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Pesticide field trials on shade and shelterbelt trees in Alberta, 1976

by J. A. Drouin and D.S. Kusch

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PESTICIDE FIELD TRIALS ON SHADE AND SHELTERBELT TREES IN ALBERTA, 1976

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ABSTRACT

Twenty-eight insecticides, two microbials, and one adjuvant were tested for the control of pests in shade and shelterbelt trees in 66 separate evaluations. The target organisms were 10 insect species. The purpose of the trials was to obtain information on efficacy of insecticides, optimum timing of application, equipment performance, and adverse effects on nontarget species. These data are used to provide support for Canadian registration of the candidate chemicals tested. Good to excellent control was obtained in 58 of the treatments, providing data to support the registration for the control of 5 specific insect pests.

RESUME

Les auteurs testèrent 28 insecticides, deux microbiques et un auxiliaire pour leur efficacité contre les infestations d'insectes nuisibles aux arbres produisant de l'ombre et aux rideaux d'arbres. Ils effectuèrent 66 différentes évaluations. Le groupe cible comprenait 10 espèces d'insectes. Les essais consistaient à obtenir des données sur l'efficacité des insecticides, le temps d'application le plus désirable, l'accomplissement des dispositifs et les effets chimiques produits sur les espèces non visées, ceci pour permettre l'enregistrement au Canada de produits chimiques efficaces. L'efficacité variait de bonne à excellente dans 58 des traitements. A la suite de ces essais, on peut maintenant pourvoir la donnée efficace pour soutenir l'enregistrement contre 5 insectes nuisibles spécifiques.

CONTENTS

INTRODUCTION

Control of insects and diseases in amenity plantings, both on the farm and in residential areas, has increased in importance as people become more aware of their environment. To obtain more information on the application of pesticides, efficacy trials with experimental or established pesticides were continued in 1976 as part of an ongoing program at the Northern Forest Research Centre. Results of similar tests in 1975 (Drouin and Kusch 1976) provided data to support the registration of additional insecticides for the control of the forest tent caterpillar, three species of sawflies, and a midge.

Objectives of the 1976 trials were: 1) to establish the most suitable treatment methods, 2) to develop low-hazard application techniques (e.g. soil drench), and 3) to provide data to support new Canadian registrations for the candidate chemicals tested.

MATERIALS AND METHODS

During the 1976 field trials, 28 chemical insecticides, 2 microbial insecticides, and 3 adjuvants (Table I) were tested against 10 insect species (Table II). The treatments were carried out at nine different sites throughout central Alberta. A total of 66 separate pesticide evaluations was made using five application methods: mist blower, ultra low volume, hydraulic and compressed-air sprays, and soil drenches.

Soil drench treatments were continued in 1976 for the control of the northern pitch twig moth in lodgepole pine nursery blocks, thus obtaining 2 years of data on selected candidate chemicals. Nine soil treatments were carried out to: 1) obtain efficacy data on various systemic insecticides, 2) determine optimum timing of soil drench application, 3) record phytotoxic effects of systemic insecticides on host plants, and 4) determine the necessity of irrigation. Soil drench treatments were continued in 11 plots at the provincial tree nursery at Oliver for control of the willow stem sawfly which is causing serious damage to whips in willow cutting beds.

Table I. Pesticides and additives used in field tests on shade, shelterbelt, and ornamental trees in Alberta, 1976

Trade Name and Formulation	Common Name	Supplier
Atplus 411 F	oil surfactant	Atlas Chem.
Atplus 526	spreader/sticker	Atlas Chem.
Basudin 50 EC	diazinon	Ciba-Geigy
Baygon 1.5 EC	propoxur	Chemagro
Cygon 4E	dimethoate	Cyanamid
Dimecron 94 EC	phosphamidon	Ciba-Geigy
Dimilin 25 WP	diflubenzuron	Ciba-Geigy
Dipel 3.2% b.t.	Bacillus thuringiensis	Abbott Lab.
Dutox 24 EC	trichlorfon and oxydemeton-methyl	Chipman
Dylox 4 E	trichlorfon	Chemagro
Furadan 10 G	carbofuran	FMC
Galecron 50 EC	chordimeform	Ciba-Geigy
Gardona 75 WP	tetrachlorvinphos	Shell
Lannate L 25%	methomynl	DuPont
Malathion 50 EC	cythion	Cyanamid
Malathion 1.8% ULV	cythion	Turbair
Metasystox-R 25%	oxydemeton-methyl	Chemagro
NRDC 143 25%	permethrin	Chipman
Orthene 75 SP	acephate	Chevron
Polyhedral virus 10^9	microbial	N.F.R.C.
Pirimor 50 W	pirimicarb	Chipman
Shell WL 43775	experimental	Shell
Shell WL 43479 40%	experimental	Shell
Sevin 50 WP	carbaryl	FMC
Supracide 40 EC	methidathion	Ciba-Geigy
Systemic ULV	dimethoate, dicofol, methoxychlor	Turbair
Temik 10 G	aldicarb	Union Carbide
Tetrachlorvinphos 2.5%	tetrachlorvinphos	Turbair
Thiodan 4 E	endosulfan	FMC
Triton B-1956	spreader/sticker	Rohm & Haas
Vapona-methoxychlor 6%	dichlorvos, methoxychlor	Turbair
Vydate 10 G	oxamyl	DuPont
Vydate L 25%	oxamyl	DuPont

