# Summary of Laboratory Evaluation of Insecticides Against Forest Insect Pests During 1971

Project No. CC-006

By

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C O N T E N T S



G L O S S A R Y

| | | |
|---|---|---|
| Tech. | = | Technical grade |
| E.C. | = | Emulsifiable concentrate |
| W.M. | = | Water miscible |
| Sol. | = | Solution |
| W.S. | = | Water soluble |
| W.P. | = | Wettable powder |
| Oil | = | Oil solution |
| Corrected mortality | = | Using Abbott's formula |
| gpa | = | gallon per acre |
| ULV | = | Ultra low volume |
| Flowable | = | Wettable powder mixed with oil |

## INTRODUCTION

Thirty-seven insecticides were tested against 14 species of insects during 1971. The results are summarized under two sections: Section A deals with studies on spruce budworm and Section B presents results of experiments performed with other species of forest insect pests of economic importance to different regions of Canada, i.e., British Columbia, Ontario, Quebec, and the Maritimes. Description of testing techniques, rearing of insects, formulation of insecticides, etc., and results given by insecticides tested previously are reported in the references listed and are quoted against each species. The details of this year's work will be published in separate reports and papers.

## RESULTS

### (A) Studies on Spruce Budworm for 1971 Field Season

The testing procedures and previous year results are presented in references 1,6,7,8,9,12,14, and 21.

The following problems directly related to field operations were undertaken.--

(a) Phytotoxicity of fenitrothion formulations:-

At the request of Mr. B. W. Flieger of Forest Protection Ltd. and Dr. J. A. Armstrong of this Institute, the phytotoxicity of a fenitrothion solution in aerotex was evaluated. The aerotex solution of fenitrothion was proposed for early spring use in place of regular water emulsions which may freeze due to low temperatures.

The fenitrothion solution in aerotex was slightly phytotoxic to young foliage. The laboratory spraying was done on flushing potted balsam fir, white spruce and jackpine. The fenitrothion emulsion was not phytotoxic.

It appeared from these results that in mature trees, during early spring when buds are not flushed, the aerotex formulation would not cause phytotoxicity.

(b) Toxicity Studies of Matacil and Dylox Formulation for Control of Spruce Budworm:-

Ultra low volume and emulsifiable formulations of Matacil had been used experimentally against spruce budworm up to 1970. They were found very effective but are not as economical as the fenitrothion emulsion used in the field. In order to compete with fenitrothion economically in large scale operations the Chemagro Corporation developed 75% Matacil (W.P.) Air Mill formulation to be used in summer oil (as flowable material). It was suggested that efficiency of this formulation and a Dylox water soluble formulation should be tested under laboratory conditions during the spring so that the results could be made available before the field season.

In residual toxicity tests the Matacil (W.P.) flowable formulation gave consistently higher mortalities than the ULV formulations up to 10 days and the same was true for the Dylox formulations. Two percent active ingredient of each insecticide was applied at the rate of 1 gpa. It appears from these studies, that flowable formulations are more toxic than ULV in the laboratory residual toxicity tests.

(c) Residual Toxicity of Zectran Manufactured by Two Different Processes:-

The residual toxicity of new and old process Zectran was compared using fifth-instar spruce budworm. Two percent concentrations of both types of Zectran were formulated in 80% ethylene glycol and 20% Dowanol and were sprayed at the rate of 1 gallon per acre on potted spruce trees. The insects were released on the foliage for toxicity observation, just after spraying and 1, 3, 5, and 10 days later. There was no significant difference in the corrected percentage mortality of new and old process Zectran, i.e. their toxicity appears to be the same.

(d) Studies on Spruce Budworm and Fenitrothion Received from Petawawa Spraying Operations:-

The aerial spraying operation against spruce budworm failed at Petawawa so an investigation was carried out to check the susceptibility of the Petawawa spruce budworm population and efficacy of the fenitrothion formulation. The fenitrothion received from Petawawa was tested using spruce budworm larvae from the Ottawa population and was found to be effective. The spruce budworm collected at Petawawa were tested using a laboratory formulation of fenitrothion prepared from technical grade. This collection proved to be susceptible to the laboratory formulation. Petawawa fenitrothion formulation and spruce budworm population both appear to be normal.

