Summary of Laboratory Evaluation of Insecticides Against Forest Insect Pests During 1970

Project No. CC-4

By

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Introduction and Discussion

Thirty-one insecticides were tested against nine species of insects for contact toxicity. Residual toxicity of eleven insecticides was determined against four species of insects. The systemic activity of five insecticides was evaluated by bioassay of the untreated foliage of treated plants, and in the case of Baygon, studies with radioactive Baygon C^{14} were also carried out. Baygon is a very effective compound against balsam woolly aphid under laboratory conditions (Nigam 1967, Randall et al. 1967, Nigam and Clark 1969). The details of methods and materials for determining the various types of toxicities were as described in previous reports (Nigam 1967, 1968a,b, 1969c, 1970b). The details of the radio assay technique will be reported shortly. Results of potential insecticides (Matacil, Zectran, Baygon, Imidan, SD8447, Bayer 77488 and Sumithion) against some of the insects from previous tests are included for comparative studies (Nigam 1968b, 1969a-e, 1970a,d).

The summary of results and a review of literature on fish and wildlife toxicity of the compounds is presented in Table I. Zectran appears to be highly effective on the basis of contact, residual and systemic toxicity, but it is relatively toxic to mammals and birds. Matacil is comparable to Zectran in toxicity to insects and is relatively less toxic than Zectran to mammals and fish. Methoxychlor is very low in toxicity to wildlife but relatively ineffective against forest insect pests. Among the

pyrethrum related compounds, Allethrin and Pyrix 20 have a low toxicity to insects while F-6957 (stabilized pyrethrins) and Pyrocide are toxic to insects but the effectiveness lasts for only a few hours. SD 8447 (Gardona) and Baygon are highly toxic to different species of sawflies. Bayer 77488 is toxic to both sawflies and budworm. The mammalian and fish toxicity of Bayer 77488 and SD 8447 is very low and they appear to be very promising compounds for field evaluation against budworm and sawflies. The details of the 1970 work will be published in separate reports and papers.

Acknowledgement

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TABLE I [1].

SUMMARY CHART OF EFFICACY OF INSECTICIDES TESTED AGAINST FOREST INSECT PESTS DURING 1970

	TOXICITY TO INSECTS											TOXICITY TO WILDLIFE			
	CONTACT (LD_{95} value in ug/cm^2 or highest % mortality at lowest dosage in ug/cm^2 after 72 hrs.)									RESIDUAL (more than 70% mortality in hrs or days after spraying)		MAMMALS	BIRDS	FISH	
INSECTICIDES	AMB (*)	SBW	JPB	GSL	RPS	SJS	EPS	JPS	LS	SBW 2% at 1gpa; JPS 1% at 1gpa; LS 1% at 1gpa; EHL 2% at 4gpa	Based on bio-assay & radio tracer studies	AO Rats LD_{50} mg/kg	AO Mallards LD_{50} mg/kg	LD_{50}	REMARKS
1. ALLETHRIN					9.91	15.47	17% at .561		1.077			680-1000	>2000		
2. BASSA	7% at .280				90% at 2.803		2.368	2.193	5.626			Mice 410		Carp 24-48 ppm after 48 hrs	
3. BAYER 77488	.180	.260			.030	.055		.032	.067	6 hrs. 6 hrs.		8500-8800		A.S. 1 ml/l 24 hrs.	Appears to be very promising compound for field investigation.
4. BAYGON	3.81	28.84	7.543		.048		.049	.053	.087	Poor 6 hrs. 10 days poor	Slight absorption	95-175	11.9	G.T.1 ppm. not after 1 week	
5. BROMOPHOS									.095			3750-7700			
6. CIBA 17974					.157	69% at .112			10% at .112	Poor		450			
7. CIDIAL					.027	100% at .112			.011			200-2000	P. 218	Carp 4.5 ppm 100% mort. after 4 days	
8. CYGON (Dimethoate)		3.76	10.340		100% at .112	100% at .067		.227	.154	6hrs. 18 days	Slight absorption	155-500	41.7	T. 20 ppm. at 96 hrs.	
9. DDT		19.82	6.64		2.830	19.42*		15.26	1.985**			87-500	2240	T.10µg/l.	
10. DIBROM	.550	.299			100% at .022		.078		.047	6 hrs. 6 hrs		430	52.2	JWM 0.55 ppm.	
11. DUPONT 1642	53% at .280				.108		100% at .090		.621			60			
12. DURSBAN	.123			100% at 1.121	.052		.129	.097	.093			97-276	75.6		

(*) Legend at the end of table.

1 Dosages and Results of laboratory evaluation are for comparative study of insecticides and provide basic data and leads for field trials. Dosages cannot be adapted directly for field control operations due to variables involved in field application of insecticides.