Table II. Target pest species and host plants in the 1976 field trials

Pests	Scientific Name	Host
Forest tent caterpillar	*Malacosoma disstria* (Hbn.)	Trembling aspen
A willow shoot-boring sawfly	*Euura atra* (Jurine)	Willow
Caragana aphid	*Acyrthosiphon caraganae* (Cholodk.)	Caragana
Northern pitch twig moth	*Petrova albicapitana* (Busck)	Pine
Chokecherry midge	*Contarinia virginianiae* Felt	Chokecherry
A seed-boring sawfly	*Hoplocampa lacteipennis* Roh.	Chokecherry
European fruit lecanium	*Lecanium corni* Bouché	Pin cherry, Chokecherry, Hazel, Dogwood, Saskatoon
Box-elder twig borer	*Proteoteras willingana* Kft.	Box elder
Pear slug	*Caliroa cerasi* (L.)	Hawthorn
Mold mite	*Tyrophagus putrescentiae* (Schrank)	Birch, Willow, Poplar

Thirty-three sprays were applied with a backpack mist blower (Solo) on the forest tent caterpillar, caragana aphid, European fruit lecanium, a chokecherry midge, and a sawfly. Insecticides used included emulsifiable concentrates, wettable powders, and synthetic pyrethroids.

Five sprays were applied with a hydraulic sprayer unit, three using microbial insecticides (*Bacillus thuringiensis*, Dipel) combined with sublethal doses of an insecticide (Sevin) on second-instar larvae of the forest tent caterpillar, and two using systemic insecticides on newly hatched larvae of the box-elder twig borer.

Six systemic insecticides were applied as ovicide dips on forest tent caterpillar egg bands to determine their effect on larval hatch.

Six ultra low volume sprays were applied with a gravity-fed roto sprayer (TOT 2S) and specially formulated oil-base chemicals (p.b.i. Turbair) on two species of sawflies, a midge, and the European fruit lecanium.

One trial consisting of five weekly sprays was applied with a compressed-air hand pump using an oil surfactant AL 411 F to control mites in a greenhouse. The effectiveness of two spreader/stickers, Atplus 526 and Triton B-1956, was evaluated in 39 tests for uniformity of spray coverage in wetting the waxy or water-repelling surfaces of some leaves and fruit and reducing runoff. A summary of the 1976 field tests and a list of the insecticides and hosts suggested for registration recommendation are presented in Tables VII and VIII. Chemical descriptions (Kenaga and Allison 1971) of all insecticides tested in 1976 are listed in Appendix 1. The exclusion of certain manufactured products from tests does not imply rejection nor does the mention of other products imply endorsement by the Canadian Forestry Service.

ABBREVIATIONS

a.i. = Active ingredient

EC = Emulsifiable concentrate

G = Granular

HP = Hand pump

H = Hydraulic

L	=	Liquid
MB	=	Mist blower
SD	=	Soil drench
SP	=	Soluble powder
ULV	=	Ultra low volume
WP	=	Wettable powder

EQUIVALENT MEASURES

	Metric		English
Length	2.54 cm	=	1 in.
	.305 m	=	1 ft
Area	0.404 686 ha	=	1 acre
Weight	28.35 g	=	1 oz
	0.453 592 kg	=	1 lb
Volume	5 ml	=	1 tsp
	28.41 ml	=	1 oz
	4.546 litre	=	1 gal
Pressure	60 kg/cm^2	=	850 psi
	50 kg/cm^2	=	700 psi

RESULTS OF FIELD TREATMENTS

PEST: Forest tent caterpillar, *Malacosoma disstria* (Hbn.)

