

Summary of Laboratory Evaluation of Insecticides Against
Various Species of Forest Insect Pests - 1969

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Insecticides were tested against twelve species of insects in the laboratory during 1969. The results are summarized under each species.

1. Balsam Woolly Aphid (*Adelges piceae* (Ratz.))

Thirty-two insecticides were tested against balsam woolly aphid at 1% concentration at the rate of 1 gallon per acre from November 1968-January 1969. The toxicity of four most effective insecticides is as follows:--

Baygon > Furadan > Herc 13462 = Exptl. Cyan. 47470.

To date, all the compounds are inferior to Baygon and Furadan, which are being used as standard compounds against balsam woolly aphid. The insecticides used during 1969 are listed in Table 1.

2. Spruce Budworm (*Choristoneura fumiferana* (Clem.))

Twelve insecticides were tested against spruce budworm for contact toxicity during 1969.

Bay 77488, SD 8447 and S 4084 appear to be quite promising when considered on the basis of toxicity to spruce budworm and mammalian toxicity. Bay 77488, SD 8447 and S 4084 are better than Zectran and Matacil (last year's most promising compounds) in toxicity to mammals. The insecticides used during 1968 and 1969 with the LD 50 and LD 95 values are listed in Tables 2, 3, and 4.

3. Ambrosia Beetle (*Trypodendron lineatum* (Oliv.))

Eleven insecticides, NIA 10242 (Furadan), Herc 13462, Bay 77488, S 4084, Exptl. Cyan. 47470, Exptl. Cyan. 47031, Baygon, Mc 62, SD 8447, Carbamult and DDT were tested against ambrosia beetle adults for contact toxicity during 1969. The four most effective compounds were Furadan, Herc 13462, Bay 77488, S 4084. In 1968 tests Sumithion and Phosphamidon/Sumithion Mixture were the most toxic. The relative potencies in descending order of toxicity at 72 hours after treatment of the six most effective compounds, when compared with BHC at LD 95 level are as follows:--

Furadan 39 > Herc 13462 33 > Bay 77488 18 >
Phos./Sum. Mix. 12 > Sumithion 11 > BHC 1.

The LD 95 value of BHC is 3.202 $\mu\text{g}/\text{cm}^2$. Out of these six compounds Bay 77488 is least toxic to mammals as compared to the other compounds. The toxicity of Bay 77488 to fish and birds is not available.

4. Sitka Spruce Weevil (*Pissodes sitchensis* Hopk.)

Six insecticides were tested against sitka spruce weevil adults. The highest mortality at the lowest dose at 72 hours after treatment is given below:--

<u>Insecticide</u>	<u>Dose</u> <u>$\mu\text{g}/\text{cm}^2$</u>	<u>% Mortality</u>
Methyl Trithion	0.448	100
Sumithion	0.642	100
Zectran	1.078	94
SD 8447	1.144	100
Phosphamidon	2.242	95
BHC	3.363	100

Methyl Trithion appears to be most effective as a contact insecticide.

5. Western Hemlock Looper (*Lambdina fiscellaria lugubrosa* Hulst.)

Six insecticides were tested for contact toxicity against third instar larvae of western hemlock looper. The insecticides are arranged below in descending order of toxicity with their LD 95 values in $\mu\text{g}/\text{cm}^2$ for 72 hours after treatment.

Zectran 0.14 > Matacil 0.41 > Sumithion 0.50 >
Phosphamidon 0.72 > SD 8447 1.76 > Baygon 5.67.

Zectran was best followed by the others, however taking into consideration the mammalian toxicity, SD 8447 appears to be very promising.

6. Eastern Hemlock Looper (*Lambdina fiscellaria fiscellaria* (Guen.))

The LD 95 values in $\mu\text{g}/\text{cm}^2$ of the insecticides tested against third instar larvae of the looper for 72 hours after treatment are as follows:--

Zectran 0.27 > Sumithion 0.43 > Phosphamidon 2.18 > SD 8447 3.30.

Experiments with Baygon and Matacil could not be subjected to analysis. Matacil gave 100% mortality at 0.90 $\mu\text{g}/\text{cm}^2$ and Baygon gave 35% mortality at 2.24 $\mu\text{g}/\text{cm}^2$ at 72 hours after treatment.

7. Green-striped Forest Looper (Melanolophia imitata Wlk.)

Sumithion, Zectran and Matacil were tested against third and last instar larvae of this looper. The experiments with Sumithion were carried out against third instar larvae at the beginning of the season and it appears that this species is tolerant to Sumithion. Sumithion gave 93% mortality at 5.605 $\mu\text{g}/\text{cm}^2$ when observed at 72 hours after treatment. The experiments with Matacil and Zectran were not conclusive due to pre-pupation and high control mortality.

