Comparison of Chemical and Cultural Controls for Pales and Northern Pine Weevils in Tree Stumps[1]

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Abstract

Selected insecticides were applied in kerosene or water to Scotch pine (*Pinus silvestris* L.) stumps in a Christmas tree plantation. Other stumps were treated by covering with black plastic mulch, roof sealer or hot caps plant protectors. The black plastic was considered to be as effective as the registered insecticides in controlling production of northern pine weevil, *Pissodes approximatus* Hopkins, and pales weevil, *Hylobius pales* (Herbst) (Coleoptera: Curculionidae). The use of black plastic was cost comparable to applying the insecticide lindane.

Index Words: *Hylobius pales, Pissodes approximatus*, Christmas trees, control tactics

Introduction

Pales weevils, *Hylobius pales* (Herbst), and northern pine weevils, *Pissodes approximatus* Hopkins, are common pests in eastern Christmas tree plantations and tree nurseries. Both weevils oviposit in the bark of newly cut pine stumps, slash and weakened trees (2, 4, 5). Larvae mature during early summer and adults generally emerge from late July through September. The adults cause damage by feeding on the bark of seedlings and twigs of nearby conifers especially Douglas-fir [*Pseudotsuga menziesii* (Mirb.)], spruces (*Picea* sp.) and Scotch (*Pinus sylvestris* L.) pine. This feeding results in death of seedlings and branch tips, a condition called flagging.

Successful weevil control has been obtained by spraying new stumps with insecticides in kerosene in the early spring (6, 9, 10, 12, 13).

Development of weevil larvae under the protective bark of the stump seems to inhibit the effectiveness of natural controls. Biological agents such as nematodes, fungi, and parasites are occasionally effective in reducing weevil populations (4, 7, 11, 15). Woodpeckers and sapsuckers have been observed feeding on larvae, sometimes stripping bark from trees to locate their prey (4).

Cultural control measures have been used for many years to decrease weevil populations. Growers whose plantations have chronic weevil infestations resort to stump removal, burning or grinding. These practices are time consuming and costly, but reliable. Delayed planting of seedlings until weevil populations have declined is also suggested (14). However, a two year delay may be necessary.

Cost effective cultural methods for weevil conrol would be a valuable addition to growers' management strategies. With this in mind, we covered fresh stumps with black plastic mulch, tar roof sealer, or standard garden hot caps in an attempt to make them unsuitable for oviposition. These cultural methods were compared with chemical control for reducing weevil populations.

[1]Received for publication November 21, 1983; in revised form December 5, 1985. We wish to thank Roy Fleming for the use of his tree plantation.

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Materials and Methods

A commercial Scotch pine plantation in Armstrong County, Pennsylvania was selected for the study. The stand contained trees ready for harvest, fresh stumps from the previous year's cutting, and older stumps no longer suitable for weevil oviposition. This site had been observed for two years prior to this study; weevils were known to be present. A randomized complete block design was used. Five blocks were used; within each block, each treatment was applied to 6 fresh stumps in a row.

Chemical and cultural controls were applied on April 17, 1979. The air temperature was 11°C (52°F), with a wind of 8–11 kph (12–18 mph). The insecticides (Table 1) were applied with 3.8 1 (1 gal) compression sprayers; each stump received approximately 150 ml (5 oz) of spray. The control treatment consisted of approximately 150 ml (5 oz) of water per stump.

Cultural control materials tested as barriers were: 1 ½ mil black polyethylene (Science Products Company, Inc., Chicago, IL), commercial roof sealer (Monsey Products Co., Kimberton, PA), and waxed paper plant protectors called "hot caps" (Hot Kaps®, 15.2 cm high × 27.9 cm in diameter at the base (6 × 11 in), Germain's Inc., Los Angeles, CA). The plastic, applied as 45.7 cm^2 (18 in^2) sheets, was secured over the stump on all sides by scraping nearby duff. A single hot cap was placed over each treatment stump and secured with duff. The roof sealer was applied with a putty knife to all above ground portions of the stump after the duff had been scraped away.