HOST: Trembling aspen

MATERIALS: Basudin (diazinon) 50 EC, Dutox (trichlorfon and oxydemeton-methyl) 24%, Baygon (propoxur) 1.5 EC, Galecron (chlordimeform) 50 EC, Orthene (acephate) 75 SP, Gardona (tetrachlorvinphos) 75 WP, Metasystox-R (oxydemeton-methyl) 25%, Vydate (oxamyl) L 25, Dimilin (diflubenzuron) 25 WP, Shell WL 43479 40 EC, Polyhedral virus, Dylox (trichlorfon) 4 E, Dipel (3.2% *Bacillus thuringiensis*)

PROCEDURE: The 17 treatments carried out in 1976 consisted of 8 sprays applied in early May with a backpack mist blower (Solo), 3 sprays using a hydraulic sprayer unit, and 6 ovicide dip treatments. Mist-blower plots were established in a farm woodlot and consisted of three replicates of 10 tagged trees averaging 6 m in height. Solutions were applied at the rate of 9.0 ℓ per plot with 5 ml Atplus 526 spreader/sticker added. Hydraulic spray plots, each 0.4 ha, were established in a forested area on trees ranging from 9.0 to 10.5 m in height. Spray solutions were applied at the rate of 227 ℓ per plot with 28.4 ml Triton B-1956 spreader/sticker added. Ovicide dip treatments were carried out in the laboratory using two replicates of five egg bands each per test. Eggs were dipped in pesticide solutions equivalent to 227 ml a.i. per 454 ℓ. Percentage insect control was determined from egg hatch and by comparing counts of living and dead larvae in the insecticide plots and applying Abbott's (1925) formula. Results of the microbial sprays (hydraulic) were assessed by comparing defoliation estimates in treated and untreated plots.

RESULTS: All tests indicated very good control; chemicals provided from 80 to 100%, and microbials from 75 to 98% (Table III).

COMMENTS: Results with Basudin, Baygon, Orthene, Metasystox-R, Cygon, and Dipel agree with previously reported good control results (Drouin and Kusch 1975). Dimilin, Dutox, Dylox, Shell WL 43479, and Vydate L were tested for the first time in controlling the forest tent caterpillar. Most larvae were in the second instar (some third) at the time of chemical application. Very light phytotoxicity appeared in the Baygon plots, particularly at spray overlaps.

PEST: A willow shoot-boring sawfly, *Euura atra* (Jurine)

HOST: Willow

MATERIALS: Cygon (dimethoate) 4 E, Metasystox-R (oxydemeton-methyl) 25%, Furadan (carbofuran) 10 G, Baygon (propoxur) 1.5 EC, Basudin (diazinon) 50 EC, Temik (aldicarb) 10 G, Vydate (oxamyl) 10 G, Dimecron (phosphamidon) 94 EC

PROCEDURE: Eleven soil drench plots were established on June 29 in a tree nursery in acute and golden willow cutting beds; each stool averaged 12.7 cm basal diameter (cumulation of stems). Each plot consisted of two replicates of five stools. Chemicals were applied into holes at the base of the stool at the rate of 4.5-5.6 ml or g a.i./cm of tree diameter and watered by irrigation to 1.27 cm water. Percentage insect control was determined by examination of ten 46-cm whips randomly selected from each replicate and the control plot about 8 weeks later and application of Abbott's (1925) formula.

Table III. Description and results of 1976 field treatments, *M. disstria* (Hbn.)

Material	Type	Dosage		Plot	Av. dbh	Av. Ht	% Control
		Litres	a.i. (ml or g)	(ha)	(cm)	(m)	
Basudin 50 EC	*	454	227	10 EB	-	-	100
Baygon 1.5 EC	*	454	227	10 EB	-	-	100
Baygon 1.5 EC	MB	9.1	3.1	0.04 ha	6	6	100
Cygon 4 E	*	454	227	10 EB	-	-	80
Dimilin 25 WP	MB	9.1	3.1	10 T	5	6	100
Dipel 3.2 bt	H	227	3.6 BIU	0.4 ha	9	9	85
Dipel 3.2 bt	H	227	3.6 BIU	0.4 ha	10	10	75
Dutox 24 EC	*	454	227	10 EB	-	-	100
Dutox 24 EC	MB	9.1	3.1	0.04 ha	5	6	100
Dylox 4 E	MB	9.1	3.1	0.04 ha	5	6	95
Galecron 50 EC	*	454	227	10 EB	-	-	100
Gardona 75 SP	MB	9.1	3.1	10 T	5	6	100
Metasystox-R 25%	MB	9.1	3.1	10 T	5	6	100
Orthene 75 SP	*	454	227	10 EB	-	-	84
Polyhedral virus	HP	9.1		0.2 ha	8	10	98
Shell WL 43479	MB	9.1	3.1	10 T	5	6	100
Vydate L 25%	MB	9.1	3.1	10 T	5	6	100

* = ovicide dip
T = tree unit
EB = egg band
BIU = British International Unit

RESULTS: Controls varied from fair to excellent (Table IV) and were consistent with data previously reported (Drouin and Kusch 1976).

