucket pine tip moth injures the growing shoots of young pines. The larva bores into and feeds on inner tissues of the buds and shoots. Such feeding severs the conductive tissue and causes death of the shoot (fig. 3). Shoot injury occurs primarily in the first 5 years and decreases as the tree reaches about 10 feet (3 m) in height and the crown closes.

In severe and prolonged infestations, trees less than 3 feet (0.9 m) tall may be killed by larvae, but usually the loss or retardation of height growth and deformation of the main stem cause the greatest economic losses. During the first 5 or 6 years, height growth differs

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Figure 3.—An injured pine shoot dissected to expose a feeding larva.

significantly between treated and untreated loblolly pine trees. In some areas, every shoot may be killed, and little or no height added to the trees. If tree vigor is poor, deformities such as stem crooks and forks may also develop. In seed orchards and seed production areas, cone and seed production may be reduced by destruction of shoots containing embryonic flower buds and by direct feeding of larvae on pine conelets (fig. 4). Shortleaf pine is particularly susceptible to conelet injury.

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Figure 4.—A shortleaf pine conelet killed by larval feeding of Nantucket pine tip moth (left); nonattacked healthy conelet is on the right.

Description of Life Stages

The egg is slightly convex and about 1/32 inch (0.8 mm) in diameter (fig. 5). It is opaque white when laid, but turns yellow to medium orange as it matures. The very small, young larva is cream colored with a black head; the late instar larva (fig. 3) is light brown to orange and about 3/8 inch (9 mm) long. The pupa (fig. 6) is light to dark brown and about 1/4 inch (6 mm) long. When the adult (see cover) emerges, gray scales cover its head, body, and appendages, except for the forewings, which are covered with brick-red and copper-colored patches separated by irregular bands of gray scales.

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Figure 5.—An egg laid on a succulent pine shoot at the base of a needle fascicle.

Life History and Habits

This insect overwinters as a pupa within damaged shoots of the host trees. On warm days, as early as

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Figure 6.—Pupae of the Nantucket pine tip moth.

February in the Deep South and southern California, adult moths emerge, mate, and lay eggs on the current season's shoots and conelets or on shoots of the previous season if moths emerge before new growth has occurred. Eggs may take as long as 30 days to hatch if cool weather follows egg laying in the spring; later in the summer, eggs hatch in only 5 to 10 days.

Newly hatched larvae feed on the surface of new growth and cause shallow injuries, or they may bore into the needle fascicles. Later the larvae move to the shoot tips, build a protective web at the base of the buds, and begin boring into the bud or stem tissue. Feeding continues for 3 to 4 weeks inside these tissues until larvae are fully grown. Pupation occurs within the cavities formed by the larvae.

When conelets are attacked, adults lay eggs on the developing shoots or on conelets. Larvae first feed on the surface tissues, then migrate to the axil formed by the shoot and the conelet stalk. Boring begins in the conelet stalk and extends up into the conelet, killing the conelet. The larva then moves either to the shoot tip or to a healthy conelet and continues feeding and developing. Most of this damage occurs in the spring during the first generation.

This cycle, depending on location and weather conditions, is repeated from one to five times during a year. Two generations usually occur in the northern part of the United States. South of Pennsylvania and into the Midwest, three generations occur. States south of North Carolina and Tennessee have four

generations per season, with the exception of Florida and parts of the Gulf Coast where five generations may occur. In southern California there are four or five generations.

Control

More than 30 known species of parasites attack the Nantucket pine tip moth. Several predatory insects and birds also attack this pest. Low winter temperature in the northern part of the range can kill overwintering pupae.

A parasitic wasp, *Campoplex frustranae* (Cushman), has been successfully introduced from Georgia to the infested area of southern California and has greatly reduced the damage suffered by Monterey pine at some locations.

Because of the high cost, the benefit/cost ratio is small for large-scale treatments. Control by insecticides is usually not recommended except in seed orchards, nurseries, Christmas tree plantations, or on ornamentals.

Several insecticides are registered for tip moth control: azinphos-methyl, dimethoate, disulfoton, and trichlorphon. Some are applied to pine foliage and others, which are systemic insecticides, are applied to the soil.

If foliar sprays are used and season-long control is desired, spraying may be necessary for each generation. The spray should be directed at young larvae, which feed on the exterior of the shoot for several days. Eggs hatch 5 to 10 days after the peak of adult emergence. When cool weather follows peak adult emergence in early spring, spraying should be deferred for about 14 days. When systemics are used, they should be applied in late winter or early spring.

Certain cultural practices may be used to minimize damage done by this insect. Highly susceptible species of pine should be planted only on sites to which they are well adapted. On poor sites, species of pine resistant to Nantucket pine tip moth should be substituted if possible. Such practices as close spacing and planting under an overstory may help reduce moth populations and subsequent injury to trees.

In California, quarantine regulations forbid the shipment of pine nursery stock out of infested areas.

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