FALL AND SPRING INSECTICIDE TREATMENTS FOR CONTROL OF THE ZIMMERMAN PINE MOTH[1]

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This paper reviews some studies conducted on the biology and control of the Zimmerman pine moth *Dioryctria zimmermani* (Grote), and reports the latest results of chemicals that are registered on pines and their performance in controlling the Zimmerman pine moth.

The Zimmerman pine moth is a common pest of pines in the northern half of the United States east of the Rockies and the southern Canadian provinces. Carlson and Wilson (1971) indicated that the host trees are Scotch, Japanese red (*Pinus densiflora* Sieb. & Zucc.), red, ponderosa, eastern white, jack, mugo (*P. mugo* var. *mughus* [Scop.] Zenari), and Austrian (*P. nigra* var. *austriaca* [Hoess] Aschers. & Graebn.) pines with Scotch and Japanese red pine being the most susceptible to attack. The insect can cause serious problems in Christmas tree plantations, nurseries, and trees in the home landscape. Occasionally boring will occur within a branch but generally it is within the whorl area of the tree trunk (Fig. 1). Death of several tree branches radiating from the whorl area may occur. If the infestation site is near the base of the tree the entire tree may die. Trees of 6-15 feet in height often break at infestation sites during strong windstorms (Fig. 2). A young tree which survives an attack may eventually have a crooked trunk making it unsuitable for Christmas tree sale.

Life History

In Central Illinois adult moths emerge from mid-July to mid-August with peak emergence during the first week of August, in northern Illinois it occurs 8 days later (Rennels 1960). Peak emergence in northern Indiana is in mid-August (Schuder 1960). In southwestern Michigan moth emergence was between August 5-25 (Carlson & Butcher 1967). Rennels (1960) stated that mating occurs within 1 day after emergence and that eggs are deposited 2 or 3 days later. Adult moth longevity is unknown under natural conditions but in outside cages males lived a maximum of 7 days and females 17 days (Rennels 1960).

Eggs are generally deposited on the trunk under bark scales and they hatch in 7 days (Carlson & Butcher 1967) or 8-10 days (Rennels 1960) after being deposited.

Rennels (1960) reports that the larvae upon hatching feed on the outer trunk bark, however, Carlson & Butcher (1967) indicate that the newly

Fig. 1. Sap exudate on the whorl area of a red pine trunk in late July indicating Zimmerman pine moth infestation.

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hatched larva does not feed, but almost immediately crawls beneath bark flakes and constructs a hibernaculum (a thin silkened overwintering case). The larva overwinters in the hibernaculum until spring. In southwestern Michigan larvae emerge from hibernacula during the first week in May. This corresponds closely to the initiation of terminal growth in Scotch pine (Carlson & Butcher 1967). The larvae bore into the bark tissues and begin feeding. If a branch is infested the first symptoms will be a wilting and browning of the new growth. Infested tree terminals usually take on a "fish-hooked" appearance (Schuder 1960). Schuder (1960) states that late in June the larvae leave the new growth and invade the whorl area. In mid-June sap exudate begins to exude at infestation sites. The sap, when fresh, is clear and shiny but soon becomes a white resin. As the season progresses and the larvae mature the amount of sap exudate increass and sawdust-like frass is incorporated within it. The mature larva is about ¾ inch long with a brown head and a pink to greenish body that is covered with small black dots each with a black seta (Schuder 1960).

In mid to late July the larvae stop feeding and change to the pupal stage. Pupation occurs within a tunnel just under the tree bark or within a resin mass. Adult moths emerge about 15-23 days after pupating. Reynolds (1960) states that at rest the moth is about ½ inch long, the front wings are gray with rust colored markings and with alternating zigzag light and dark lines.

Fig. 2. A fallen Scotch pine tree resulting from a Zimmerman pine moth infestation in the tree trunk.

Chemical Control

Research by Butcher et al. (1966) in Michigan showed that full coverage sprays of BHC, endosulfan (Thiodan), and naled (Dibrom) gave good control if applied in late April. They reported that treatments of BHC and naled applied in late September or BCH and endosulan in early November gave control. Schuder (1960) recommended DDT be applied in mid-August. Carlson and Wilson (1971) state control of 95% or more of the larvae may be obtained by spraying with endosulfan between early April and early May in the North. Because many of the chemicals previously mentioned are no longer available, experiments were initiated in 1976 to find other substitutes.

