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Northern Forest Research Centre • Edmonton, Alberta • Information Report NOR-X-205

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INFORMATION REPORT NOR-X-205
MARCH 1978

NORTHERN FOREST RESEARCH CENTRE
CANADIAN FORESTRY SERVICE
FISHERIES AND ENVIRONMENT CANADA
5320 - 122 STREET
EDMONTON, ALBERTA, CANADA
T6H 3S5

Drouin, J.A. and D.S. Kusch. 1978. Pesticide field trials on shade and shelterbelt trees in Alberta, 1977. Fish. Environ. Can., Can. For. Serv., North. For. Res. Cent. Inf. Rep. NOR-X-205.

ABSTRACT

Twenty-six insecticides and one nucleopolyhedrosis virus were tested for the control of 11 insect pests in shade and shelterbelt trees in 71 separate evaluations. 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 were used to provide additional support for registration of candidate chemicals, 30 of which were tested from 1972 to 1977. These data have been forwarded to the various chemical firms involved and to the Control Products Section, Department of Agriculture in Ottawa.

RESUME

Les auteurs testèrent vingt-six insecticides et un polyhedrosis virus pour leur efficacité contre les infestations d'insectes nuisibles aux arbres produisant de l'ombre et aux rideaux d'arbres. Ils effectuèrent 71 différentes évaluations. Le groupe cible comprenait 11 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 effects chimiques produits sur les espèces non visées, ceci pour soutenir l'enregistrement de 30 produits chimiques efficaces au Canada, en essais depuis 1972 à 1977. Les données ont été envoyées aux sociétés chimiques et à la Division des Produits Végétaux à Ottawa.

CONTENTS

INTRODUCTION

Increased public awareness of insects and diseases that are capable of causing extensive damage to high-value trees and shrubs has resulted in frequent requests for information on effective controls. In order to provide this information, field efficacy testing of experimental and established insecticides was continued in 1977 as part of an ongoing program at the Northern Forest Research Centre. Objectives of the tests were (1) to establish the most suitable equipment and treatment methods, (2) to develop low-hazard application techniques, and (3) to provide technical data to support the Canadian registration of potentially safe, effective insecticides.

Results of similar tests contained in previous reports (Drouin and Kusch 1973, 1974, 1975, 1976, 1977) provided the necessary additional data for registration review of some 30 chemical products tested for the control of about 20 insect pests of ornamental, shade and shelterbelt trees, and shrubs in Alberta. All test results and recommendations have been forwarded to the various chemical companies and to the Control Products Section, Department of Agriculture, Ottawa.

MATERIALS AND METHODS

Twenty-six insecticide formulations and one nucleopolyhedrosis virus with two additives (Table 1) were tested during the 1977 field trials against 11 insect species (Table 2). The test sites were established in woodlots, recreational areas, tree nurseries, and on crown and privately owned lands in Alberta. A total of 71 separate evaluations (Table 8) was made using six application methods: mist blower, soil drench, ultra low volume, ovicide dip, bark paint, and hydraulic spray.

Thirty-six sprays were applied with a backpack mist blower (Solo) on three birch leaf-mining sawflies, the forest tent caterpillar, insects attacking the fruit of saskatoon and chokecherry, the yellow-headed spruce sawfly, and the pear slug. Twenty-four soil drench treatments were conducted to control birch leaf-mining sawflies, the northern pitch twig moth, a willow shoot-boring sawfly, and a root collar weevil. Chemicals with systemic qualities were applied into holes dug within the dripline of the tree at dosages based on the basal diameter of the tree. Four ultra low volume sprays using special oil-base formulations (pbi/Turbair) were applied with a gravity-fed roto sprayer (TOT 2S) to control the pear slug, a pest on ornamental plantings. Three ovicide dip trials using 12 insecticide products were conducted in the laboratory on forest tent caterpillar egg bands. Three bark paint treatments were applied using 3 systemic chemicals to control birch leaf-mining sawflies. The width of band applied to the stems was related to stem diameters. Two sprays were applied with a high-pressure hydraulic sprayer unit as ovicides against the forest tent caterpillar.

Insecticides used included emulsifiable concentrates, wettable powders, granular products, nucleopolyhedrosis virus, and special ultra low volume formulations. A spreader/sticker adjuvant (Atplus 526) and a sunlight protectant (IMC 90-001) were also utilized. An updated summary of insecticides recommended for registration and the pest species involved is presented in Table 9. Chemical descriptions (Kenaga and Allison 1971) of all insecticides tested in 1977 are listed in Appendix 1. The exclusion of certain manufactured products from these tests does not imply rejection nor does the mention of other products imply endorsement by the Canadian Forestry Service.