Treatment effectiveness was evaluated on October 20 and 25, 1979 by exposing each stump to the first major lateral root, peeling away the bark and counting weevil chip "cocoons" (8). Chip cocoons indicates successful weevil emergence but do not reveal which species of weevil constructed it.

Results and Discussion

1. Effectiveness of Experimental Treatments. Table 1 contains a list of the chemical and cultural treatments applied to the stumps, the rates, carriers, number of chip cocoons, and percent reduction. In general, kerosene-based sprays provided better control than the water-based sprays. Water-

Table 1. Effectiveness of chemical and cultural treatments for control of pales and northern pine weevils.

Treatment	Carrier	Rate (kgs ai/ha) (lb ai/100 gal)	Chip Cocoons $\bar{x}$/stump	% Reduction[y]
Acephate 75SP (Orthene®)	k	0.74(0.7)	1.70	74.0abc[z]
Acephate Spray (Orthene®)	k	0.84(0.8)	4.60	25.8d
Bendiocarb 76WP (Turcam®)	k	4.50(4.0)	0.00	100.0a
Bendiocarb 76WP (Turcam®)	k	2.20(2.0)	0.05	99.2a
Black plastic	—	— —	0.35	94.3ab
Carbaryl 50WP (Sevin®)	k	1.10(1.0)	0.70	88.7ab
Carbaryl 50WP (Sevin®)	k	0.56(0.5)	2.15	65.3bc
Carbaryl UCSF-1 (Sevin®)	w	8.70(7.8)	5.00	19.3cd
Carbaryl UCSF-1 (Sevin®)	w	1.10(1.0)	7.90	0.0d
Chlorpyrifos 2E (Dursban®)	k	8.40(7.5)	0.00	100.0a
Chlorpyrifos 2E (Dursban®)	k	1.10(1.0)	0.70	88.7ab
Hot Caps	—	—	1.80	71.0bc
Kerosene	k	—	1.70	72.6bc
Lindane 1.8EC	k	2.00(1.8)	0.00	100.0a
Methomyl 24%L (Lannate®)	k	7.20(6.4)	1.10	82.2ab
Methomyl 24%L (Lannate®)	k	1.10(1.0)	0.20	96.8ab
Oxamyl 2L (Vydate®)	k	8.70(7.8)	1.85	70.2ab
Oxamyl 2L (Vydate®)	k	4.40(3.9)	0.80	87.1ab
Oxamyl 2L (Vydate®)	k	1.10(1.0)	0.40	93.2ab
Oxamyl 2L (Vydate®)	k	0.56(0.5)	0.15	97.6a
Roof Sealer	—	—	1.70	72.6abc
Control	w	—	6.20	— d

[x]k = kerosene carrier; w = water carrier.

[y]Data was transformed using a log transformation before analysis.

[z]Means followed by the same letter are not significantly different at the 5% level using the Duncans Multiple Range Test.

based sprays were not significantly better than the control (p = .05). In this study, kerosene alone provided significant reduction in chip cocoons (72.6%) although in an Ohio study, Nielsen and Balderston (9) achieved only 35% reduction in chip cocoons with kerosene.

Dursban® (chlorpyrifos) at 8.4 kg ai/ha (7.5 lb/100 gal) (a high rate), lindane at 2.0 kg ai/ha (1.8 lb/100 gal), and Turcam® (bendiocarb) at 2.2 and 4.5 kg ai/ha (2.0 and 4.0 lb/100 gal) prevented weevil development (>99%).

Of the barrier materials tested, black plastic provided the best weevil control with a 94% reduction when compared to the water control. The hot caps and roof sealer provided as much control as kerosene alone.