The eastern and western hemlock looper are susceptible to Sumithion while green-striped forest looper seems to be tolerant.

8. Black-headed Jack-pine Sawfly (Neodiprion pratti banksianae Roh.)

Seven new insecticides were tested against fourth instar larvae of this sawfly. The LD 95 values are presented below for 72 hours after treatment and DDT is included for comparative studies.

<u>Insecticide</u>	<u>LD 95 values</u> <u>$\mu\text{g}/\text{cm}^2$</u>	<u>Insecticide</u>	<u>LD 95 values</u> <u>$\mu\text{g}/\text{cm}^2$</u>
Herc 13462	0.026	Mc 62	0.390
Bay 77488	0.032	Carbamult	0.480
S 4084	0.091	DDT	15.259
Exptl. Cyan. 47470	0.160	NIA 10242 (Furadan) gave 100% mortality at	0.056 $\mu\text{g}/\text{cm}^2$

9. Larch Sawfly (Pristiphora erichsonii (Htg.))

Ten insecticides were tested against fourth instar larch sawfly larvae. The LD 95 values for 72 hours after treatment are as follows:--

<u>Insecticide</u>	<u>LD 95 values</u> <u>$\mu\text{g}/\text{cm}^2$</u>	<u>Insecticide</u>	<u>LD 95 values</u> <u>$\mu\text{g}/\text{cm}^2$</u>
NIA 10242 (Furadan)	0.011	S 4084	0.130
Cidial	0.011	Exptl. Cyan. 47470	0.190
SD 8447	0.039	Abate	0.290
Bay 77488	0.067	Imidan	0.480
Dursban	0.069	Mc 62	0.530

Cidial and NIA 10242 (Furadan) seem to be very effective against this pest in this year's testing.

10. European Pine Sawfly (N. sertifer (Geoff.))

Two insecticides S 4084 and Herc 13462 were tested against fourth instar larvae of this pest. The LD 95 values for 72 hours after treatment for S 4084 and Herc 13463 were 0.069 and 0.085 $\mu\text{g}/\text{cm}^2$ respectively.

11. Mountain-ash Sawfly (P. geniculata (Htg.))

Three insecticides, Phosphamidon, Sumithion and Zectran were tested against fourth instar larvae of this sawfly. The highest mortality for 72 hours after treatment at the lowest dose is as follows:--

<u>Insecticide</u>	<u>Dose</u> <u>$\mu\text{g}/\text{cm}^2$</u>	<u>% Mortality</u>
Zectran	0.224	83
Phosphamidon	0.242	100
Sumithion	0.242	63

All three compounds appear to be very toxic to this species.

12. Red-headed Pine Sawfly (N. lecontei Fitch)

Zectran and SD 8447 were tested against fourth instar larvae of red-headed pine sawfly. The highest mortality for 72 hours after treatment at the lowest dose is as follows:--

<u>Insecticide</u>	<u>Dose</u> <u>$\mu\text{g}/\text{cm}^2$</u>	<u>% Mortality</u>
Zectran	0.048	100
SD 8447	0.096	100

SD 8447 is half as toxic as Zectran but it is very low in mammalian toxicity as mentioned before.

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Table 1: List of Insecticides and Source Used Against Balsam Woolly Aphid During 1968-69