ABBREVIATIONS

a.i.	=	Active ingredient
BP	=	Bark paint
eb	=	Egg band
EC	=	Emulsifiable concentrate
G	=	Granular
H	=	Hydraulic
L	=	Liquid
MB	=	Mist blower
OD	=	Ovicide dip
NPV	=	Nucleopolyhedrosis virus
PIB	=	Polyhedral inclusion bodies
SD	=	Soil drench
SP	=	Soluble powder
ULV	=	Ultra low volume
WP	=	Wettable powder

TABLE 1. Pesticides and additives used in field tests on shade, shelterbelt, and ornamental trees in Alberta, 1977

Trade Name and Formulation	Common Name	Supplier
Ambush 50% EC	synthetic pyrethroid	Chipman
Atplus 526	spreader/sticker	Atlas Chem.
Basudin 50% EC	diazinon	Ciba-Geigy
Baygon 1.5 (15% EC)	propoxur	Chemagro
Cythion 50% EC	malathion	Cyanamid
Cygon 4 E (50% EC)	dimethoate	Cyanamid
Dimecron 94% EC	phosphamidon	Ciba-Geigy
Dimilin 25% WP	diflubenzuron	Ciba-Geigy
Dutox 25% EC	trichlorfon and oxydemeton-methyl	Chipman
Dylox 4 E (42% EC)	trichlorfon	Chemagro
Furadan 10 G (10%)	carbofuran	FMC
IMC 90-001	sunlight protectant	Sandoz-Wander
Lannate L 25%	methomyl	DuPont
Malathion 1.8 (ULV)	malathion	Turbair
Metasystox-R 25% EC	oxydemeton-methyl	Chemagro
M 3726 48% EC	experimental	Dow
Nem-A-Tak 25% EC	experimental	Cyanamid
Orthene 75% SP	acephate	Chevron
Nucleopolyhedrosis virus	NPV	IPRI*
Sevin 50% WP	carbaryl	FMC
Supracide 40% EC	methidathion	Ciba-Geigy
Systemic (ULV)	dimethoate, dicofol, methoxychlor	Turbair
Temik 10 G (10%)	aldicarb	Union Carbide
Tetrachlorvinphos 2.5% (ULV)	tetrachlorvinphos	Turbair
Vapona-methoxychlor 6% (ULV)	dichlorvos, methoxychlor	Turbair
Vydate L 25%	oxamyl	DuPont
WL 43467 40% EC	experimental pyrethroid	Shell
WL 43479 40% EC	experimental pyrethroid	Shell
WL 43775 30% EC	experimental pyrethroid	Shell

* Insect Pathology Research Institute, Sault Ste. Marie, Ontario.

TABLE 2. Target pest species and host plants in the 1977 field trials

Pest	Scientific Name	Host
Birch leaf miners	*Fenusa pusilla* (Lep.)	Birch
	Heterarthrus nemoratus (Fallen)	
	Profenusa thomsoni (Konow)	
Forest tent caterpillar	*Malacosoma disstria* Hbn.	Trembling aspen
Chokecherry midge	*Contarinia virginianiae* (Felt)	Chokecherry
A seed-boring sawfly	*Hoplocampa lacteipennis* (Roh.)	Chokecherry
A root collar weevil	*Hylobius warreni* Wood	Pine
Northern pitch twig moth	*Petrova albicapitana* (Busck)	Pine
Yellow-headed spruce sawfly	*Pikonema alaskensis* (Roh.)	Spruce
Pear slug	*Caliroa cerasi* (L.)	Cotoneaster
A willow shoot-boring sawfly	*Euura atra* (Jurine)	Willow

RESULTS OF FIELD TREATMENTS

BIRCH LEAF-MINING SAWFLIES

Pest: Birch leaf-mining sawflies, *Fenusa pusilla* (Lep.), *Profenusa thomsoni* (Konow), *Heterarthrus nemoratus* (Fallen)

Host: Birch, white

Materials: Cygon (dimethoate) 4 E, Baygon (propoxur) 1.5 EC, Vydate (oxamyl) L 25, Dimecron (phosphamidon) 94 EC, Temik (aldicarb) 10 G, Furadan (carbofuran) 10 G, Nem-A-Tak 25%, Metasystox-R (oxydemeton-methyl) 25 EC, Basudin (diazinon) 50 EC, Supracide (methidathion) 40 EC, Sevin (carbaryl) 50 WP, Cythion (malathion) 50 EC, Orthene (acephate) 75 SP, Ambush 50 EC, WL 43775 40 EC

Procedure: Twenty-six tests consisting of 12 foliar sprays applied with a backpack mist blower (Solo), 11 soil drenches and 3 bark paint treatments were carried out. Spray plots were approximately 0.04 ha each with trees averaging about 5.5 m in height. Spray solutions were applied on 7 July at the rate of 9.1 L per plot at 3.1 mL or g a.i./L. One teaspoon (5 mL) Atplus 526 spreader/sticker was added to four of the solutions. Soil drench and bark paint applications were made on 10 May using the established techniques. Plots consisted of five clumps, each containing two to five stems averaging about 10 cm in basal diameter. Bark paints were reapplied on 24 May and 25 July. All plots were established in natural stands of white birch. Percentage insect control was determined by two or more examinations of two 45-cm branches randomly selected from the upper and lower crown of each tree, including those in control plots. Cumulative counts of mined and unmined leaves and living and dead larvae of all species in each plot were combined, and Abbott's (1925) formula was applied.