COMMENTS: Results with Cygon, Metasystox-R, Baygon, Basudin, and Vydate were similar to previously reported data. Temik showed a noticeable increase in efficacy over previous tests. Dimecron was tested for the first time, with fair results. For best results, irrigation is essential for soil drenches. Phytotoxicity occurred in all Baygon treatments and resulted in some stem mortality and reduced growth in comparison to other treated or control plots.

PEST: Caragana aphid, *Acyrthosiphon caraganae* (Cholodk.)

HOST: Caragana

MATERIALS: Dimecron (phosphamidon) 94 EC, Metasystox-R (oxydemeton-methyl) 25%, Supracide (methidathion) 40 EC, Shell 43775 40%, NRDC 143 (permethrin) 25%, Pirimor (pirimicarb) 50 W, Lannate (methomyl) L 25%, Vydate (oxamyl) L 25%, Basudin (diazinon) 50 EC, Baygon (propoxur) 1.5 EC, Thiodan (endosulfan) 4 E

PROCEDURE: Foliar spray treatments were applied in a tree nursery with a backpack mist blower (Solo) on July 22 and were evaluated for their efficacy on July 26. The 11 plots consisted of two replicates of 0.04 ha each with bushes ranging from 2.4 to 3.3 m in height. Spray suspensions with 5 ml Atplus 526 spreader/sticker added were applied at the rate of 9.0 ℓ per replicate containing 3.1 ml or g a.i./ℓ. Percentage insect control was determined by comparing mortality in 25 randomly selected seed pods from both treated and control plots and applying Abbott's (1925) formula.

RESULTS: All tests gave good controls except Thiodan, which gave fair control (Table V).

COMMENTS: Winged adults dropped to the ground during or immediately after spray application. Most of the dead insects were nymphs still attached to the pea pods. Light phytotoxicity occurred on only a few branches in the plot treated with Baygon.

Table IV. Description and counts of *E. atra* larvae in acute and golden willow cutting beds after treatment with eight systemic insecticides in 1976

Material	Dosage (a.i.) ml or g/cm	Av. ht (m)	Larvae Live	Larvae Dead	Mean % Control
Metasystox-R 25%	5.6	.9	1	48	95
Furadan 10 G	4.5	.9	1	34	95
Cygon 4 E	5.6	.9	3	33	91
Baygon 1.5 EC	5.1	.9	8	67	88
Basudin 50 EC	5.6	.9	14	26	64
Temik 10 G	4.5	.9	10	17	61
Vydate 10 G	4.5	.9	16	13	55
Dimecron 94 EC	5.4	.9	26	20	43
Cygon 4 E	5.6	1.8*	0	22	100
Metasystox-R 25%	5.6	1.8*	0	14	100
Basudin 50 EC	5.6	1.8*	4	10	69

* = golden willow

Table V. Counts of *A. caraganae* on caragana seed pods in plots established in a shelterbelt in 1976

Material	Aphids/25 Pods Live	Aphids/25 Pods Dead	% Control
Dimecron 94 EC	0	16	100
Metasystox-R 25%	1	258	100
Supracide 40 EC	0	132	100
Shell 43775 40%	0	120	100
NRDC 143 25%	0	67	100
Pirimor 50 W	0	31	100
Lannate L 25%	3	183	98
Vydate L 25%	3	108	97
Basudin 50 EC	42	345	89
Baygon 1.5 EC	1	4	80
Thiodan 4 E	43	30	40

PEST: Northern pitch twig moth, *Petrova albicapitana* (Busck)

HOST: Lodgepole pine

MATERIALS: Cygon (dimethoate) 4 E, Metasystox-R (oxydemeton-methyl) 25%, Orthene (acephate) 75 SP, Temik (aldicarb) 10 G, Furadan (carbofuran) 10 G, Vydate (oxamyl) 10 G, Baygon (propoxur) 1.5 EC

PROCEDURE: Nine soil drench treatments were carried out in a tree nursery on lodgepole pine trees ranging from 1.8 to 2.1 m in height and with a basal diameter of 2.5 to 5.0 cm in seven plots. Two other plots of nursery seedlings were 1.0-1.2 m in height, averaging 2.5 cm in basal diameter. Each test consisted of two replicates of five trees. Chemicals were applied on April 29 into holes dug at the base of the tree within the drip line at the rate of 4.5-5.6 ml of a.i./cm of basal diameter and watered to saturate the root system. (Irrigation was not available.) All pitch nodules, including those in the control plots, were examined 8 weeks later (June 21), and counts of living and dead insects were made to determine percentage insect control by applying Abbott's (1925) formula.

RESULTS: Considerable variation in percentage control was observed (Table VI).