<u>No.</u>	<u>Name</u>	<u>Type</u>	<u>Formula</u>	<u>Source</u>
1.	Anthio [®] (25% E.C.)	Organo-phos Systemic	O,O-dimethyl-S-(N-methyl-N-formoylcarbamoylmethyl)-dithiophosphate	Sandoz Ltd.
2.	Bayer 25141 (10% E.C.)	(Technical) Organo-phos	O,O-diethyl O-p-(methylsulfinyl) phenyl phosphorothioate	Chemagro Corp.
3.	Bayer 29493 (Baytex) (46% E.C.)	Organo-phos	O,O-dimethyl O-[4-(methylthio)-m-tolyl] phosphorothioate	Chemagro Corp.
4.	Bayer 38156 (10% E.C.)	(Technical) Organo-phos	O-Ethyl S-p-tolyl ethylphosphorodithioate	Chemagro Corp.
5.	Baygon [®] (13.9% E.C.)	Carbamate Systemic	o-isopropoxyphenyl methylcarbamate	Chemagro Corp.
6.	C 8353 (15% W.S.)	Carbamate (Contact)	2-(1,3-dioxolane-2-yl)-phenyl-N-methyl-carbamate	Ciba Co. Ltd.
7.	C 8514 (50% E.C.)		N, N-dimethyl-N-(2-methyl-4-chlorophenyl)-formanidine	Ciba Co. Ltd.
8.	C 9491 (30% E.C.)	Contact	O,O-dimethyl-O-2,5-dichloro-4-iodophenyl thiophosphate	Ciba Co. Ltd.
9.	C 9643 (40% E.C.)	Carbamate	O-(4-methyl-1,3-dioxolane-2-methyl)phenyl-N-methyl-carbamate	Ciba Co. Ltd.
10.	C 13963 (40% E.C.)	Carbamate	2-(1,3-dithiolan-2-yl)phenyl N,N-dimethylcarbamate	Ciba Co. Ltd.
11.	CO-RAL [®] (11.6% E.C.)	Organo-phos	O,O-diethyl O-3-chloro-4-methyl-2-oxo-2H-1-benzopyran-7-yl-phosphorothioate	Chemagro Corp.
12.	Diazinon [®] (50% E.C.)	Organo-phos Contact	O,O-diethyl O-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate	Geigy
13.	Exptal 47031 (35% E.C.)	Organo-phos Systemic	P,P-diethyl cyclic ethylene ester of phosphonodithioimidocarbonic acid	American Cyanamid
14.	Exptal 47470 (36% E.C.)	Organo-phos Systemic	P,P-diethyl cyclic propylene ester of phosphonodithioimidocarbonic acid	American Cyanamid
15.	WARBEX [®] (13.4% E.C.)	Organo-phos	O-p-(dimethylsulfamoyl)phenyl O,O-dimethyl phosphorothioate	Amer. Cyan.

Table 1: List of Insecticides and Source Used Against Balsam Woolly Aphid During 1968-69 (Cont.)

<u>No.</u>	<u>Name</u>	<u>Type</u>	<u>Formula</u>	<u>Source</u>
16.	Herc 13462 (12.5% E.C.)	Organo-phos Systemic	0,0-dimethyl S-(1-sucini- midoethyl) phosphorodithioate	Hercules
17.	Korlan [®] (24% E.C.)	Organo-phos	0,0,dimethyl 0-2,4,5-tri- chlorophenyl phosphorothioate	Dow Chemical
18.	MARETIN [®] (2.5%E.C.)	(Technical) Organo-phos	N-hydroxynaphthalimide diethyl phosphate	Chemagro Corp.
19.	MATACIL [®] (10% E.C.)	(Technical) Carbamate Contact	4-dimethylamino-m-tolyl methylcarbamate	Chemagro Corp.
20.	MC 62 (sophamide) (25% E.C.)		0,0-dimethyl S-(N-methoxymethyl- carbamoylmethyl) phosphorothiol othionate	Murphy Chem.
21.	MORPHOTOX [®] (20% E.C.)	Organo-phos Systemic	0,0-dimethyl S-((morpholino= carbonyl)methyl) phosphoro= dithioate	Sandoz Ltd.
22.	NIA 10242 (2.5%E.C.) Furadan	(Technical) Carbamate Systemic	2,3-dihydro-2,2-dimethyl-7- benzofuranyl methylcarbamate	Niagara Chem.
23.	Phosdrin [®] (60% W.S.)	Organo-phos Systemic	methyl 3-hydroxy-alpha- crotonate, dimethyl phosphate	Shell
24.	PROBAN [®] (1.35%) E. C.	organo-phos Systemic	0,0-dimethyl 0-p-sulfamoyl= phenyl phosphorothioate	Amer. Cyan.
25.	Ruelene [®] (25% E.C.)	Organo-phos Systemic	0-4-tert-butyl-2-chlorophenyl 0-methyl methylphosphoramidate	Dow Chem.
26.	S 4084 (40% E.C.)	Organo-phos	0-p-cyanophenyl 0,0-dimethyl phosphorothioate	May & Baker
27.	SD 6073 W.S.	(Technical) Urea hormone	2-Imidazolidinone	Shell Chem. Co.
28.	SD 8591 W.S.	(Technical) Urea hormone	4-Imidazolin-2-one	Shell Chem. Co.
29.	Systox (28.5%E.C.)	Organo-phos. Systemic	mixture of 0,0-diethyl S-(and 0)-2-(ethylthio)ethyl phos= phorothioates	Chemagro Corp.
30.	Sytam [®] (55% E.C.)	Organo-phos Systemic	octamethylpyrophosphoramide	Murphy Chem.
31.	Thimet [®] (47.7%)	Organo-phos Systemic	0,0-diethyl S-(ethylthio)methyl phosphorodithioate	Amer. Cyan.
32.	Zytron [®] (37.5% E.C.)	Organo-phos Systemic	0-2,4-dichlorophenyl 0-methyl isopropylphosphoramidothioate	Dow Chem.