Methods and Materials

A five acre nursery of Scotch pine trees of 4-6 feet in height planted 4 feet apart and consisting of 14 rows with about 100 trees per row was selected in Whiteside County, Illinois (northwestern) because of the high incidence of Zimmerman pine moth damage. On September 10, 1976 nine trees that had symptoms of Zimmerman pine moth infestations were tagged in each of 14 rows. All the hardened sap exudate from previous infestations was scraped off all the tagged trees. The insecticide treatments (Table 1) were applied with a 100 gallon hydraulic sprayer at 85 psi.

Table 1. Treatments and rates applied for the fall and spring treatments.

Insecticide	*Formulation in 100 gal.*
Acephate 75SP (Orthene)	1.0 lb.
Chlorpyrifos 2EC (Dursban)	1.0 qt.
Dimethoate 267EC (Cygon)	1.5 pt.
Check (untreated)	—

Fall treatments. — On September 14, 1976 insecticide sprays were applied until runoff onto the branches and trunks of the trees. Each treatment was applied onto 9 trees in each of 2 adjoining rows (18 trees per treatment). The following year on August 12, 1977 the number of infestation sites seen as new sap exudate was counted on

each tree. The hardened sap exudate was then removed. The same trees were retreated on September 4, 1977. Counts of infestation sites were made the following year on July 13, 1978.

Spring treatments. — On April 16, 1977 other trees in adjoining rows were treated as described in the September 14 applications using the same insecticides. On August 12 the same year counts were taken of the new infestation sites. The sap exudate was then removed. The same trees were retreated the following year on April 27, 1978 and the counts taken July 13, 1978.

Results and Discussion

Table 2 shows the results after the 1st and 2nd year of treatments. The enclosed numbers represent the total number of infestation sites found on 18 trees. Fall treatments were not as effective as those applied in the spring. In past experiments conducted by other researchers using different insecticides, the results were similar. The poor results of the fall treatments can probably be attributed to the fact that the larvae, upon hatching, are reported to move only a short distance and not to feed prior to constructing their hibernacula. Of the fall treatments, chlorpyrifos (Dursban) applied in early September was the most effective.

All trees treated in the spring had fewer infestation sites than did the untreated check trees. A treatment of chlorpyrifos applied in mid to late