Comments: *F. pusilla* may produce two or more overlapping generations during the summer that tend to attack the newer foliage. Both *P. thomsoni* and *H. nemoratus* produce one generation each year. Eggs are deposited in the mature leaves during the latter part of the summer; the larvae continue to feed until leaf drop in the fall. Because of the coexistence and variable overlap of all three species in Alberta in 1977, mining progressively increased to severe on untreated trees in the test areas. *P. thomsoni* had the highest populations and consequently caused most of the damage.

Results: See Table 3. Some leaves were attacked but either the eggs did not hatch or the larvae died before mining could commence.

Metasystox-R, Basudin, Supracide, and Orthene worked well when applied by mist blower, but not when used as a soil drench, indicating little systemic action under the test conditions. Ambush and WL 43775 gave poor results.

A trace of phytotoxicity occurred in some plots, but was confined to a few branches in the lower third of the tree crowns.

TABLE 3. Results of 1977 field tests on birch leaf-mining sawflies

Material	Type	No. Leaves** U	No. Leaves** L	No. Mined U	No. Mined L	% Leaves Attacked	% Control
Cygon	SD	380	584	132	119	26	100 T
Cygon	BP	551	581	67	157	19	100 T
Cygon	MB	421	416	121	72	23	90
Baygon	SD	403	820	97	63	13	100
Baygon	MB	442	527	94	38	13	90 T
Vydate	SD	593	407	00	00	11	100
Vydate	MB	515	575	136	138	25	90 T
Dimecron	SD	444	398	00	00	20	100
Dimecron*	MB	459	503	144	67	32	89 T
Dimecron	BP	786	538	89	88	13	98 T
Temik	SD	467	350	00	00	11	100
Furadan	SD	567	486	00	00	13	100 T
Nem-A-Tak	SD	304	383	17	29	04	100 T
Metasystox-R	BP	511	483	160	226	35	100
Metasystox-R	MB	388	361	118	86	27	89
Metasystox-R	SD	498	440	20	83	11	61
Basudin	MB	367	377	159	86	56	90
Basudin	SD	722	1231	169	321	25	00
Supracide*	MB	392	443	131	110	29	90 T
Supracide	SD	580	584	73	158	19	51
Sevin*	MB	607	499	125	68	17	90
Cythion	MB	406	410	146	126	33	90
Orthene*	MB	469	565	119	174	28	89
Orthene	SD	382	376	43	44	11	34 T
Ambush	MB	449	439	88	126	24	37 T
WL 43775	MB	433	378	94	35	13	02

* = Spreader/sticker added
** = U = upper crown; L = lower crown
T = Trace of phytotoxicity

FOREST TENT CATERPILLAR

Pest: Forest tent caterpillar, *Malacosoma disstria* Hübner

Host: Aspen, trembling

Materials: Ambush 50 EC, Basudin (diazinon) 50 EC, Baygon (propoxur) 1.5 EC, Cygon (dimethoate) 4 E, Dutox (trichlorfon and oxydemeton-methyl) 25 EC, Metasystox-R (oxydemeton-methyl) 25 EC, Dylox (trichlorfon) 4 E, Dimecron (phosphamidon) 94 EC, Lannate (methomyl) L 25, WL 43479 40 EC, WL 43775 30 EC, Vydate (oxamyl) L 25, Dimilin (diflubenzuron) 25 WP, nucleopolyhedrosis virus

Procedure: Twenty-one tests consisting of 12 ovicide dip treatments, 7 sprays with a backpack mist blower (Solo) and 2 ovicide sprays applied with a hydraulic sprayer unit were conducted in 1977. Ovicide dip treatments were carried out in the laboratory using two replicates of five egg bands dipped in pesticide solutions equivalent to 227 mL a.i./454 L. Mist-blower plots were established in farm woodlots on 6 May and were approximately 0.04 ha in size, including one virus egg-band spray test area which consisted of four 0.04-ha plots sprayed on 14 April at viral concentrations of 1×10^8, 1×10^7, 1×10^6, and 5×10^5 PIB/mL. Control was assessed by estimating mortality based on weekly samples of 300 or more larvae per plot during the larval period. Spray solutions were applied at the rate of 18 L/0.04 ha. Trees in all plots ranged from 3 to 6 m in height. Hydraulic spray plots of 0.2 ha each were established on 13 April in a forested area with trees averaging about 8 m in height. Solutions with 1 tbsp (14 mL) Atplus 526 spreader/sticker added were applied at the rate of 114 L/plot. Percentage insect control was determined from egg hatch and counts of living and dead larvae and the application of Abbott's formula.

Comments: No phytotoxicity was observed in the spray areas.

Results: See Table 4. All ovicide dip tests indicated excellent results with the exception of Dimilin, which was not expected to be very effective as an ovicide. Hydraulic spray results were similiar to previously reported data, considering that the tops of several trees could not be reached by the spray.

CHOKECHERRY MIDGE AND A SEED-BORING SAWFLY

Pest: Chokecherry midge, *Contarinia virginianiae* (Felt) and a seed boring sawfly, *Hoplocampa lacteipennis* (Roh.)