COMMENTS: An unusually early spring, low water table, and very dry conditions when the larvae were actively feeding resulted in some poor or erratic control. This was particularly noticeable with the granular chemicals, which were found relatively undissolved when the plots were examined in June. The test results were inconclusive and have been rescheduled for next spring using posttreatment irrigation.

PEST: Chokecherry midge, *Contarinia virginianiae* Felt and a seed-boring sawfly, *Hoplocampa lacteipennis* Roh., on chokecherry

HOST: Chokecherry

MATERIALS: Basudin (diazinon) 50 EC, Baygon (propoxur) 1.5 EC, Cygon (dimethoate) 4 E, Dimecron (phosphamidon) 94 EC, Malathion (cythion) 50 EC and ULV, Metasystox-R (oxydemeton-methyl) 25%

PROCEDURE: Seven spray treatments using a backpack mist blower (Solo) and one ultra low volume treatment with a roto sprayer (TOT 2S) were applied on

Table VI. Larval counts of *P. albicapitana* after treatments with seven systemic insecticides in 1976

Material	Dosage (a.i.) ml or g/cm	Av. ht (m)	Larvae Live	Larvae Dead	Mean % Control
Cygon 4 E	5.6	3.0	36	94	72
Metasystox-R 25%	5.6	2.0	63	79	54
Orthene 75 WP	5.6	2.0	33	40	51
Temik 10 G	4.5	2.0	73	31	26
Furadan 10 G	4.5	1.8	90	12	9
Vydate 10 G	4.5	2.1	107	5	2
Baygon 1.5 EC	5.1	2.0	64	2	0
Cygon 4 E*	5.6	1.0	11	11	36
Metasystox-R 25%*	5.6	1.0	10	3	16

* = Seedling plot

May 27 in a tree nursery. Each test consisted of two replicates of 0.04 ha each containing shrubs averaging 3 m in height. Mist blower suspensions using 5 ml Atplus 526 spreader/sticker were applied at the rate of 9.0 ℓ per replicate (3.1 ml a.i./ℓ). An oil-base chemical formulation (p.b.i. Turbair) containing 1.8% malathion was applied at the rate of 42.6 ml per replicate (0.77 ml a.i.). Percentage control was determined by examination of the fruit on ten 46-cm branches randomly selected from treated and control plots approximately 10 weeks later and application of Abbott's (1925) formula.

RESULTS: All treatments gave 100% control.

COMMENTS: The results for both pests agreed with data previously reported (Drouin and Kusch 1976). The shrubs were approximately 90% in bloom at the time of treatment. The sawfly lays eggs in the flower calyx in late May similar to the midge and damages two cherries during the larval stage. Timing of control is critical; spraying should take place shortly before peak petal drop because egg-laying is complete by then. Care must be taken when applying systemic insecticides to *Prunus* and *Amelanchier* plant species because both are susceptible to chemical injury. Cygon caused medium to heavy phytotoxicity, while Basudin, Baygon, Metasystox-R, and Dimecron were slightly phytotoxic. The droplet-sized burnt portions of the leaves turned brown and eventually sloughed away, leaving the foliage with a lacy, shot-hole appearance. Where appearance is important, careful application of malathion will give good results with very little burning.

PEST: European fruit lecanium, *Lecanium corni* Bouché
HOST: Chokecherry, saskatoon, pin cherry, hazel, dogwood
MATERIALS: Basudin (diazinon) 50 EC, Sevin (carbaryl) 50 W, Dutox (trichlorfon and oxydemeton-methyl) 24 EC, NFRC 143 (permethrin) 25%, Baygon (propoxur) 1.5 EC, Dimecron (phosphamidon) 94 EC, Malathion (cythion) 1.8%
PROCEDURE: Eight spray treatments (two with Basudin) were applied in a recreational park on July 13, seven with a backpack mist blower (Solo), and one ultra low volume spray with a roto sprayer (TOT 2S). Each plot consisted of two replicates of 0.04 ha with bushes averaging 1.8 m in height. Mist blower solutions with 5 ml Atplus 526 spreader/sticker added were applied on July 5 at the rate of 9.0 ℓ per replicate (3.1 ml or g a.i./ℓ). An oil-base chemical formulation (p.b.i. Turbair) containing 1.8% malathion was applied at the rate of 28.4 ml per replicate (0.5 ml a.i.). Percentage insect control was determined from the counts of crawlers on 15 leaves randomly selected from each treated and control replicates 3 days later and application of Abbott's (1925) formula.
RESULTS: Control ranged from 93 to 99%.
COMMENTS: All chemicals gave excellent control. Dutox was slightly phytotoxic to chokecherry, Dimecron to pin cherry, and Basudin to hazel and saskatoon. Severe scale attack on chokecherry, pin cherry, and hazel caused light branch mortality.