(e) Monitoring of Resistance Level of Spruce Budworm Field Populations Sprayed with Fenitrothion:-

Fifth-instar spruce budworm from Quetico Park (unsprayed area) and Light Lake (sprayed area) were sprayed with

fenitrothion using a modified Potter's tower. Results indicated no significant difference in susceptibility to fenitrothion between larvae from the sprayed and unsprayed areas.

(f) Residual Toxicity of Larch Foliage Sprayed with Fenitrothion at Larose Forest:-

Insecticide contaminated larch foliage was collected from a sprayed plot at periods of one and six days after spraying. Larch sawfly larvae were used for the bioassay. There was a large variation in mortality between foliage samples. The average corrected percentage mortality was 22% one day after spraying and 6% six days after spraying.

(B) Summary of Laboratory Screening of Insecticides Against Various Species of Forest Insect Pests

Insecticides were tested against insects from British Columbia, Ontario, Quebec, and the Maritimes during 1971. The laboratory results are summarized by area of origin under each species. The insect collections were provided by the staff of the Forest Insect and Disease Survey with the exception of Gypsy Moth and native Elm Bark Beetle which were provided by the staff of the Department of Agriculture and National Capital Commission, respectively.

BRITISH COLUMBIA

Ambrosia Beetle - *Trypodendron lineatum* (Oliv.)[5,9,14,17]

Nine insecticides were tested against ambrosia beetle adults. The corrected percentage mortality ranged from 19% to 100% for 72 hours after treatment. The insecticides are arranged in descending order of toxicity.

Phoxim > Methyl Trithion > BHC > Surecide > Phosvel > Methoxychlor > Gardona > Hopcide > Bassa

Sitka-spruce Weevil - Pissodes sitchensis (Hopk.)[14]

The corrected percentage mortality for three insecticides tested against Sitka-spruce weevil adults ranged from 70% to 87%. Their order of toxicity is as follows:-

Methyl Trithion > Sumithion > Dursban

Filament Looper - Nematocampa filamentaria (Gn.)[15]

The corrected percentage mortality for the fourth-instar larvae of the filament looper tested with 0.5% Sumithion applied at the rate of 1 gpa was 88% for 72 hours after treatment.

ONTARIO

White-pine Weevil - Pissodes strobi (Peck)[9,14]

Fifteen insecticides were tested against white-pine weevil adults. The corrected percentage mortality ranged from 50% to 100%. The insecticides are arranged in descending order of toxicity for 72 hours after treatment.

Methyl Trithion > Sumithion > Phoxim > Dursban > Gardona > Zectran(new) > Lindane > BHC = Zectran(old) = Methomyl > C20132 = Phosphamidon > DDT > Methoxychlor > Chlordane

Jack-pine Budworm - Choristoneura pinus (Free.)[6,11,16,17]

The corrected percentage mortality for fourth-instar jack-pine budworm larvae treated with 1% Sumithion at 0.8 gpa was 100% for 72 hours after treatment.

European Pine Sawfly - Neodiprion sertifer (Geoff.)[13,19]

Six insecticides were tested against the fourth-instar larvae of European pine sawfly. The corrected percentage mortality ranged from 41% to 100%. The insecticides are arranged in descending order of toxicity for 72 hours after treatment.

DuPont 1642 > F6957 > Fitios > Pyrocide > Allethrin > Pyrix

Black-headed Jack-pine Sawfly - Neodiprion pratti banksianae (Roh.)[3,4,6,9,10,14,17,21]

Five insecticides were tested against the fourth-instar larvae of black-headed jack-pine sawfly. The corrected percentage mortality ranged from 80% to 100%. The insecticides are arranged in descending order of toxicity for 72 hours after treatment.

F6957 = Pyrocide > Surecide > Fitios > Pyrix

Larch Sawfly - Pristiphora erichsonii (Htg.)[3,4,9,10,14]

The corrected percentage mortality for five insecticides tested against fourth-instar larvae of larch sawfly ranged from 59% to 100%. The insecticides are arranged in descending order of toxicity for 72 hours after treatment.

