Control of Nantucket Pine Tip Moth in Eldarica Pine Christmas Tree Plantations

Authors: R. Phillips[1/], J.G. Mexal[1/] and L.M. English[2/]

ABSTRACT

Nantucket pine tip moth (Rhyacionia frustrana) is a serious insect pest on eldarica pine (Pinus eldarica) in southern New Mexico. The pest bores into buds and expanding shoots resulting in deformation of the tree. Height is reduced 23% compared to protected trees. Protective methods using pheremone traps and pesticide applications are discussed.

INTRODUCTION

Eldarica pine (Pinus eldarica Medw.) has become an important Christmas tree species in southern New Mexico. The Nantucket pine tip moth (Rhyacionia frustrana Comstock) is a highly destructive pest on P. eldarica. Because of potential economic impact of this pest on southern New Mexico's Christmas tree plantations, a study of the moth life cycle and its impact on this particular pine species is warranted. The Nantucket pine tip moth (NTPM) attacks most 2- and 3-needle pines. The larvae mine into the terminal and lateral buds, resulting in dead needles and shoots. This damage deforms trees, and reduces growth and cone production (Pfadt 1985). Crown deformities result in loss of value from sales, and can quarantine live Christmas trees scheduled for shipment to non-infested areas.

1/ Department of Agronomy and Horticulture, New Mexico State University, Las Cruces, NM 88003.
2/ Extension, Entomologist, Copperative Extension Service Las Cruces, NM 88003.

Figure 1. Nantucket pine tipmoth (R. frustrana). Photo courtesy by Gerald Nielsen.

DESCRIPTION

Adult Nantucket pine tip moths are small, grayish moths with a wing span of 9 to 14 mm (3/8" to 2/3"). The forewings are marked with irregular reddish-brown patches (Fig. 1). The larvae can reach a length of 9 mm (3/8"). They range in color from light brown to orange-red with dark heads. The pupae are brown and approximately 6 mm (1/4") long (Sakovich 1982).

BIOLOGY

This pest overwinters as pupae in damaged pine shoots. Adults emerge and mate in early spring as temperatures warm. The adult female lays small, flattened eggs on the needles of succulent shoot tips, near the base of the needles or bud scales. The first instar larvae feed on the needles, while the second instar feeds directly on elongating shoots. The larvae then mine into the shoot and feed on the stem tissue for up to 4 weeks (Dixon 1987). The presence of feeding larvae is usually first distinguished by a grayish-white, sticky substance around the wound area and later down the shoot. The larvae pupate inside the shoot, emerge and repeat the cycle. The pest can undergo as many as four generations under favorable environmental conditions in southern New Mexico. The first moths can emerge as early as February, but the peak of the first flight usually occurs in early April (Fig. 2). The second flight emerges in June with either a gradual tapering off of this flight or a more distinct third flight in July-August.

This pest is particularly well adapted to multi-flush conifer hosts like P. eldarica. Eldarica pine can have as many as eight cycles (flushes) in a growing season. The numerous cycles during the season provide a continued source of food and protection for this multi-voltine insect. Consequently, populations of this pest remain reproductively active throughout the growing season, and dramatic increases in numbers can occur in a short time.

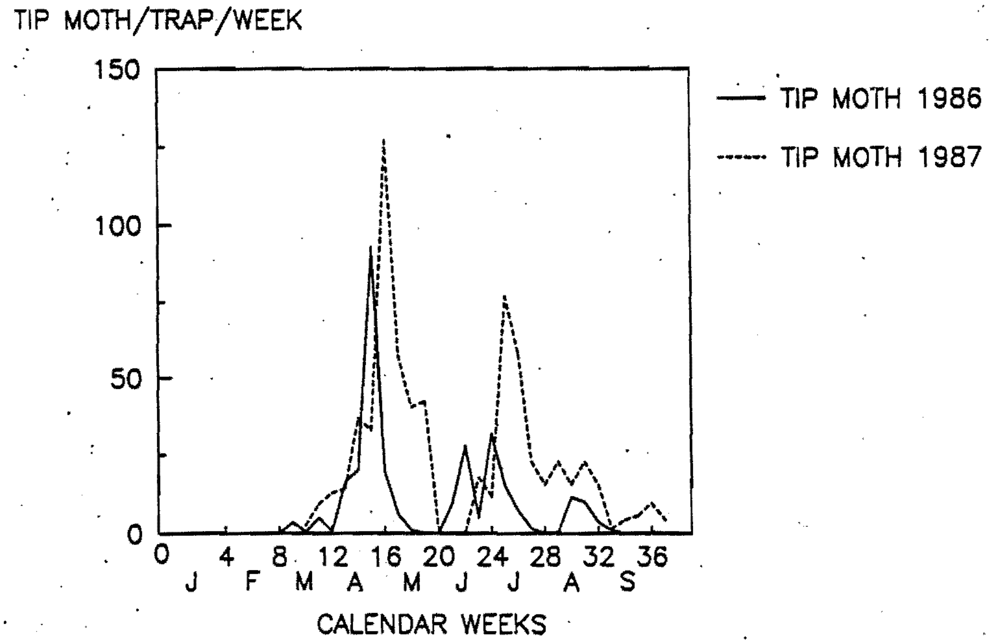

Figure 2. Nantucket pine tip moth flights based on moths traped per week in 1986 and 1987.