Host: Chokecherry and Saskatoon

Materials: Baygon (propoxur) 1.8 EC, Ambush 50 EC, Basudin (diazinon) 50 EC, Dutox (trichlorfon and oxydemeton-methyl) 25 EC, Dylox (trichlorfon) 4 E

Methods: Ten spray treatments using five insecticides were applied with a backpack mist blower (Solo) on 26 May in a tree nursery. Plots were about 0.02 ha in size with shrubs averaging about 3 m in height. Spray solutions were applied at the rate of 4.5 L per plot (3.1 mL a.i./L) with alternate plots treated at half that dosage (1.5 mL a.i./L). Percentage insect control was determined by examination of ten 45-cm branches randomly selected from treated and control plots about 11 days later and application of Abbott's formula.

Comments: Populations of the chokecherry midge were down considerably in 1977 compared to 1975 and 1976 infestations. Also, most of the enlarged fruit caused by the midge had dropped to

TABLE 4. Results of 1977 field tests on *Malacosoma disstria* Hübner

Material	Type	Solution a.i./L	Plot	Larvae Dead	Larvae Alive	% Control
Ambush 50 EC	OD	.53 mL	10 eb	1366	0	100
Ambush 50 EC	MB	3.1 mL	.04 ha	-	0	100
Basudin 50 EC	OD	.53 mL	10 eb	1655	0	100
Baygon 1.5 EC	OD	.53 mL	10 eb	1571	0	100
Cygon 4 E	OD	.53 mL	10 eb	1432	0	100
Dutox 24 EC	OD	.53 mL	10 eb	1776	0	100
Dylox 4 E	OD	.53 mL	10 eb	1330	0	100
Dylox 4 E	MB	3.1 mL	.04 ha	-	0	100*
Dimecron 94 EC	MB	3.1 mL	.04 ha	-	0	100
Metasystox-R 25 EC	OD	.53 mL	10 eb	1486	0	100
Lannate 25 L	OD	.53 mL	10 eb	1490	0	100
WL 43479 40 EC	OD	.53 mL	10 eb	1223	0	100
WL 43775 30 EC	MB	3.1 mL	.04 ha	-	0	100
Dimecron 94 EC	OD	.53 mL	10 eb	1422	27	98
Vydate L 25	MB	3.1 mL	.04 ha	-	22	90
Dimilin 25 WP	MB	3.1 g	.04 ha	-	25	90*
Vydate L 25	OD	.53 mL	10 eb	1267	177	87
Basudin 50 EC	H	.50 mL	.2 ha	2944	940	75
Baygon 1.5 EC	H	.50 mL	.2 ha	2053	1023	68
Dimilin 25 WP	OD	.53 g	10 eb	103	1221	17
Virus (NPV)**	MB	1×10^8	.04 ha	-	-	99†
Virus (NPV)**	MB	1×10^7	.04 ha	-	-	94†
Virus (NPV)**	MB	1×10^6	.04 ha	-	-	81†
Virus (NPV)**	MB	5×10^5	.04 ha	-	-	68†

* Estimated control, because no counts of dead larvae possible
** Sunlight protectant IMC 90-001 (25 g/L) added
† Cumulative mortality during larval period from data provided by W.G.H. Ives (personal communication)

the ground before the final check was made. Fruit production was somewhat higher in the treated areas than in the untreated. Larvae of an unidentified Lepidoptera also caused damage to about 8% of the chokecherry fruit, indicating that a second spray application, probably in early July, may be warranted to control this other pest.

Fruit production on saskatoon in the general test area was very low and spotty, with many shrubs not producing. Spring drought had probably affected flowering and fruit set, which were so poor that meaningful tests were impossible. An unidentified sawfly, very similar to *H. lacteipennis*, caused considerable damage to the fruit. Distribution of this species was recorded through south-central Alberta.

A trace of phytotoxicity occurred in all treated plots except for the lower-dosage applications. Chokecherry in particular is subject to loss of small portions of the leaves, resulting in a lace-like appearance of the foliage. Although the damage resembles phytotoxicity, its cause is unknown.

Results: See Table 5.

TABLE 5. Control results of insects attacking the fruit of chokecherry

Material	Dosage a.i./L	Total Fruit	Fruit Attacked by Midge	Fruit Attacked by Sawfly	% Control Midge	% Control Sawfly
Baygon 1.8 EC	1.5 mL	1081	0	1	-	100
Baygon 1.8 EC	3.1 mL	949	0	1	-	99
Ambush 50 EC	3.1 mL	1005	0	0	-	100
Ambush 50 EC	1.5 mL	790	0	0	-	100
Basudin 50 EC	1.5 mL	765	0	1	-	99
Basudin 50 EC	3.1 mL	1031	0	4	-	95
Dutox 24 EC	1.5 mL	852	0	3	-	96
Dutox 24 EC	3.1 mL	991	0	22	-	71
Dylox 40 EC	3.1 mL	1105	0	1	-	99
Dylox 40 EC	1.5 mL	1015	0	46	-	41