PEST: Box-elder twig borer, *Proteoteras willingana* (Kft.)
HOST: Box elder
MATERIALS: Malathion (cythion) 50 EC, Cygon (dimethoate) 4 E
PROCEDURE: On August 10 two insecticides were applied with a hydraulic sprayer at a pressure of 60 kg/cm^2 and a rate of 55 ℓ per plot (28.5 ml a.i.).

Atplus 526 spreader/sticker was used at a rate of 0.5 ml/ℓ. Experimental plots, each consisting of five trees averaging 3.6 m in height, were located in a farm shelterbelt and arranged in a randomized block design. The data were recorded as percentage insect control determined by counts of dead insects in five 46-cm branches selected from each plot 25 h after treatment. Each treatment was compared with a nonsprayed control plot; Abbott's (1925) formula was applied.

COMMENTS: Mean percentage control was 79 for Malathion and 74 for Cygon. Although some third-instar larvae had bored into the buds, most were killed by the spray. No phytotoxicity was observed on the treated trees.

PEST: The mold mite, *Tyrophagus putrescentiae* (Schr.)

HOST: Poplar, willow, birch

MATERIALS: Atplus 411 F (#5825) oil surfactant

PROCEDURE: Spray treatments applied with a compressed-air hand pump were conducted in the NFRC greenhouse on 60 potted seedlings averaging 0.3 m in height. Each week 4.5 ℓ of solution with 10 ml Atplus 411 F added was applied to the trees for 5 consecutive weeks. Percentage mite control was determined by examination of five randomly selected leaves from each host 24 h after each application.

RESULTS: Atplus 411 F proved effective in controlling greenhouse mites (99%), although several applications were required.

COMMENTS: Severe mite damage to foliage was recorded at start of treatment on all hosts, birch in particular. There was no odor or disruption of greenhouse activities during the 5-week period. No phytotoxicity was observed.

PEST: Pear slug, *Caliroa cerasi* (L.)

HOST: Hawthorn

MATERIALS: ULV formulations of Malathion (cythion) 1.8%, Tetrachlorvinphos 2.5%, Systemic (contains dimethoate), Vapona-Methoxychlor (dichlorvos 1% and methoxychlor 5%)

PROCEDURE: Four ultra low volume spray treatments were applied in a tree nursery on July 30 with a roto sprayer (TOT 2S). Each plot consisted of two replicates of 0.04 ha with bushes averaging 1.5 m in height. The oil-base chemical formulations (p.b.i. Turbair) were applied at the rate of 28.4 ml per replicate. Percentage insect control was determined by examination of 25 leaves randomly selected from treated and control plots 4 days later and application of Abbott's (1925) formula.

RESULTS: Percentage insect control was as follows: Malathion 97, Tetrachlorvinphos 95, Systemic 86, Vapona-Methoxychlor 80.

COMMENTS: All chemicals gave excellent control which agrees with data previously reported. No phytotoxicity was observed.

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Table VII. Summary of 1976 field tests

No.	Type	Chemical	Species	% Control	No.	Type	Chemical	Species	% Control
1.	SD	Cygon 4 E	Petrova	71	37.	SD	Vydate 10 G	Euura	43
2.	SD	Furadan 10 G	"	9	38.	SD	Temik 10 G	"	61
3.	SD	Meta-S-R	"	55	39.	SD	Dimecron	"	41
4.	SD	Temik 10 G	"	28	40.	SD	Cygon 4 E	"	100
5.	SD	Vydate 10 G	"	2	41.	SD	Basudin	"	68
6.	SD	Baygon 1.5	"	0	42.	SD	Meta-S-R	"	100
7.	SD	Cygon 4 E	"	46	43.	MB	Basudin	Scale	99
8.	SD	Meta-S-R	"	16	44.	MB	Dutox EC	"	98
9.	HP	Atplus 411 F	Mites	99	45.	MB	Basudin	"	95
10.	H	Cygon	FTC	80	46.	MB	Baygon	"	97
		Basudin	"	100	47.	MB	Sevin	"	99
		Dutox	"	100	48.	MB	NRDC 143	"	98
		Baygon	"	100	49.	MB	Dimecron	"	97
		Galecron	"	100	50.	ULV	Malathion	"	93
		Orthene	"	84	51.	ULV	Malathion	P. Slug	97
11.	H	Polyhedral vir.	FTC	98	52.	ULV	Tetrachlor	"	95
12.	H	Malathion	Twig B.	79	53.	ULV	Systemic	"	86
13.	H	Dipel	FTC	85	54.	ULV	Vapona	"	80
14.	H	Dipel	"	75	55.	MB	Dimecron	C. Aphid	100
15.	MB	Baygon	"	100	56.	MB	Basudin	"	89
16.	MB	Gardona	"	100	57.	MB	Lannate L	"	98
17.	MB	Meta-S-R	"	100	58.	MB	Meta-S-R	"	100
18.	MB	Dylox 4 E	"	95	59.	MB	Supracide	"	100
19.	MB	Dutox 24 EC	"	100	60.	MB	Thiodan 4 E	"	40
20.	MB	Vydate L	"	100	61.	MB	Vydate L	"	97
21.	MB	Dimilin 25%	"	100	62.	MB	Shell 43775	"	100
22.	MB	Shell WL 43479	"	100	63.	MB	Baygon	"	80
23.	MB	Cygon 4 E	Sfy. x	100	64.	MB	NRDC 143	"	100
			Midge	100	65.	MB	Pirimor	"	100
24.	MB	Basudin	"	100	66.	H	Cygon 4 E	Twig B.	73
25.	MB	Baygon	"	100					
26.	MB	Meta-S-R	"	100					
27.	MB	Dimecron	"	100					
28.	ULV	Malathion	"	100					
29.	MB	Basudin	"	100					
30.	MB	Malathion EC	"	100					
31.	SD	Orthene 75	Petrova	54					
32.	SD	Cygon 4 E	Euura	92					
33.	SD	Furadan 10 G	"	97					
34.	SD	Basudin	"	64					
35.	SD	Meta-S-R	"	98					
36.	SD	Baygon	"	89					

