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Southwestern Pine Tip Moth

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The southwestern pine tip moth, *Rhyacionia neomexicana* (Dyar), injures young ponderosa pines (*Pinus ponderosa* Dougl. ex Laws) in the Southwest, central Rockies, and midwestern plains. Larvae feed on and destroy new, expanding shoots, often seriously reducing terminal growth of both naturally regenerated and planted pines. The tip moth is especially damaging to trees on reseeded and planted burns in Arizona, New Mexico, and Colorado.

The southwestern pine tip moth has been found in Arizona, New Mexico, California, Colorado, Utah, Nebraska, southern Montana, and southwestern North Dakota (fig. 1). It probably occurs throughout the interior range of ponderosa pine.

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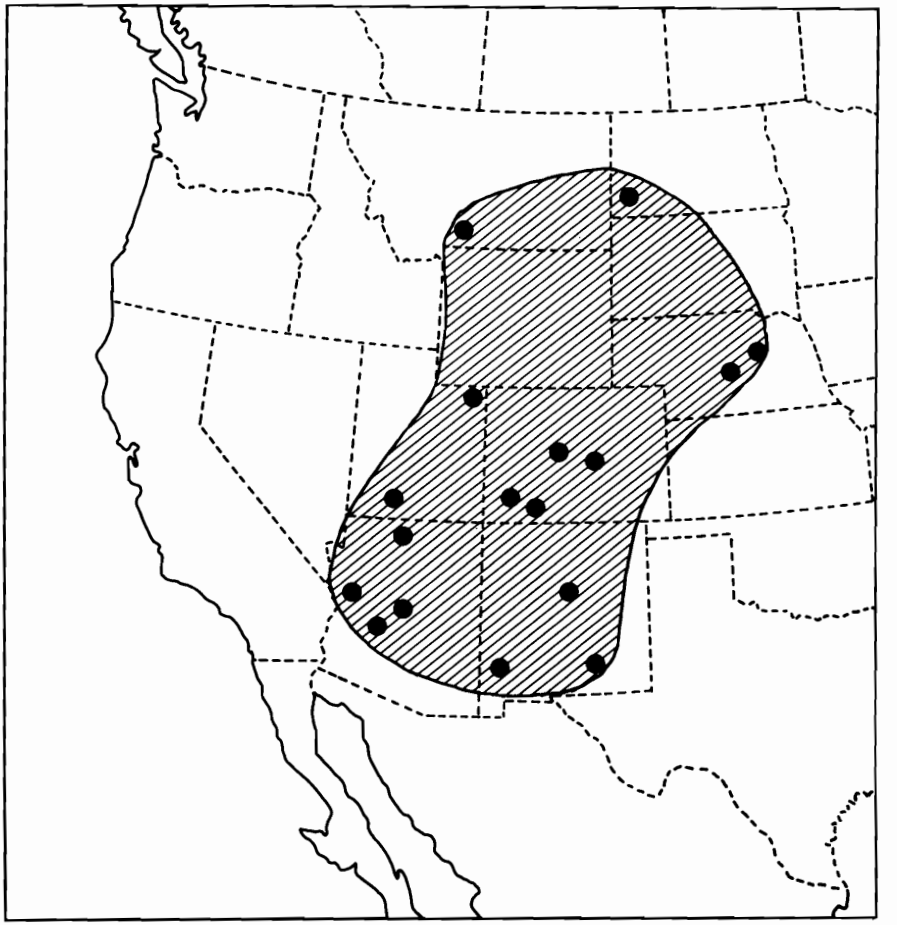

Figure 1.—*General distribution of southwestern pine tip moth. Points show major published collection records.*

Hosts

Ponderosa pine is the principal host for the southwestern pine tip moth. Other species of pines are attacked in plantations and in ornamental plantings. Plantings of Scotch pine (*Pinus sylvestris* L.), jack pine (*P. banksiana* Lamb.), and Austrian pine (*P. nigra* Arnold) have been damaged on the Nebraska National Forest in central Nebraska. Trees under 6 to 8 feet (1.8 to 2.4 m) tall are most susceptible. Seedlings may be attacked the same year they are planted.