Several reasons may account for the effectiveness of black plastic treatment. Heat build up under the plastic may have minimized oviposition, inhibited weevil development, or accelerated stump decay. The hot caps and roof sealer were not effective in excluding weevil oviposition and development; rips in the caps and cracks in the sealer provided entrance sites. Allegheny mound ants, *Formica exsectoides* Forel (Hymenoptera: Formicidae), were found under the plastic (warming their larvae and pupae) during evaluation. These pugnaceous ants may have influenced the weevils' development by reducing weevil oviposition or attacking weevil larvae.

II. Cost/Benefit Estimate of Black Plastic vs. Chemical Sprays. Black plastic, the most effective physical barrier, is compared to the registered insecticide, lindane (Table 2); Turcam® (bendiocarb) is also registered but is more expensive. Time needed for application of plastic strips and spraying was determined in a clear cut Christmas tree plantation. One gallon (3.8 l) of lindane 1.8EC (@$32.30 in 1982) will treat 2500 stumps, as will 2858 m (3030 yd) (45.7 cm wide) of black plastic (@$51.70 in 1982). Plastic applied in strips to fresh stumps takes longer to apply (16 man-minutes/20 stump row) than spraying with a backpack sprayer

Table 2. Comparison of application costs between lindane and black plastic to treat 2500 pine stumps.

Treatment	Cost of Materials		Cost of Labor		Total Cost
	1 gal lindane 1.8EC	$ 32.30	Mixing chemical 10 min/18.9 l (5 gal)	= 3.3 hr	
Lindane	100 gal kerosene @ $1.20/gal	$120.00	Application 20 sec/stump	= 13.9 hr	
		$152.30	17.2 hr @ $3.50/hr	= $60.20	$212.50
Black Plastic	20 new stumps per row; rows are 22.9m (25 yd) long; treat 125 rows = 2858m (3030 yd) plastic = 94 rolls @ $.55/30.5m (100 ft) roll		16 man/min/row to lay plastic over 20 new stumps To cover 125 rows @ 16 min/row	= 33.3 hr	
	94 rolls @$.55	= $ 51.70	33.3 hr @ $3.50/hr	= $116.55	$168.25

(6.67 man-minutes/20 stump row). However, when the cost of kerosene ($1.20/gal) is added to the chemical spray, the total cost of the plastic application is less. If the black plastic is applied separately to each stump (typical of selective cutting in plantations), as was done in this study, its application time cost exceeds that of the insecticide application, and makes it economically unfeasible at current labor and fuel costs.

Thus, clear cut plantations may be economically treated with black plastic while selective cut plantations would not. In addition to weevil control, other benefits of plastic should be noted. Plastic has been found to increase growth and survival of pine seedlings (1, 3). The moisture content and temperature of the soil are increased thereby providing a better climate for plant growth (8). Plastic is also effective in controlling weeds surrounding the seedlings, and may act as a barrier to other Christmas tree pests, such as the pine root collar weevil, *Hylobius radicis* Buchanan.

Significance to the Nursery Industry

Registered and non-registered insecticides were compared to a cultural tactic, isolation of pine tree stumps, for reducing pales and northern pine weevil reproduction in fresh stumps. Fresh stumps were isolated by covering them with black plastic mulch, tar roof sealer, or standard garden hot caps.

Only the black plastic was as effective as the best conventional insecticides in reducing weevil reproduction. If the black plastic is applied in strips over the pine stumps, the cost of usage is actually less than using lindane in kerosene, the registered standard pesticide. However, this control technique is only cost effective in clear-cut operations. Selective cut plantations require too much labor to cover each stump individually.

Nurserymen clearing land for planting, or Christmas tree growers cutting most or all of a field, could use black plastic economically for weevil control. The plastic should also promote new seedling growth and help in weed control.

(Ed. Note: This paper reports the results of research only and does not imply registration of a pesticide under amended FIFRA. Before using any of the products mentioned in this research paper, be certain of their registration by appropriate state and/or federal authorities.)

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