Surecide > Dylox > Cygon > C17974 > Allethrin

Native Elm Bark Beetle - Hylurgopinus rufipes (Eichh.)[5]

Nine insecticides were tested against the adults of the native elm bark beetle. The corrected percentage mortality ranged from 87% to 100%. The insecticides are arranged in descending order for 72 hours after treatment.

Sumithion > Matacil > Dursban > DDT > Gardona = Baygon > Diazinon > Methoxychlor = Chlordane

## QUEBEC

### Red-headed Pine Sawfly - *Neodiprion lecontei* (Fitch)[18]

Fifteen insecticides were tested against fourth-instar of red-headed pine sawfly. The corrected percentage mortality ranged from 43.5% to 100% excluding Methoxychlor which gave 13%. The insecticides are arranged in descending order of toxicity for 72 hours after treatment.

> Gardona > Baygon = Dibrom = Zectran = Phoxim > Sevin > Phosphamidon = Cygon > F6957 > Phosvel > Galecron > Bassa > Monitor > Allethrin > Methoxychlor

### Swaine Jack-pine Sawfly - *Neodiprion swainei* (Midd.)[4,10,21]

The corrected percentage mortality for eight insecticides tested against fourth-instar Swaine jack-pine sawfly larvae ranged from 84% to 100%. The insecticides are arranged in descending order of toxicity for 72 hours after treatment.

> Furadan > Matacil > Phoxim > Cygon > Dylox > C17974 > Cidial > Allethrin

### Gypsy Moth - *Porthetria dispar* (L.)

The corrected percentage mortality was 100% with the six insecticide formulations tested against third-instar larvae of gypsy moth. They are listed in descending order of toxicity for 72 hours after treatment.

> Matacil > Sevin 80S > Sevin ULV > Sevin 4 oil > Phosphamidon > Sumithion

## MARITIMES

### White-marked Tussock Moth - Hemerocampa leucostigma (J.E. Smith)

Twelve insecticides were tested against the fourth-instar larvae of white-marked tussock moth. The corrected percentage mortality ranged from 82.7% to 100% except Sevin ULV and Gardona where 20% and 33% mortality were observed. The insecticides are arranged in descending order of toxicity for 72 hours after treatment.

Phoxim > Pyrocide > Zectran > Matacil > Sumithion > Dylox > Sevin 4 oil > Sevin ULV > Phosvel > Phosphamidon > GS 13005 > Gardona

## NEWFOUNDLAND

### Balsam Woolly Aphid - Adelges piceae (Ratz.)[2,14,20,22]

Insecticide testing was not carried out during the 1971 season. Studies on penetration of Baygon $C^{14}$ in potted balsam fir were carried out. There was some indication of slight movement of Baygon in flushing buds. Experiments are being repeated.

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## REFERENCES

(1) Nigam, P.C. 1966. Effect of formulation on the toxicity of insecticides. (Abstract). Proc. Entomol. Soc. Ont. (1966), 97: 125, 1967.

(2) Nigam, P.C. 1967. Chemical control trials against balsam woolly aphid in New Brunswick. Can. Dept. For. and Rural Dev. Internal Report CC-3, 19 p., March, 1967.

(3) Nigam, P.C. 1968. Laboratory screening of insecticidal compounds for comparative contact toxicity against sawflies and forest tent caterpillar. Can. Dept. For. and Rural Dev., Bi-mon. Res. Notes 24(1): 4-5.

(4) Nigam, P.C. 1968. Activity of insecticides of different chemical structure against sawflies. Proc. XIII Intern. Congr. Entomol., Moscow, 2: (In press).

(5) Nigam, P.C. 1969. Laboratory evaluation of twelve insecticides against adult ambrosia beetles. Can. Dept. Fish. and For., Bi-mon. Res. Notes 25(2): 11-12.

(6) Nigam, P.C. 1969. Wide-spectrum toxicity of Zectran against forest insect pests. (Abstract). Proc. Entomol. Soc. Ont. 100: 233-34, (Sept., 1970).