Evidences of Infestation

Tip moth larvae injure trees by mining in the new shoots and killing buds. Both terminal and lateral shoots are attacked. However, injury is seldom noticed until midsummer, when infested shoots turn reddish brown. Mined needles are an earlier sign of infestation, but are difficult to find. Glistening pitch "tents" formed by larvae that attack the new, expanding shoots are more noticeable early indicators of infestation. The larvae bore into the shoot at the bases of new needles. Feeding causes pitch to

flow, and the larvae mix this pitch with silk to form tents. Tents, frass, and silk webbing are readily visible signs of tip moth activity in May and June. Injured needles stop growing and rapidly fade to yellowish brown. If the attack is severe enough, the entire shoot may stop growing and wither.

When several larvae attack, the shoot is completely hollowed out, leaving only the outer bark and central pith. By midsummer, mined shoots turn reddish brown and become dry and brittle (fig. 2). Shoots crumble when touched, and many break off during the winter. Accumulations of frass, dry needles, pitch tents, and loose webbing are reliable signs of tip moth infestation.

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Figure 2.—*Ponderosa pine shoots damaged by tip moth larval feeding.*

Shortened terminals that have a "shaving-brush" appearance are sometimes mistakenly thought to be indicators of tip moth infestation. However, these are caused by the western pine shoot borer (*Eucosma sonomana* Kearfott), a closely related species. Occasionally, both shoot borers and tip moths are found in the same tree and even in the same shoot.

Damage

Damage is caused by larvae that mine in the new shoots, destroying the bud and often the entire shoot. When the terminal shoot or leader is destroyed, a lateral shoot usually becomes dominant. New buds may also form just below the damaged shoot. When these buds elongate, they produce several new shoots, leading to multiple stems and a bushy tree.

Repeated tip moth attacks severely deform host trees (fig. 3) and retard

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Figure 3.—*Common kinds of severe tree deformities caused by the tip moth.*

height growth. Common tree deformities include crooks, forks, multiple stems, and spiketops (dead leaders). These deformities often occur in combination and can be recognized years after initial attack.

Established trees are rarely killed outright by tip moths, but tip moth infestations jeopardize the survival and growth of young planted seedlings. Tip moth damage can contribute to the overall decline of plantations by retarding tree growth and producing deformities.

Description of Life Stages

The adult tip moth has a wingspan of about 0.9 inches (24 mm) and can be identified by two black lines on the outer third of the forewing. These lines may be faint in some moths, but are almost always present. The forewings are irregularly banded with transverse bars of dark gray, blackish, and brick-red scales on the inner two-thirds of the wing. The hindwings are gray. Female tip moths are slightly smaller than males.

The tip moth egg (fig. 4) is elliptical; the upper surface is convex; and the underside, which is attached to the needle, is flat. When laid, eggs are light greenish yellow and resemble the needle color. As the embryo develops, the egg changes from greenish yellow to yellowish orange and finally to bright reddish orange. By this time, the developing larvae are visible inside the eggs.

Larvae (fig. 5) are usually orange in color; early stages are yellowish orange, and later stages are reddish orange. The head capsule and thoracic and anal shields are dark brown to light tan. Tip moth larvae go through five instars, and fully developed larvae are about 0.5 to 0.6 inch (12 to 16 mm) long.

When first formed, tip moth pupae are golden yellow to yellowish brown. They are found in silken cocoons attached to tree root collars. Older pupae are dark yellowish brown to reddish brown. The two black streaks on the outer portion of the forewing are usually visible through the pupal skin. The pupal head has a prominent

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Figure 4.—*Tip moth eggs on pine needle.*

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Figure 5.—*Infested shoot cut open to expose tip moth larva.*

ridge or frontal horn. Pupae are about 0.3 to 0.4 inch (7 to 10 mm) long.