NORTHERN PITCH TWIG MOTH

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

Host: Pine, lodgepole

Materials: Furadan (carbofuran) 10 G, Metasystox-R (oxydemeton-methyl) 25 EC, Orthene (acephate) 75 SP, Cygon (dimethoate) 4 E, Baygon (propoxur) 1.8 EC

Procedure: Five soil drench tests were conducted on 18 April in plots established in a tree nursery. Plots consisted of two replicates of five trees each averaging about 1.8 m in height and 3.8 cm in basal diameter. Chemicals were applied into holes dug at the base of the tree at the rate of 4.5-5.6 mL or g a.i./cm basal diameter. All old and new first- and second-year nodules in the treated and control plots were examined at the time of chemical application. All nodules were re-examined again approximately 8 weeks later to determine percentage insect control from counts of living and dead larvae and application of Abbott's formula.

Comments: Because of severe drought and absence of the expected irrigation facilities, the chemicals were not sufficiently translocated by the root system.

Results: Insect control was 45% with Furadan, 25% with Metasystox-R, 7% with Orthene, and 5% with Cygon; no control was evident with Baygon. Although the results with Furadan were fair, all test results were inconclusive.

PEAR SLUG

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

Host: Cotoneaster

Materials: ULV formulations of Systemic (contains dicofol, dimethoate, methoxychlor), Tetrachlorvinphos 2.5%, Malathion (cythion) 1.8%, Vapona-Methoxychlor (dichlorvos 1% and methoxychlor 5%), and Orthene (acephate) 75 SP

Procedure: Four ultra low volume sprays were applied on 25 August with a gravity-fed roto sprayer (TOT 2S) at the rate of 6.2 mL formulation (pbi/Turbair) per 9 m of hedge 1.2 m in height. Plots were established in a recreation area. One Orthene spray was applied on 10 August using a backpack mist blower (Solo) at the rate of 9.1 L solution in a 0.04-ha plot on private property. Percentage insect control was determined by a random 10-leaf sampling technique in treated and untreated plots 24 h after treatment and application of Abbott's formula.

Comments: No phytotoxicity was observed.

Results: See Table 6. Results were similar to those recorded in previous reports, and registration has been recommended.

TABLE 6. Results of 1977 field tests, *Caliroa cerasi* (L.)

Material	Type	Dosage (a.i.) mL or g/plot	% Control
Systemic	ULV	unknown	100
Tetrachlorvinphos 2.5%	ULV	0.7 mL	92
Malathion 1.8%	ULV	0.5 mL	90
Vapona-Methoxychlor 6%	ULV	1.7 mL	88
Orthene 75 SP	MB	6.2 g	85

ROOT COLLAR WEEVIL

Pest: Root collar weevil, *Hylobius warreni* Wood

Host: Pine, lodgepole

Materials: Cygon (dimethoate) 4 E, Basudin (diazinon) 50 EC, Vydate (oxamyl) L 25, Metasystox-R (oxydemeton-methyl) 25 EC, Dimecron (phosphamidon) 94 EC

Procedure: Five soil drench tests were conducted on 16 June in a reforestation plantation established in 1960. Each plot consisted of five trees ranging from 3 to 4 m in height. Chemicals were applied into holes dug within the drip line of the tree but at least 0.3 m from the stem, at the rate of 3.1 mL a.i./cm basal diameter. Percentage insect control was determined from insect counts taken before application and approximately 6 weeks after in treated and control plots and application of Abbott's formula.

Comments: Percentage control with Cygon was less than half that of the 1974 field test, which was 86%. This was probably due to deposition of the chemical farther from the base of the tree than in 1974, which reduced contact and effects of fumigation. Drought until early summer may also have resulted in low translocation of chemicals.

Five of the 50 attacked trees tagged in 1975 had died in 1976. Mortality in this area will mount as the girdling increases.

Results: See Table 7.

TABLE 7. Results of 1977 field tests, *Hylobius warreni* Wood

Material	Av. Tree Diam. (cm)	Av. Ht (m)	Dosage a.i. (mL)	Larvae Live	Larvae Dead	% Control
Cygon 4 E	10.0	4.2	31.0	25	17	40
Basudin 50 EC	9.0	3.3	27.9	21	7	25
Vydate L 25	9.0	3.6	27.9	10	1	9
Metasystox-R 25 EC	7.6	3.0	23.6	17	0	0
Dimecron 94 EC	9.0	3.0	27.9	8	0	0

YELLOW-HEADED SPRUCE SAWFLY

Pest: Yellow-headed spruce sawfly, *Pikonema alaskensis* (Roh.)

Host: Spruce, white and Colorado blue

Materials: Ambush 50 EC, Dow M 3726 (experimental) 48 EC, WL 43467 40 EC, WL 43479 40 EC, WL 43775 30 EC

Procedure: Five spray treatments were applied on 4 July using a backpack mist blower (Solo). Plots were established in a farm shelterbelt and consisted of 10-22 trees each ranging from 3.6 to 7.9 m in height. Solutions were applied at the rate of 9.1 L per 10 trees (3.2 mL a.i./L). Percentage insect control was determined from examination of all treated trees 48 h after application.