DISTRIBUTION

The Nantucket pine tip moth has a wide geographic range (Fig. 3) including the east and southeastern United States (Baker 1972). NTPM attacks 20 species of pine in the United States (Hedlin et al. 1981). It attacks most southern and western pine species in addition to exotic pines such a P. eldarica and P. sylvestris. It has been a problem in southern California on radiata pine since the 1970s (Sakovich 1982). It was first noticed on eldarica pine in southern New Mexico in 1984.

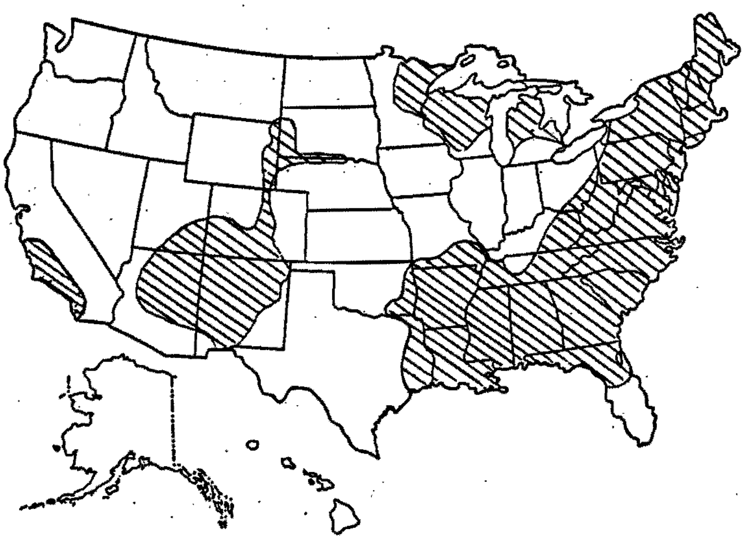

Figure 3. Nantucket pine tip moth distirbution in the United States.

MONITORING AND CONTROL

A multi-voltine pest such as NTPM has dynamic population growth. A knowledge of the population dynamics of NTPM allows effective control. Pheromone traps can be used to monitor tip moth population activities. Current spray dates are scheduled on the basis of peak moth count per flight (Fig. 2). Successful control requires pesticide application when larvae are in the first and second instar before the larvae bore into the stem (Garquillo et al. 1983). Spraying Sevin XLR® applied as a foliar spray 1 week after the peak moth count was recorded (April 12, 1987) resulted in minimum tip moth infestations from the first moth flight (Table 1). Subsequent flights were effectively controlled with three sprays. No better control was obtained by spraying weekly after June 26, 1987. Figure 2 includes only 2 year's data on moth flights and should not be used to predict spray dates.

Table 1. Effect of Sevin XLR applications on NPTM damage to eldarica pine Christmas trees. Values in a column followed by the same letter are not significantly different (a = .05). Values in parentheses represent ranges.

Treatments	Sprays (#)	Terminal Damage (%) Flt 1	Terminal Damage (%) Flt 2	Laterals Damage (#) Flt 1	Laterals Damage (#) Flt 2
Untreated	0	30 b	70 b	1.1 (0-8)	9.0
Degree Day	4	7 a	2 a	0.1 (0-2)	0.1
Peak + 7	4	16 a	2 a	0.3 (0-3)	0.1
Peak + 7 + wkly	10	5 a	5 a	0.1 (0-3)	0.3

In addition to pheromone traps, the use of degree/day models have been effectively used to predicte optimum spray dates in the Southeast (Garguillo et al. 1983). Degree/day models use pheromone trap information and minimum/maximum temperatures above a threshold to predict NPTM larval growth and development. Consequently, sprays could be applied when the pest is at the most vulnerable larval stage. In the 1987 trial, the degree/day model provided no better control than the peak day approach (Table 1). Furthermore, the model adapted from the Southeast did not seem to accurately predict the first flight. This could be caused by greater temperature fluctuations characteristic of the Southwest. More research is needed to adapt degree/day models to the Southwest before they can be used to predict spray schedules in southern New Mexico.