Life History and Habits

Depending on locality, adult emergence begins as early as late March and peaks as early as mid-April. Peak flight activity is at night when males are attracted to females by a sex pheromone. Egg laying begins in April, shortly after female emergence and mating. Eggs are laid singly or in an overlapping row on the inner surface of needles near the bundle sheath. Most eggs are found on 1-year-old needles in the upper three whorls of foliage.

The eggs hatch in about 2 weeks. In Arizona, hatching begins in early to mid-May. The small larvae may mine 1-year-old needles or move directly to the new, expanding shoots. Only one larva is found per needle mine; completed mines are 0.4 to 0.8 inch (1 to 2 cm) long. First-stage larvae occasionally molt to the second instar within the needle mines.

After mining needles, the larvae move to the new shoots and feed near the junction of a needle fascicle and the surface of the expanding shoot. Feeding causes pitch to flow from the wounds. The larvae mix pitch with silk to form the shiny, semitransparent tents in which they feed. Tip moth larvae frequently enlarge these tents to encompass the bases of several needles. The young larvae sever the needles within the bundle sheath; severed needles turn yellowish brown and sometimes drop.

Larvae then bore into the shoot and feed on the tender tissues between the pith and the bark. The larvae feed gregariously; as many as 31 have been found mining a single terminal. Feeding usually begins below the bud and continues upward. Individual feeding galleries are usually not distinct. They coalesce and often result in a hollowed-out shoot. The pith remains more or less intact and forms a hardened central support. Extruded frass accumulates on the outer surface of the shoot along with dry needles, pitch tents, and loose webbing.

Mining stops in early summer when the larvae leave the shoots and descend the tree boles. In Arizona, descent begins in early July, peaks in mid-July, and is generally completed by early August. The larvae crawl down the tree boles and enter the soil where they spin cocoons and pupate. Cocoons are attached to the tree root collar 1 inch (2 to 3 cm) below the soil surface. Often, cocoons form a ring that completely surrounds the tree in the root-collar zone. By mid-August, most larvae within the cocoons have transformed into pupae, the overwintering stage.

The next spring, pupae break through the cocoons and wriggle upwards to the ground surface. The adult moths then emerge and crawl up the tree boles where they expand their wings.

Control

The southwestern pine tip moth is attacked by various natural enemies. Eggs are parasitized by species of *Telenomus* and *Trichogramma* wasps, and several species of parasitic flies and wasps attack and kill the larvae and pupae. These include species of *Geron, Apanteles, Bracon, Itoplectis,* and *Scambus.*

Predators of the tip moth include ants, spiders, mites, wireworms, lizards, birds, and mice. Mites feed on

the eggs; and ants, spiders, and lizards feed on larvae when they leave the shoots to pupate. Birds open the shoots and extract larvae. Mice dig up cocoons at the bases of trees and feed on larvae and pupae. Wireworms prey on overwintering pupae.

Clipping and destroying infested shoots before the larvae leave the shoots to pupate will reduce populations, but clipping will not prevent current-year damage or halt invading moths the next spring. Clipping is feasible only for ornamentals and small, isolated plantings; it is not feasible for large, extensive plantings or reseeded burns.

Silvicultural measures that promote rapid tree growth may help reduce tip moth damage. For example, thinning overstocked "dog-hair" stands releases trees and promotes height growth. The released trees soon grow to a height of 6 to 8 feet, beyond which they are less susceptible to tip moth attack. Thinning should be done in the fall or winter when *Ips* beetles are less likely to build up in slash.

The southwestern pine tip moth can be controlled with chemical insecticides, but this is usually practical only in situations such as residential plantings or small plantations. Consult your State or Federal forest pest management specialist or your county agricultural agent to obtain current information on chemicals registered for tip moth control.

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