Comments: Tops of some of the larger trees were out of mist-blower range. Scattered colonies of *Neodiprion abietis* Harr. were found on some trees.

Results: Control was excellent in all tests; no living larvae were found on the sprayed trees.

A WILLOW SHOOT-BORING SAWFLY

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

Host: Willow, acute

Materials: Baygon (propoxur) 1.8 EC, Dimecron (phosphamidon) 94 EC, Furadan (carbofuran) 10 G

Procedure: Three soil drench plots were established on 13 June in acute willow stool beds in a tree nursery. Each plot consisted of two replicates of five stools each averaging about 12.7 cm basal diameter (cumulation of stems per replicate). Chemicals were applied into holes at the base of the stool at the rate of 5.1 mL a.i./cm with Baygon, 5.6 mL a.i./cm with Dimecron, and 4.5 g a.i./cm with Furadan. Plots were irrigated to about 2 cm of water after treatment. Percentage insect control was determined by examination of ten 45-cm whips randomly selected from each replicate and control plot about 9 weeks later and application of Abbott's formula.

Comments: No phytotoxicity occurred in the Baygon plot in 1977, probably because the chemical was applied away from the root collar, while in 1976, it contacted the root collar. The variable results were probably caused by extreme drought conditions at the time of application in 1977. For best results, irrigation is essential for soil drenches.

Results: Percentage insect control was 100% for Baygon, 76% for Dimecron, and 44% for Furadan. Results with Baygon were consistent with previously reported data. Results with Dimecron were higher than in 1976 (41%), and results with Furadan were much lower than expected (97% in 1976).

TABLE 8. Summary of 1977 field tests

No.	Type	Chemical	Species*	% Control
1	OD	Basudin 50 EC	FTC	100
		Baygon 1.5 EC	FTC	100
		Cygon 4 E	FTC	100
		Dutox 25 EC	FTC	100
		Metasystox-R 25	FTC	100
2	OD	Dylox 50 EC	FTC	100
		Dimilin 25 WP	FTC	17
		Ambush 50 EC	FTC	100
		WL 43479 40 EC	FTC	100
3	OD	Dimecron 94 EC	FTC	98
		Lannate L 25	FTC	100
		Vydate L 25	FTC	87
4	H	Baygon 1.5 EC	FTC	68
5	H	Basudin 50 EC	FTC	75
6	MB	Virus	FTC	99
7	SD	Cygon 4 E	Petrova	5
8	SD	Furadan 10 G	Petrova	45
9	SD	Metasystox-R 25	Petrova	25
10	SD	Baygon 1.5 EC	Petrova	00
11	SD	Orthene 75 SP	Petrova	7
12		---		
13	MB	Dimilin 25 WP	FTC	90
14	MB	Dylox 40 EC	FTC	100
15	MB	Ambush 50 EC	FTC	100
16	MB	WL 43775 30 EC	FTC	100
17	MB	Dimecron 94 EC	FTC	100
18	MB	Vydate L 25	FTC	90
19	SD	Cygon 4 E	BLM	100
20	SD	Basudin 50 EC	BLM	00
21	SD	Baygon 1.5 EC	BLM	100
22	SD	Metasystox-R 25	BLM	61
23	SD	Supracide 40 EC	BLM	51
24	SD	Dimecron 94 EC	BLM	100
25	SD	Orthene 75 SP	BLM	34
26	SD	Vydate L 25	BLM	100
27	SD	Temik 10 G	BLM	100
28	SD	Furadan 10 G	BLM	100
29	BP	Cygon 4 E	BLM	100
30	BP	Metasystox-R 25	BLM	76
31	BP	Dimecron 94 EC	BLM	98
32	SD	Nem-A-Tak 25 EC	BLM	97
33		---		
34	MB	Basudin 50 EC	Sfy & Midge	95
35	MB	Basudin 50 EC	Sfy & Midge	99
36	MB	Baygon 1.5 EC	Sfy & Midge	99
37	MB	Baygon 1.5 EC	Sfy & Midge	100
38	MB	Dutox 25 EC	Sfy & Midge	71
39	MB	Dutox 25 EC	Sfy & Midge	96
40	MB	Ambush 50 EC	Sfy & Midge	100
41	MB	Ambush 50 EC	Sfy & Midge	100
42	MB	Dylox 40 EC	Sfy & Midge	99
43	MB	Dylox 40 EC	Sfy & Midge	41
44	SD	Furadan 10 G	Euura	44
45	SD	Baygon 1.5 EC	Euura	100
46	SD	Dimecron 94 EC	Euura	76
47	SD	Cygon 4 E	RCW	40
48	SD	Basudin 50 EC	RCW	25
49	SD	Vydate L 25	RCW	9
50	SD	Metasystox-R 25	RCW	00
51	SD	Dimecron 94 EC	RCW	00
52	MB	Ambush 50 EC	YHS	100
53	MB	M 3726 48 EC	YHS	100
54	MB	WL 43479 40 EC	YHS	100
55	MB	WL 43467 40 EC	YHS	100
56	MB	WL 43775 30 EC	YHS	100
57	MB	Cygon 4 E	BLM	100
58	MB	Basudin 50 EC	BLM	100
59	MB	Baygon 1.5 EC	BLM	100
60	MB	Metasystox-R 25	BLM	89
61	MB	Supracide 40 EC	BLM	90
62	MB	Dimecron 94 EC	BLM	89
63	MB	Orthene 75 SP	BLM	89
64	MB	Vydate L 25	BLM	90
65	MB	Sevin 50 WP	BLM	90
66	MB	Ambush 50 EC	BLM	37
67	MB	WL 43775 30 EC	BLM	2
68	MB	Cythion 50 EC	BLM	90
69	MB	Orthene 75 SP	Caliroa	85
70	ULV	Malathion 1.8	Caliroa	90
71	ULV	Systemic	Caliroa	100
72	ULV	Tetrachlor	Caliroa	92
73	ULV	Vapona-Methox	Caliroa	88