SUMMARY

MB	33
SD	20
H, HP	7
ULV	6

Table VIII. Registration recommendations, 1976

Basudin 50 EC (Ciba-Geigy)

*	_Malacosoma disstria_ Hbn.	MB & H
*	_Pikonema alaskensis_ (Roh.)	MB & H
*	_Pristiphora erichsonii_ (Htg.)	MB & H
*	_Lithocolletis_ sp.	MB
	Aphids (open feeders)	MB

Baygon 1.5 EC (Chemagro)

*	_Lithocolletis_ sp.	MB
	Malacosoma disstria Hbn.	MB & H
	Euura atra (Jurine)	SD

Cygon 4 E (Cyanamid)

*	_Malacosoma disstria_ Hbn.	MB
*	_Caliroa cerasi_ (L.)	SD
*	_Pikonema alaskensis_ (Roh.)	MB, H, SD
*	_Pristiphora erichsonii_ (Htg.)	MB & H
*	_Periphyllus negundinis_ (Thos.)	MB
*	_Saperda calcarata_ Say	SD
*	_Proteoteras willingana_ (Kft.)	SD
	Petrova albicapitana (Busck)	SD
	Euura atra (Jurine)	SD
	Contarinia virginianiae Felt	MB

Dipel 3.2 bt (Abbott)

	Malacosoma disstria Hbn.	H

Fundal SP 97% (Niagara)

*	_Malacosoma disstria_ Hbn.	MB

Furadan 10 G (Niagara)

*	_Pikonema alaskensis_ (Roh.)	SD
*	_Nematus ribesii_ (Scop.)	SD
*	_Gracillaria syringella_ (Fabr.)	SD
*	_Caliroa cerasi_ (L.)	SD
	Petrova albicapitana (Busck)	SD

Galecron 50 EC (Ciba-Geigy)

*	_Pristiphora erichsonii_ (Htg.)	MB

Gardona 75 WP (Shell)

	Malacosoma disstria Hbn.	MB & H

Imidan 1 E and 50 WP (Chipman)

*	_Malacosoma disstria_ Hbn.	H
*	_Pikonema alaskensis_ (Roh.)	MB & H
*	_Lithocolletis_ sp.	MB

Lannate L 25 and 90 WP (DuPont)

*	_Malacosoma disstria_ Hbn.	MB & H
*	_Pikonema alaskensis_ (Roh.)	MB
	Aphids (open feeders)	MB

Lorsban 25 W (Dow)

	Malacosoma disstria Hbn.	MB & H

Malathion 50 EC (Niagara)

*	_Pikonema alaskensis_ (Roh.)	MB
*	_Malacosoma disstria_ Hbn.	MB
	Contarinia virginianiae Felt	MB

Metasystox-R 25% (Chemagro)

*	_Saperda calcarata_ Say	SD
	Euura atra (Jurine)	SD
	Malacosoma disstria Hbn.	MB & H
	Aphids (open feeders)	MB

Nexion 25 W (Ciba-Geigy)

*	_Malacosoma disstria_ Hbn.	MB & H

Orthene 75 SP (Chevron)

*	_Malacosoma disstria_ Hbn.	MB & H
*	_Caliroa cerasi_ (L.)	SD

Pirimor 50 W (Chipman)