Treated Christmas trees grew better than the control trees that received no protection from NPTM (Fig. 4). Height measured in December 1987 was 23% greater for treated trees compared to the controls. While moth flights ended in August,

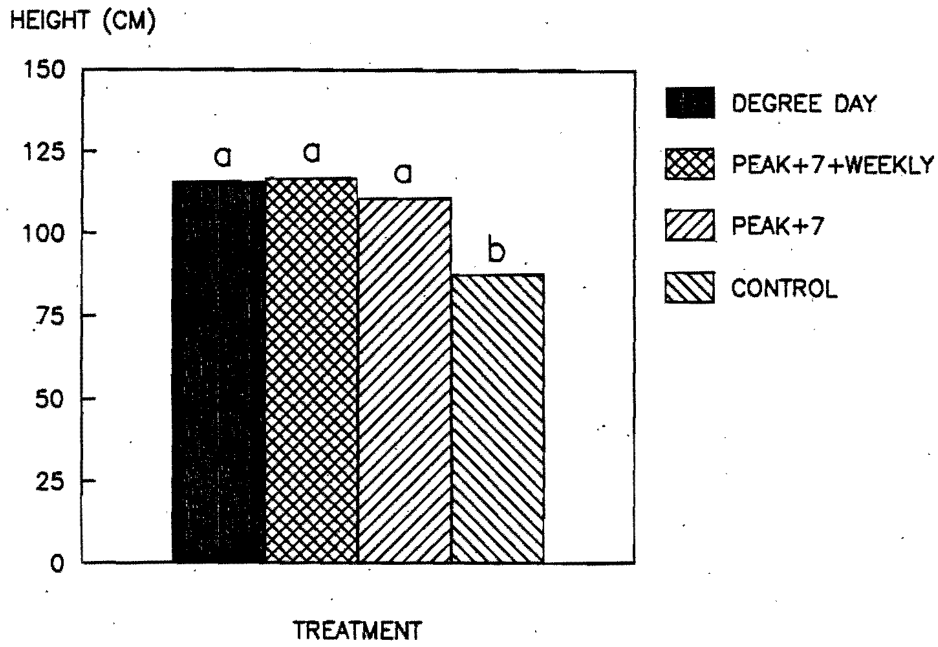

Figure 4. Height of eldarica pine Christmas trees in December 1987 after one season of protection from NPTM.

growth continued through October. The protected trees increased 26% in height in the intervening period. The untreated trees increased only 19% in height. Furthermore, the trees were disfigured even after pruning to remove dead shoots and forked branches Cade and Hedden (1987) found tip moth control for 3 years increased height of loblolly pine about 0.60 m. In their study, up to 98% of the trees were infested by age 5. In our study, 1 year of protection increased height 0.27 m. Without protection, 70% of the trees suffered terminal shoot damage. The inability to market 70% of a stand of Christmas trees is disastrous

(Table 2). The cost of control is estimated at $832/ac with about 5% of the trees damaged by tip moth. Incomplete application of insecticide could result in 40% damage. The application costs are the same ($832/ac), but lost sales range from $2800/ac to $4800/ac depending on whether the trees are cut or sold live. No protection will result in 70% damage with loss of sales ranging up to $8400/ac (Table 2). Once the tip moth population is established in a plantation a grower must protect the crop. Even poor protection is better economically than no protection.

Table 2. Economics of protection against tip moth in an eldarica pine Christmas tree plantation. Protection requires four applications of registered insecticide in each of two years. Trees are valued at $12 and $7 for live and cut trees, respectively. Stocking is 1000 trees per acre.

Damage Level (%)	Control Cost ($)	Sales Losses		
		Trees/ Ac.	Live Trees ($/Ac) (or)	Cut Trees ($/Ac)
5	$832	50	$ 600	$ 350
40	$832	400	$4800	$2800
70	0	700	$8400	$4900

RECOMMENDATIONS

Growers should monitor NTPM populations within their own plantations. In a study of NPTM control in Christmas trees, Davis (1986) used one trap per hectare (2.4 ac). A minimum of two traps per plantation is recommended to safeguard against trap damage and loss of data (Cade 1983). Growers should install traps in early March and check the traps three times a week through August. Traps should be changed monthly to ensure adequate pheromone levels. Pheremone traps are available from different sources (see below) and are inexpensive relative to the losses caused by NPTM.

The objective of the monitoring is to determine the peak of the flight. Suitable pesticides should be applied 7 days after the peak. Several systemic and contact type pesticides are registered for control of pine tip moth. The timing and method of application differs depending on the particular pesticide. Among the pesticides registered for use on NPTM are Orthene (acephate), Cygon (dimethoate), Dimilin (diflubenzuron), DiSyston (disulfoton), Dylox trichlorfon), Zolone (phosalone), Guthion (azinphos-methyl), Furadan (carbofuran), Sevin (carbaryl) and Pydrin (fenvalerate). Sevin XLR and Orthene have worked successfully in New Mexico with no more than four applications over the growing season.

One important aspect of contact insecticides is that complete coverage of all the elongating shoots is required for maximum protection. Failure to cover adequately may result in high levels of infestation. Growers should apply only registered pesticides and read labels carefully before applying any product.

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Footnote: Pheromone traps are available from: Scentry, Inc., P.O. Box 426, Buckeye, AZ 85326, (602) 386-6737; and Trace, Inc., P.O. Box 6267, Salinas, CA 93915, (400) 758-0205.