* FTC = Forest tent caterpillar
Petrova = *P. albicapitana*
BLM = Birch leaf miners (sawflies)
Sfy = *H. lacteipennis*
Midge = *C. virginianiae*
Euura = *E. atra*
RCW = Root collar weevil
YHS = Yellow-headed sawfly (spruce)
Caliroa = *C. cerasi*

TABLE 9. Registration recommendations, 1977. Based on insecticides field-tested during the period 1972-1977 (Drouin and Kusch). Included are those insecticides that indicated good control of specific pests in 2 or more years of testing.

Pest	Host	Method
Basudin 50 EC (Ciba-Geigy)		
Malacosoma disstria Hbn.	aspen	MB & H
Pikonema alaskensis (Roh.)	spruce	MB & H
Pristiphora erichsonii (Htg.)	larch	MB & H
Lithocolletis sp.	poplar, aspen	MB
Aphids (open feeders)	caragana, saskatoon	MB
Contarinia virginianiae (Felt)	chokecherry	MB
Hoplocampa lacteipennis (Roh.)	chokecherry	MB
Baygon 1.5 EC (Chemagro)		
Lithocolletis sp.	poplar, aspen	MB
Malacosoma disstria Hbn.	aspen	MB & H
Euura atra (Jurine)	willow	SD
Cygon 4 E (Cyanamid)		
Malacosoma disstria Hbn.	aspen	MB
Caliroa cerasi (L.)	cotoneaster, hawthorn	SD
Pikonema alaskensis (Roh.)	spruce	MB, H, SD
Pristiphora erichsonii (Htg.)	larch	MB & H
Periphyllus negundinis (Thos.)	M. maple	MB
Saperda calcarata Say	poplar	SD
Proteoteras willingana (Kft.)	M. maple	SD
Petrova albicapitana (Busck)	pine	SD
Euura atra (Jurine)	willow	SD
Contarinia virginianiae (Felt)	chokecherry	MB
Dimilin 25 WP (Thompson-Hayward)		
Malacosoma disstria Hbn.	aspen	MB
Dipel 3.2 bt (Abbott)		
Malacosoma disstria Hbn.	aspen	H
Fundal SP 97% (FMC)		
Malacosoma disstria Hbn.	aspen	MB
Furadan 10 G (FMC)		
Pikonema alaskensis (Roh.)	spruce	SD
Nematus ribessii (Scop.)	currant	SD
Gracillaria syringella (Fabr.)	lilac	SD
Caliroa cerasi (L.)	cotoneaster	SD
Petrova albicapitana (Busck)	pine	SD
Galecron 50 EC (Ciba-Geigy)		
Pristiphora erichsonii (Htg.)	larch	MB
Gardona 75 WP (Shell)		
Malacosoma disstria Hbn.	aspen	MB & H

Imidan 1 E and 50 WP (Chipman)		
Malacosoma disstria Hbn.	aspen	H
Pikonema alaskensis (Roh.)	spruce	MB & H
Lithocolletis sp.	poplar, aspen	MB
Lannate L 25 and 90 WP (DuPont)		
Malacosoma disstria Hbn.	aspen	MB & H
Pikonema alaskensis (Roh.)	spruce	MB
Aphids (open feeders)	M. maple, saskatoon	MB
Lorsban 25 W (Dow)		
Malacosoma disstria Hbn.	aspen	MB & H
Cythion 50 EC (FMC)		
Pikonema alaskensis (Roh.)	spruce	MB
Malacosoma disstria Hbn.	aspen	MB
Contarinia virginianiae (Felt)	chokecherry	MB
Metasystox-R 25% (Chemagro)		
Saperda calcarata Say	poplar	SD
Euura atra (Jurine)	willow	SD
Malacosoma disstria Hbn.	aspen	MB & H
Aphids (open feeders)	M. maple, caragana	MB
Nexion 25 W (Ciba-Geigy)		
Malacosoma disstria Hbn.	aspen	MB & H
Orthene 75 SP (Chevron)		
Malacosoma disstria Hbn.	aspen	MB & H
Caliroa cerasi (L.)	cotoneaster	SD
Pirimor 50 W (Chipman)		
Aphids (open feeders)	caragana	H
PP 505 10 G (Chipman)		
Pikonema alaskensis (Roh.)	spruce	SD
RH 218 50 EC (Rohm & Haas)		
Malacosoma disstria Hbn.	aspen	MB & H
Sevin 50 WP and Sevimol 4 (FMC & U. Carbide)		
Pikonema alaskensis (Roh.)	spruce	MB & H
Malacosoma disstria Hbn.	aspen	MB & H
Pristiphora erichsonii (Htg.)	larch	MB
Supracide 40 EC (Ciba-Geigy)		
Malacosoma disstria Hbn.	aspen	MB
Aphids (open feeders)	M. maple	MB
Temik 10 G (Union Carbide)		
Pikonema alaskensis (Roh.)	spruce	SD
Thiodan 4 E (FMC)		
Malacosoma disstria Hbn.	aspen	MB & H

