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CONTACT AND RESIDUAL TOXICITY OF  
CHIPMAN NRDC 143 AGAINST VARIOUS  
FOREST INSECT PESTS DURING 1975

By

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Chemical Control Research Institute  
Canadian Forestry Service  
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Confidential Report of Compounds obtained from  
Chipman Chemicals Limited

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CONTACT AND RESIDUAL TOXICITY OF CHIPMAN NRDC 143  
AGAINST VARIOUS FOREST INSECT PESTS DURING 1975

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INTRODUCTION ,

Pyrethroids are under study as alternate chemical compounds for the control of forest insect pests since the late sixties. Their residual toxicity was very short (6-8 hours), so they could not be used for large scale control operations. Chipman NRDC 143 possesses longer residual toxicity than the pyrethroids synthesized previously. This study was carried out in order to test its contact and residual toxicity against various forest insect pests.

METHODS AND MATERIALS

FIELD COLLECTED SPRUCE BUDWORM - *Choristoneura fumiferana* (Clemens)

Third and fourth instar larvae of spruce budworm were collected in the field from the Ottawa area. The larvae were kept in a cold room at 5°C and 70-80% R.H. until they were sorted for different instars. They were provided with young, tender buds of white spruce and balsam fir as food. The insects were kept in growth chambers maintained at 20-21°C, 70% R.H., and a photoperiod of 16 hours. Pupae were collected, sexed, and the date was marked daily. Male pupae were placed for approximately one day into a cold-room at the same temperature and R.H. as mentioned above for the larvae. The emergence of adults took place in a cage at room temperature (24°C) and

from which the moths were removed daily. Adults used in experiments were 24-48 hours old.

LABORATORY REARED SPRUCE BUDWORM -

Diapausing second instar spruce budworm larvae were received from Insect Pathology Research Institute, Sault Ste. Marie, Ontario. The larvae were kept first at room temperature of 24°C for 4-5 hours and were then placed inside an environmental chamber at 22°C, 70% R.H., and a 16 hour photoperiod for emergence from diapause. The larvae were transferred onto a synthetic diet and were reared inside the environmental chamber operating at the same settings as mentioned above.

JACK PINE SAWFLY - *Neodiprion pratti banksianae* Rohwer

Eggs were collected in the field from the Ottawa area and stored for a short while in the cold-room at 5°C and 70-80% R.H. They were later transferred into egg hatching plastic trays. The eggs were hatched at room temperature of 24°C, without any additional light source. The young larvae were fed their natural food, i.e. jack pine foliage and that was replenished as required. Test insects were obtained in the required instar from these rearing containers.

RED-HEADED PINE SAWFLY - *Neodiprion lecontei* (Fitch), was received from Quebec as 2nd to 4th instar larvae and was kept at 7°C and 70-80% R.H. for a few days and used in experiments as soon as possible. The insects were allowed to feed on red pine foliage at room temperature (24°C) every alternate day.

SWAINE JACK PINE SAWFLY - *Neodiprion swainei* Middleton, second to fourth instar larvae were received from Quebec and kept in an incubator at 7°C and

70-80% R.H. to be used in experiments as quickly as possible. The larvae were allowed to feed on jack pine foliage at room temperature (24°C) every alternate day.

LARCH SAWFLY - Pristiphora erichsonii (Hartig), eggs and young larvae were collected in the field from the Ottawa area. Twigs containing eggs were placed into hatching trays made of clear plastic in such a way that they stood in water after penetrating 1-1.5 cm thick plastic foam and held at room temperature (24°C) until they reached the 3rd instar. At this point, they were transferred to another rearing tray containing fresh foliage and no water. The larvae were allowed to feed until they reached the desired instar.

TREES - Four to five year old European larch, Larix decidua Mill., white spruce, Picea glauca (Moench) Voss; and jack pine, Pinus banksiana Lamb; of about 50-90 cm in height, were transplanted into pots from the Kemptville Forest Tree Nursery of the Ontario Ministry of Natural Resources. These trees were potted for at least two weeks prior to their use and only the trees that showed normal growth and condition were used in these studies. The foliage of red pine, Pinus resinosa Ait., was obtained in the field from the Ottawa area.

INSECTICIDES AND THEIR FORMULATIONS -

Chipman NRDC 143, 25% A.I. E.C.

Contact Toxicity: The E.C. formulation was diluted to various concentrations that ranged from 0.02% A.I. to 0.24% A.I. with AR 60 G (an aromatic solvent) containing 0.5% Dupont oil red dye.

Residual Toxicity: The E.C. formulation was diluted to 1% and 2% A.I. with pure Dowanol containing 0.1% Phodamin B dye. Insecticide solutions were stored in refrigerator after mixing.

INSECTICIDE TREATMENT -

Contact Toxicity: Five species of insects and their different stages were used in contact toxicity study. The insects were sprayed under a modified Potter's tower at different rates of application (0.1 to 1.0 GPA). A total of 30 insects per dose were used in three replications of 10 insects each. Spray deposits were determined from the deposit left on 9 cm diameter filter paper on which the CO<sub>2</sub> anaesthetized larvae were placed for spraying. The spruce budworm adults were sprayed in the same manner as the larvae. A total of 30 adults per dose were used in three replications of 10 moths each. Each replication had 5 male and 5 female moths approximately 24 to 48 hours old in age. The moths were anaesthetized with CO<sub>2</sub> and placed on filter paper for spraying in the tower. They were covered lightly with a  $\frac{1}{4}$  inch mesh wire screen in order to keep them in position inside the tower. The dosages were calculated from deposits on filter papers sprayed prior to spraying of adults. The treated adults were then transferred into transparent plastic cups (85 x 75 mm) for observations. The sprayed larvae were placed into waxed cardboard cups containing their natural food (depending on insect species, the foliage of white spruce, jack pine, red pine, and larch) in the form of fresh foliage. Both larvae and moths were held for observations in a growth chamber at 24°C, 75% R.H., and a photoperiod of 16 hours. The details of larvae and adults used in the study are as follows:

Spruce budworm, field collected, adult and laboratory reared  
5th instar larvae; jack pine sawfly, 4th and 5th instar larvae;

redheaded pine sawfly, 4th instar larvae; Swaine jack pine sawfly, 4th and 5th instar larvae; and larch sawfly, 4th and 5th instar larvae.