	Aphids (open feeders)	H

PP 505 10 G (Chipman)

* *Pikonema alaskensis* (Roh.)	SD

RH 218 50 EC (Rohm & Haas)

* *Malacosoma disstria* Hbn.	MB & H

Sevin 50 WP and Sevimol 4 (Niagara & U. Carbide)

* *Pikonema alaskensis* (Roh.)	MB & H
* *Malacosoma disstria* Hbn.	MB & H
* *Pristiphora erichsonii* (Htg.)	MB

Supracide 40 EC (Ciba-Geigy)

* *Malacosoma disstria* Hbn.	MB
Aphids (open feeders)	MB

Temik 10 G (Union Carbide)

* *Pikonema alaskensis* (Roh.)	SD

Thiodan 4 E (Niagara)

Malacosoma disstria Hbn.	MB & H

Volaton 50 EC (Chemagro)

* *Caliroa cerasi* (L.)	SD

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* Based on previous reports (Drouin and Kusch 1973, 1974, 1975, 1976) and 1976 field data.

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APPENDIX 1

LIST OF INSECTICIDES AND CHEMICAL NAMES

acephate	O,S-dimethyl N-acetyl phosphoramidothioate
aldicarb	2-methyl-2-(methylthio) propionaldehyde O-(methyl-carbamoyl) oxime
Basudin	see diazinon
Baygon	see propoxur
carbaryl	1-naphthyl methylcarbamate
carbofuran	2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate
chlordimeform	N-(2-methyl-4-chlorophenyl)-N,N'-dimethylformamidine hydrochloride
cygon	see dimethoate
cythion	diethyl meraptosuccinate S-ester with O,O-dimethyl phosphorodithioate
diazinon	O,O-diethyl O-(isopropyl-6-methyl-4-pyrimidinyl) phosphorothionate
dicofol	1,1-Bis(chlorophenyl)-2,2,2-thrichloroethanol
dichlorvos	2,2-dichlorovinyl dimethyl phosphate
diflubenzuron	N-(((4-chlorophenyl)amino)carbonyl)2,6-difluorobenzamide
Dimecron	see phosphamidon
dimethoate	O,O-dimethyl phosphorodithioate S-ester with 2-mercapto-N-methyl-acetamide
Dimilin	see diflubenzuron
Dipel	contains 25 x 10^9 viable spores/gram *Bacillus thuringiensis* var. Kurstaki
Dutox	trichlorfon and oxydemeton-methyl
Dylox	see trichlorfon
endosulfan	1,4,5,6,7,7-hexachloro-5-norbornene-2,3-dimethyl cyclic sulfite
Fundal	see chlordimeform
Furadan	see carbofuran
Galecron	see chlordimeform
Gardona	see tetrachlorvinphos
Lannate	see methomyl
Malathion	see cythion
Metasystox-R	see oxydemeton-methyl

methidathion	O,O-dimethyl phosporodithioate S-ester with thiodizolin-5-one
methomyl	S-methyl N-((methylcarbamoyl)oxy)thiacetrimidate
Methoxychlor	1,1,1-trichloro-2,2-bis(p-methoxyphenyl) ethane
NRDC 143	see permethrin
Orthene	see acephate
oxamyl	S-methyl-1-1-(dimethylcarbamoyl)-N-((methylcarbamoyl) oxy) thioformimidate
oxydemeton-methyl	S(2-(ethylsulfinyl-1,4 oxathiin-3-carboxanilide-4, 4-dioxide
Permethrin	3-phenoxybenzyl(+)-cis,trans-2,2dimethyl-3-2 (2,2-dichlorovinyl)cydopropane carboxylate
phosphamidon	O-(2-chloro-2-diethylcarbamoyl-1-methyl-vinyl)-O,Odimethy-phosphate
pirimicarb	2-(dimethylamino)-5,6-dimethyl-4-pyrimidinyl dimethylcarbamate
Pirimor	see pirimicarb
propoxur	O-isopropoxyphenyl methylcarbamate
Resmethrin	(5-benzyl-3-furyl)methyl (+) cis, trans-2,2-dimethyl -3-(2-methylpropeny) cyclopropanecarboxylate
Sevin	see carbaryl
Shell WL 43775	synthetic pyrethroid
Shell WL 43467	synthetic pyrethroid
Supracide	see methidathion
Systemic (Turbair)	see dicofol, dimethoate, methoxychlor
Temik	see aldicarb
tetrachlorvinphos	2-chloro-1-(2,4,5-trichlorophenyl) vinyl dimethyl phosphate
Thiodan	see endosulfan
trichlorfon	dimethyl (2,2,2-trichloro-1-hydroxyethyl) phosphonate
Vapona	see dichlorvos
Vydate	see oxamyl