Volaton 50 EC (Chemagro)		
Caliroa cerasi (L.)	cotoneaster	SD
Vydate L 25 (DuPont)		
Malacosoma disstria Hbn.	aspen	MB
Ultra Low Volume Tests (Turbair Rotospray systems)		
Malathion 1.8%		
Caliroa cerasi (L.)	cotoneaster, hawthorn	
Systemic		
Caliroa cerasi (L.)	cotoneaster, hawthorn	
Tetrachlorvinphos 2.5%		
Caliroa cerasi (L.)	cotoneaster, hawthorn	
Vapona-Methoxychlor 6%		
Caliroa cerasi (L.)	hawthorn	

ACKNOWLEDGMENTS

The authors wish to thank Mr. W.G.H. Ives, Northern Forest Research Centre, and Dr. R.F. De Boo, Chemical Control Research Institute, for their assistance and kind cooperation. Our thanks also go to Atlas Chemical, Chevron Chemical, Chemagro Limited, Chipman Chemical, Ciba-Geigy Limited, Cyanamid of Canada, Dow Chemical, DuPont of Canada, Elanco Products Company, F.M.C. of Canada, Roto-Spray of Canada, Shell Canada Limited, Thompson-Hayward Chemical Company, Sandoz Incorporated, and Union Carbide of Canada for their kind cooperation in providing technical information and the various chemicals or insecticides. Edmonton Nurseries Limited (Devon Centre) and the Provincial Tree Nursery (Oliver) provided holding blocks, stool beds, shelterbelts, and irrigation facilities.

The authors also wish to thank Mr. W.G.H. Ives, Dr. H.F. Cerezke, and Mr. J.A. Muldrew for reviewing the manuscript.

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APPENDIX 1

LIST OF INSECTICIDES AND CHEMICAL NAMES

acephate	0,S-dimethyl N-acetyl phosphoramidothioate
aldicarb	2-methyl-2-(methylthio) propionaldehyde 0-(methyl-carbamoyl) oxime
Ambush	see permethrin
Basudin	see diazinon
Baygon	see propoxur
carbaryl	1-naphthyl methylcarbamate
carbofuran	2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate
cygon	see dimethoate
Cythion	diethyl meraptosuccinate S-ester with 0,0-dimethyl phosphorodithioate
diazinon	0,0-diethyl 0-(isopropyl-6-methyl-4-pyrimidinyl) phosphorothionate
dichlorvos	2,2-dichlorovinyl dimethyl phosphate
dicofol	1,1-bis(chlorophenyl)-2,2,2-thrichloroethanol
diflubenzuron	N-(((4-chlorophenyl)amino)carbonyl)2,6-difluorobenzamide
Dimecron	see phosphamidon
dimethoate	0,0-dimethyl phosphorodithioate S-ester with 2-mercapto-N-methylacetamide
Dimilin	see diflubenzuron
Dutox	trichlorfon and oxydemeton-methyl
Dylox	see trichlorfon
Furadan	see carbofuran
Lannate	see methomyl
malathion	see Cythion
Metasystox-R	see oxydemeton-methyl
methidathion	0,0-dimethyl phosphorodithioate S-ester with 4-(mercaptomethyl) thiadiazolin-5 one
methomyl	S-methyl N-((methylcarbamoyl)oxyl)thiacetrimidate

Methoxychlor	1,1,1-trichloro-2,2-bis(p-methoxyphenyl) ethane
M 3726	experimental
Nem-A-Tak	experimental
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-2,2-dimethyl-3-2(2,2-dichlorovinyl) cydopropane carboxylate
phosphamidon	0-(2-chloro-2-diethylcarbamoyl-1-methyl-vinyl)-0,0-dimethy-phosphate
pirimicarb	2-(dimethylamino)-5,6-dimethyl-4-pyrimidinyl dimethylcarbamate
Pirimor	see pirimicarb
propoxur	0-isopropoxyphenyl methylcarbamate
Sevin	see carbaryl
Shell WL 43775	synthetic pyrethroid
Shell WL 43467	synthetic pyrethroid
Shell WL 43479	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
trichlorfon	dimethyl (2,2,2-trichloro-1-hydroxyethyl) phosphonate
Vapona	see dichlorvos
Vydate	see oxamyl