TABLE I cont'd [1]

SUMMARY CHART OF EFFICACY OF INSECTICIDES TESTED AGAINST FOREST INSECT PESTS DURING 1972

	TOXICITY TO INSECTS												TOXICITY TO WILDLIFE			
	CONTACT (LD_{95} value in µg cm² or highest % mortality at lowest dosage in µg/cm² after 72 hrs.)									RESIDUAL (more than 70% mortality in hrs or days after spraying)				SYSTEMIC (from foliar application)	MAMMALS	BIRDS	FISH	
INSECTICIDES	AMB	SBW	JPB	GSL	RPS	SJS	EPS	JPS	LS	SBW 2% at 1gpa	JPS 1% at 1gpa	LS 1% at 1gpa	EHL 2% at 4gpa	Based on bioassay & radio tracer studies	AO Rats LD_{50} mg/kg	AO Mallards LD_{50} mg/kg	LD_{50}	REMARKS
13. DYLOX				100% at 2.242	.228		.973	.535	.087						450-699		AS 3.5 ml/l 24 hrs.	
14. F-6957 (Stabilized Pyrethrins)		100% at .336	97% at 280			3.161	100% at .224	100% at .168	.060	6 hrs					200-2600	>10000		
15. FITIOS	7% at .028						100% at .448		.340						340			
16. HOPCIDE	20% at .280						.180		.138						Mice 150			
17. IMIDAN	.401	1.536	6.524		.750	.301	.864		.480		3 days	21 days			147-299	1830	Mullet .055 ppm. 48 hrs.	
18. MATACIL	1.874	.108	.184	100% at .336	.019	.051	.023	.037	.059	5 days	3 days	40 days			30	22.5	T.10 ppm. 48 hrs.	
19. METHOMYL	.363			.206	.031	.043	.048	.030	.067	1 day					17-24	15.9	R.T. >100ppb.	
20. METHOXYCHLOR	7.596				17% at 5.605	45% at 11.21			3.151						5000-7000	>2000	R.T. 20µg/1.	Poor toxicity to forest pests.
21. MON 856			47% at 1.121		11% at .561				7% at .448						44			
22. MONITOR	23% at 2.242				25% at .112													
23. NIA 10242	.085				.025	100% at .034		100% at .056	.011						5	0.397		
24. PHOSPHAMIDON	.489	.752			100% at .045		.473	.395	.182		35 days	18 days		Absorption, not translocation	15-33	3.05	JAS 15 mg/1. 24 hrs.	

[1] Dosages and Results of laboratory evaluation are for comparative study of insecticides and provide basic data and leads for field trials. Dosages cannot be adapted directly for field control operations due to variables involved in field application of insecticides.

TABLE I cont'd [1]

SUMMARY CHART OF EFFICACY OF INSECTICIDES TESTED AGAINST FOREST INSECT PESTS DURING 1970

	TOXICITY TO INSECTS											TOXICITY TO WILDLIFE			
	CONTACT (LD_{95} value in $\mu g/cm^2$ or highest % mortality at lowest dosage in $\mu g/cm^2$ after 72 hrs.)									RESIDUAL (more than 70% mortality in hrs or days after spraying)		SYSTEMIC (from foliar application)	MAMMALS	BIRDS	FISH	
INSECTICIDES	AMB	SBW	JPB	GSL	RPS	SJS	EPS	JPS	LS	SBW 2% at 1gpa	JPS 1% at 1gpa	LS 1% at 1gpa / EHL 2% at 4gpa	Based on bio-assay & radio tracer studies	AO Rats LD_{50} mg/kg	AO Mallards LD_{50} mg/kg	LD_{50}	REMARKS
25. PYRIX 20		21% at 1.121			9.174	21% at 3.363	7% at 1.121	89% at 3.587	1.518					>10000			
26. PYROCIDE		100% at .224	97% at .224		1.561	1.092	100% at .336	100% at .168	.055					>10000			
27. S 4084	.440	.410			.051	.139		.091	.130					18-238			
28. SD 8447	5.47	3.63			100% at .022	.111			.039		5 days	30 days		4000-5000	>2000	T.81 ppm 24 hrs.	Field testing against sawflies & other insects should be carried out
29. SUMITHION	.305	.667	.901	13% at 7.174	.034		.140	.058	.141	1 day	40 days	15 days	Slight absorption	250-670	1190	JAS 2mg/1. 24 hrs.	
30. SURECIDE	11% at .280				.076		.070		.117					1000		Carp 1.35 48 hrs.	
31. ZECTRAN	.400	.126	.133	100% at .673	100% at .045		.059	.105	.057	5 days	40 days	21 days / 20 days	Absorption and slight translocation	19-22	3.0	JAS 16mg/1.24 hrs.	