TABLE NO. 2

Toxicity of Insecticides to Fifth Instar Spruce Budworm Larvae
at 72 Hours After Treatment - 1968

Insecticide	LD 50 ug/cm ²	Fiducial Limits	Relative Potency	Toxicity Index	LD 95 ug/cm ²	Fiducial Limits	Relative Potency
Zectran [®]	0.036	0.030 - 0.043	36.7	3670	0.126	0.096 - 0.199	52.7
Matacil [®]	0.043	0.036 - 0.050	30.7	3070	0.108	0.087 - 0.160	61.5
Dibrom [®]	0.157	0.138 - 0.176	8.4	840	0.299	0.258 - 0.369	22.2
Sumithion [®]	0.315	0.206 - 0.425	4.2	420	0.666	0.480 - 1.551	10.0
Phosphamidon	0.392	0.255 - 0.527	3.4	340	0.752	0.554 - 1.729	8.8
Cyan 47031	0.447	0.353 - 0.524	3.0	300	1.026	0.819 - 1.630	6.5
Ciba 9491	0.582	0.488 - 0.670	2.3	230	1.127	0.955 - 1.447	5.9
VCS 506 [®]	0.703	0.620 - 0.813	1.9	190	1.447	1.102 - 3.282	4.6
Imidan [®]	0.806	0.673 - 0.916	1.6	160	1.536	1.320 - 1.972	4.3
Baytex [®]	0.967		1.4	140	8.603		0.8
Cygon [®]	0.993	0.339 - 4.517	1.3	130	3.756	1.753 - .8360 + 07	1.8
Anthio [®]	1.010	0.837 - 1.169	1.3	130	2.596	2.096 - 3.722	2.6
DDT	1.320	1.002 - 1.625	1.0	100	6.641	4.666 - 12.340	1.0
Baygon [®]	3.435		0.4	38	18.030		0.4

Table 3: Toxicity of Insecticides to Fifth Instar Spruce Budworm Larvae
at 72 Hours After Treatment - 1969

Insecticide	LD 50 ug/cm ²	Fiducial Limits	Relative Potency	Toxicity Index	LD 95 ug/cm ²	Fiducial Limits	Relative Potency
Bay 77488	.117	0.10 - 0.13	11.3	1128	0.26	0.21 - 0.35	25.5
S 4084	.21	.19 - .24	6.3	630	.41	.35 - .50	16.2
Exp. Cy. 47470	.24	.20 - .28	5.5	550	.58	.47 - .84	11.4
DDF-d-DDT	1.11	.83 - 1.39	1.2	120	4.67	3.51 - 7.25	1.4
DDT (1968)	1.32	1.00 - 1.63	1.0	100	6.64	4.67 - 12.34	1.0
SD 8447	1.77		0.75	75	3.63		1.8
MC 62	3.67	3.20 - 4.24	.36	36	9.77	7.52 - 15.48	0.68
DDF	4.23	3.44 - 5.13	.3	30	8.92	6.54 - 32.31	.7
Baygon	4.42	3.38 - 5.86	.3	30	28.84	16.13 - 103.7	.2

Table 4: Corrected Percentage Mortality of Fifth Instar Spruce Budworm Larvae
at 72 Hours After Insecticide Treatment - 1969

Expt. Code	Insecticide	Conc. %	Rate of Application in gal./acre						Highest Mortality at Lowest Dose	
			0.1	0.2	0.4	0.6	0.8	1.0	ug/cm ²	% Mortality
SBD 1	p, p'-DDT	5.0	0	20	100	90	100	100	2.24	100
SBD 2	DDD	5.0	0	0	0	38	38	38	3.36	38
SBW 71	DDF	5.0	1	5	0	40	38	75	5.55	75
SBD 4	d-DDT	5.0	0	25	38	63	63	88	5.61	88
SBD 5	DDF-d-DDT (1:1)	5.0	16	43	76	90	94	100	5.39	100
SBD 6	DDF-DDD (1:1)	5.0	0	21	10	21	66	66	4.48	66
SBD 7	DDF-p, p'-DDT (1:1)	5.0	0	14	0	43	71	20	4.48	71
SBW 65	Carbamult	5.0	0	3	51	26	65	50	4.48	65

1% @ 1 gal. per acre = 1.121 ug/cm² or 1.6 oz./acre.