(7) Nigam, P.C. 1969. Laboratory evaluation of insecticides against fifth-instar spruce budworm larvae, Choristoneura fumiferana (Clem.) in 1968. Can. Dept. Fish. and For., Can. For. Serv., Information Report CC-X-1, 45 p., Sept., 1969.

(8) Nigam, P.C. 1969. Laboratory evaluation of insecticides against fifth-instar spruce budworm larvae, Choristoneura fumiferana (Clem.) in 1969. Can. Dept. Fish. and For., Can. For. Serv., Information Report CC-X-2, 35 p., Oct., 1969.

(9) Nigam, P.C. 1969. Summary of laboratory evaluation of insecticides against various species of forest insect pests--1969. Can. Dept. Fish. and For., Can. For. Serv., Information Report CC-X-3, 9 p., Nov., 1969.

(10) Nigam, P.C. 1970. Toxicity of insecticides against sawfly larvae. I. Contact toxicity of organophosphates and carbamates to Neodiprion pratti banksianae Roh., N. swainei Midd. and Pristiphora erichsonii Htg. J. Econ. Entomol. 63(2): 620-4.

(11) Nigam, P.C. 1970. Toxicity of insecticides to sixth-instar jack-pine budworm larvae under laboratory conditions. Can. Dept. Fish. and For., Bi-mon. Res. Notes 26(1): 2-3.

(12) Nigam, P.C. 1970. Contact, residual and systemic toxicity of 27 insecticides against spruce budworm.(Abstract). Proc. Entomol. Soc. Ont. 101: 86.

(13) Nigam, P.C. 1970. Laboratory evaluation of insecticides against fourth-instar European pine sawfly larvae, Neodiprion sertifer (Geoff.). Can. Dept. Fish. and For., Can. For. Serv., Information Report CC-X-4, 25 p., June, 1970.

(14) Nigam, P.C. 1970. Summary of laboratory evaluation of insecticides against forest insect pests during 1970. Can. Dept. Fish. and For., Can. For. Serv., Information Report CC-X-5, 10 p., Oct., 1970.

(15) Nigam, P.C. 1971. Comparative susceptibility of eastern and western hemlock loopers and green-striped forest looper to Zectran, fenitrothion and phosphamidon. Can. Dept. Fish. and For., Bi-mon. Res. Notes 27(2): 13.

(16) Nigam, P.C. 1971. Insecticide evaluation for aerial spraying against forest insect pests. Proc. Seventh Northeast Aerial Applicators Conf., Cornell University, Ithaca, New York, March 16-18, 1971, pp. 131-143.

(17) Nigam, P.C. 1971. Evaluation of fenitrothion against forest insect pests and other components of the forest ecosystem. Proc. Entomol. Soc. Ont. 102: (In press).

(18) Nigam, P.C. 1971. Comparative contact toxicity of insecticides against fourth-instar red headed pine sawfly larvae, Neodiprion lecontei (Fitch). Can. Dept. Fish. and For., Can. For. Serv., Information Report CC-X-7, April, 1971 (in press).

(19) Nigam, P.C. 1971. Further evaluation of insecticides against fourth-instar European pine sawfly larvae, Neodiprion sertifer (Geoff.). Can. Dept. Fish. and For., Can. For. Serv., Information Report CC-X-8, 32 p., May, 1971.

(20) Nigam, P.C., and R.C. Clark. 1969. Chemical control trials against the balsam woolly aphid in New Brunswick in 1968. Can. Dept. Fish. and For., Can. For. Serv., Internal Report CC-5, 24 p., March, 1969.

(21) Randall, A.P., and P.C. Nigam. 1966. Toxicity of phosphorous and carbamate insecticides to spruce budworm and two species of sawflies. Can. Dept. For., Bi-mon. Progr. Rep. 22(1): 3.

(22) Randall, A.P., W.W. Hopewell, and P.C. Nigam. 1967. Chemical control studies on the balsam woolly aphid Adelges piceae (Ratz.). Can. Dept. For. and Rural Dev., Bi-mon. Res. Notes 23(3): 18-19.