LEGEND:
AMB - Ambrosia beetles
SBW - Spruce budworm
JPB - Jack-pine budworm
GSL - Green-striped forest looper
RPS - Red-headed pine sawfly
SJS - Swaine's jack-pine sawfly
EPS - European pine sawfly
JPS - Black-headed jack-pine Sawfly
LS - Larch sawfly

gpa - gallons per acre
ppm - parts per million
ppb - parts per billion
AO - acute oral toxicity

P - Pheasant
AS - Atlantic Salmon
GT - Golden Trout
T - Trout
RT - Rainbow Trout

JAS - Juvenile Atlantic Salmon
JWM - Juvenile White Mullet
* - 24 hours
** - 48 hours

$1.121\ ug/cm^2$ = 1% at 1 gal/acre or 1.6 oz/acre

[1] Dosages and Results of laboratory evaluation are for comparative study of insecticides and provide basic data and leads for field trials. Dosages cannot be adapted directly for field control operations due to variables involved in field application of insecticides.

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List of Insecticides

No.	Insecticide	Type	Formulation	Source
1	Allethrin	Botanical derivative	90% E.C.	McLaughlin, Gormley King Co.
2	Bassa®	Carbamate	50% E.C.	Kumiai
3	Bayer 77488	Organo-phosphate	73% tech.	Chemagro
4	Baygon® (Propoxur)	Carbamate	13.9% E.C.	Chemagro
5	Bromophos	Organo-phosphate	90% tech.	Cela
6	Ciba 17974	Carbamate	40% E.C.	Ciba
7	Cidial®	Organo-phosphate	50% E.C.	Green Cross
8	Cygon® (Dimethoate)	Organo-phosphate	40% E.C.	Amer. Cyan.
9	DDT	Chlor.hydro-carbon	99% tech.	Math. Col. & Bell
10	Dibrom	Organo-phosphate	91.9% E.C.	Chevron
11	Dupont 1642	Carbamate	99% tech.	Dupont
12	Dursban®	Organo-phosphate	48% E.C.	Dow
13	Dylox®	Organo-phosphate	39% E.C.	Chemagro
14	F 6957 (stabilized pyrethrins)	Botanical	2.4%	McLaughlin, Gormley King Co.
15	Fitios® B/77	Organo-phosphate	20% E.C.	Bombini
16	Hopcide®	Carbamate	20% E.C.	Kumiai
17	Imidan®	Organo-phosphate	22.4% E.C.	Stauffer
18	Matacil® (Aminocarb)	Carbamate	34% Sol.	Chemagro
19	Methomyl	Carbamate	99% tech.	Dupont
20	Methoxychlor	Chlor.hydro-carbon	99% tech.	Dupont
21	Mon 856		99% tech.	Monsanto
22	Monitor®	Organo-phosphate	75% E.C.	Chevron

List of Insecticides (Cont'd).

No.	Insecticide	Type	Formulation	Source
23	NIA 10242 (Furadan)	Carbamate	98% tech.	Niagara Chemicals
24	Phosphamidon	Organo-phosphate	90% WM	Ciba
25	Pyrix 20	Botanical	20% E.C.	Chemical Insecticide Corporation
26	Pyrocide 175	Botanical	20% E.C.	McLaughlin, Gormley King Co.
27	S 4084	Organo-phosphate	40% E.C.	Sumitomo
28	SD 8447 (Gardona)	Organo-phosphate	99% tech.	Shell
29	Sumithion	Organo-phosphate	50% E.C.	Sumitomo
30	Surecide®	Organo-phosphate	25% E.C.	Sumitomo
31	Zectran®	Carbamate	22% E.C.	Dow

Tech. = Technical grade
E.C. = Emulsifiable Concentrate
WM = Water miscible
Sol = Solution

List of Insects

Common Name	Scientific Name	Code
Spruce budworm	Choristoneura fumiferana (Clem.)	SBW
Jack-pine budworm	Choristoneura pinus Free.	JPB
Eastern hemlock looper	Lambdina fiscellaria fiscellaria (Guen.)	EHL
Green-striped forest looper	Melanolophia imitata Wlk.	GSL
Black-headed jack-pine sawfly	Neodiprion pratti banksianae Roh.	JPS
European pine sawfly	Neodiprion sertifer (Geoff.)	EPS
Red-headed pine sawfly	Neodiprion lecontei (Fitch.)	RPS
Swaine jack-pine sawfly	Neodiprion swainei Midd.	SJS
Larch sawfly	Pristiphora erichsonii (Htg.)	LS
Ambrosia beetle	Trypodendron lineatum (Oliv.)	AMB