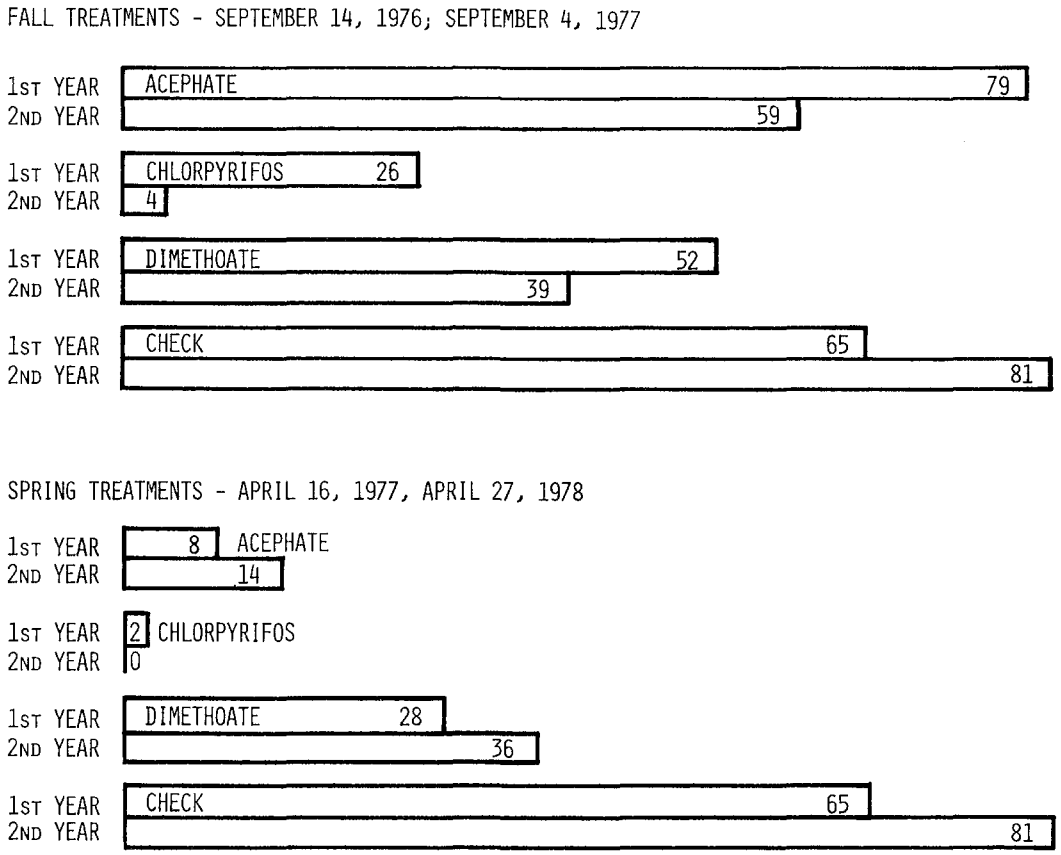

Table 2. Enclosed numbers represent the total number of infestation sites on 18 Scotch pine trees 1 and 2 years after the treatments were applied in a Christmas tree plantation in Whiteside County, Illinois for Zimmerman pine moth control.

April was particularly effective. Upon emerging from the hibernacula the larvae wander over the trunk surfaces and probably come in enough contact with insecticides that mortality results. The thorough wetting of the bark and branches is important and the addition of a wetting agent to the insecticide mixtures would probably be appropriate.

Literature Cited

Butcher, J.W., and R.B. Carlson. 1962. *Zimmerman pine moth biology and control.* J. Econ. Ent. 55(5): 668-71.

Butcher, J.W., R.B. Carlson, J. Maki, and S. Ilnitzky. 1966. Fall and spring treatments for control of Zimmerman pine moth on Christmas trees. Mich. Agric. Exper. Sta. Quart. Bull. 49(12): 111-5.

Carlson, R.B., and J.W. Butcher. 1967. *Biology and behavior of Zimmerman pine moth, Dioryctria zimmermani, in Michigan.* Canad. Ent. 99(5): 529-36.

Carlson, R.B., and L.F. Wilson. 1971. Zimmerman pine moth. USDA Forest Service Pest Leaflet 106. 7 p.

Rennels,R.G. 1960. The Zimmerman pine moth, an 8-year study of its natural history in Illinois coniferous plantations. Ill. Agric. Exper. Sta. Bull. 660. 39 p.

Schuder, D.L. 1960. The Zimmerman pine moth, *Dioryctria zimmermani* (Grote). Purdue Univ. Agric. Exper. Sta. Res. Bull. 698. 8 p.

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ABSTRACTS

LAMBE, R.C. and W.H. WILLS. 1979. **Flowering dogwood diseases.** Landscape Industry 24(4): 46-47, 49.

Diseases may be an important factor in the production of flowering dogwood under nursery conditions. Recently several different virus diseases have been reported by various researchers, but little is known about their impact on the production of dogwood. Historically, fungus diseases of the foliage, twigs, roots, and trunks have been considered important. Foliage and stem diseases generally occur under conditions of excess rainfall and low temperatures. More recently a fungus root rot and a trunk canker of undetermined cause have assumed important positions in the commercial production of dogwood in Virginia. Foliar diseases reported on dogwood have included leaf spots, blights, mildews, and viruses. Fungi causing twig blights reported on dogwood include *Botryosphaeria dothidea* and *B. ribis.* Recently we have reported a root rot caused by *Phytophthora cactorum.*

SHURTLEFF, M.C. 1979. **Sprays for important diseases of non-woody ornamentals.** Grounds Maintenance 14(5): 11, 14, 86.

The chart beginning in this issue is not intended to be a master chemical control program. Disease occurrence varies among locations, and many of the diseases listed do not cause serious damage every year. Thus, it is not necessary to spray or dust annually for their control, except possibly in nurseries. Plants growing in the eastern half of the United States, where rainfall and humidity are generally high, need more frequent spraying or dusting than those in drier areas. In the drier western states, applications may not be needed. The chart lists suggested fungicides and bactericides by common names or by names of representative proprietary products. The following chart lists diseases and chemicals for most ornamentals. It will continue in future issues of Grounds Maintenance, listing diseases and sprays for specific ornamentals from African violet to zinnia.