List of Insecticides

| No. | Insecticide | Type | Formulation | Source |
|---|---|---|---|---|
| 1 | Allethrin | Botanical derivative | 90% E.C. | McLaughlin, Gormley, King Co. |
| 2 | BHC | Chlorinated hydrocarbon | 10% E.C. | Green Cross |
| 3 | Bassa ® | Carbamate | 50% E.C. | Kumiai |
| 4 | Baygon ® | Carbamate | 13.9% E.C. | Chemagro |
| 5 | Chlordane | Chlorinated hydrocarbon | Tech. | Green Cross |
| 6 | Ciba 17974 | Carbamate | 40% E.C. | Ciba |
| 7 | Ciba 20132 | Carbamate | 40% E.C. | Green Cross |
| 8 | Cidial | Organo phosphorous | 50% E.C. | Green Cross |
| 9 | Cygon ® (dimethoate) | Organo phosphorous | 40% E.C. | American Cyanamid |
| 10 | DDT | Chlorinated hydrocarbon | 99% Tech. | Math. Col. & Bell |
| 11 | Diazinon ® | Organo phosphorous | 50% E.C. | Fisons |
| 12 | Dibrom R | Organo phosphorous | 91.9% Tech. | Chevron |
| 13 | DuPont 1642 | Carbamate | 99% Tech. | DuPont |
| 14 | Dursban ® | Organo phosphorous | 48% E.C. | Dow |
| 15 | Dylox R | Organo phosphorous | 39% E.C. | Chemagro |
| 16 | F 6957 (stabilized pyrethrins) | Botanical | 2.4% | McLaughlin, Gormley, King Co. |
| 17 | Fitios ® | Organo phosphorous | 20% E.C. | Bombrini |
| 18 | Furadan ® (NIA 10242) | Carbamate | 98% Tech. | Niagara Chemical |
| 19 | GS 13005 (Supracide) | Organo phosphorous | 40% E.C. | Geigy |

List of Insecticides (contd)

| No. | Insecticide | Type | Formulation | Source |
|---|---|---|---|---|
| 20 | Galecron® (C 8514) | Miscellaneous | 25% Oil | Green Cross |
| 21 | Gardona® (SD 8447) | Organo phosphorous | 99% Tech. | Shell |
| 22 | Hopcide® | Carbamate | 20% E.C. | Kumiai |
| 23 | Lindane | Chlorinated hydrocarbon | 99% Tech. | Green Cross |
| 24 | Matacil® (aminocarb) | Carbamate | 34% Sol.<br>75% W.P. | Chemagro |
| 25. | Methomyl (Lannate®) | Carbamate | 99% Tech. | DuPont |
| 26<br>26 | Methoxychlor | Chlorinated hydrocarbon | 88% Tech. | DuPont |
| 27 | Methyl Trithion® | Organo phosphorous | 80% Tech. | Stauffer |
| 28 | Monitor® | Organo phosphorous | 75% E.C. | Chevron |
| 29 | Phoxim (Bay 77488) | Organo phosphorous | 73% E.C. | Chemagro |
| 30 | Phosphamidon | Organo phosphorous | 90% W.M. | Ciba |
| 31 | Phosvel (VCS 506) | Organo phosphorous | 34.4% E.C. | Velsicol |
| 32 | Pyrix 20 | Botanical | 20% E.C. | Chemical Insecticide Corporation |
| 33 | Pyrocide 175 | Botanical | 20% E.C. | McLaughlin, Gormley, King Co. |
| 34 | Sevin® (Carbaryl) | Carbamate | 48.9% Oil<br>80% W.S.<br>12.7% Sol.<br>15.1% Sol. | Union Carbide |
| 35 | Sumithion® | Organo phosphorous | 20% E.C. | Sumitomo |
| 36 | Surecide® | Organo phosphorous | 25% E.C. | Sumitomo |
| 37 | Zectran | Carbamate | 92.0%(new) Tech.<br>93.3%(old) Tech. | Dow |