Residual Toxicity: The trees were sprayed and placed outside for weathering of residues. The bioassay of residues was done recently after treatment (approximately  $4 \pm 2$  hours) for 0 days, then at 1, 3, 5, and 10 days after treatment. Two trees for each concentration of insecticide and for each weathering period were treated. The insecticides were applied to the potted trees in a spray tower that was calibrated to deliver a volume of spray that was equivalent to one gallon per acre. The 1% A.I. solution was applied to jack pine against the jack pine sawfly, and the 2% A.I. solution was sprayed onto the white spruce against the spruce budworm.

OBSERVATIONS -

Contact Toxicity: Mortality counts of the treated insects were taken at 24, 48, and 72 hours and corrected for check or control mortality according to Abbott's formula.

Residual Toxicity: The treated and control jack pine and white spruce trees, after each weathering period, were carried inside the greenhouse for bioassay of residues. Thirty larvae were released on two branches of each tree. Fifteen larvae per branch were confined by means of nylon-mesh sleeves. Fourth instar jack pine sawfly and 5th instar spruce budworm larvae collected from field were used on jack pine and white spruce trees respectively. Observations were taken at 24, 48, and 72 hours after insect addition and number of dead and living insects and their respective instars were recorded.

## RESULTS

The results of contact and residual toxicity study of Chipman NRDC 143 are presented in Table 1 to 13 and Table 14 and 15 summarises three years data of aminocarb and fenitrothion residual toxicity for comparative study.

Contact Toxicity: Chipman NRDC 143 was tested against spruce budworm adult and four species of sawflies (Table 1-11). It appears to be quite effective against adult spruce budworm although control mortality was substantially high after 48 hours. It is highly toxic to all species of sawflies.

Residual Toxicity: Chipman NRDC 143 was sprayed at 1% and 2% concentrations at the rate of 1 gallon per acre, i.e. 1.6 and 3.2 oz active ingredient per acre in order to study residual toxicity against jack-pine sawfly and spruce budworm respectively. The toxicity data of NRDC 143 was compared with Matacil<sup>®</sup> (1.6 oz A.I./acre) and fenitrothion (3.2 oz A.I./acre) residual toxicity data against jack-pine sawfly (4th instar) and spruce budworm (5th instar) respectively. Data on residual toxicity of Matacil<sup>®</sup> at 1.6 oz A.I./acre against jack-pine sawfly is developed for the last three years (Table 14) and data on residual toxicity of fenitrothion at 3.2 oz A.I./acre was developed against spruce budworm over the last three years (Table 15). The average mortality from this data of Matacil and fenitrothion are being used as a standard to compare the residual toxicity of new candidate insecticide as these two materials are being used in large scale field operations.

It is clear from Table 12 that NRDC 143 has afforded 100% protection up to 10 days against the 4th instar jack-pine sawfly at 1.6 oz/acre active ingredient, while Matacil afforded 100% protection up to 3 days only (at

the same dosage level) Table 14. The residual toxicity of NRDC 143 at this dose level is approximately three times that of Matacil against 4th instar jack-pine sawfly larvae.

The residual toxicity of NRDC 143 against spruce budworm larvae on white spruce trees has given 100% protection up to 10 days at 3.2 oz A.I./acre (Table 13). Fenitrothion at the same dosage level could not afford 100% protection even 4 hours after application (Table 15). The residual toxicity of NRDC 143 against spruce budworm at this dosage level appears to be at least 10 times better than fenitrothion.

It is clear from the data developed on residual toxicity that Chipman NRDC 143 formulation can be used at lower rates than fenitrothion and Matacil and probably, at comparable rates of application, it will afford longer protection and a second field application as in the case of fenitrothion and Matacil, may be avoided. However, pyrethroids in general are hard on fish; a thorough study of fish toxicity is a must before its recommendation for field evaluation. There is no information available on the fish toxicity of formulation of NRDC 143 prepared by Chipman. It will be helpful in making a final decision for large scale aerial evaluations if this information is provided by the company.

In the meantime, the Insect Toxicology Section will try to contact the co-operative agencies at Biological Research Station, St. Andrews and Fresh Water Research Institute at Winnipeg for an evaluation of the toxicity of this formulation against Atlantic salmon and trout, respectively.

#### ACKNOWLEDGEMENT

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TABLE 1

CORRECTED PERCENTAGE MORTALITY

Experiment Number SBA-12

Date Sprayed 8-7-75

Insecticide NRDC-143

Concentration 0.2%

GPA	Dosage µg/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
-1	.0097	13/30	43	34	18/30	60	51	21/30	70	59
-2	.0221	18/30	60	54	18/30	60	51	21/30	70	59
-4	.0437	16/31	52	45	19/31	61	52	19/31	61	47
-6	.0749	21/30	70	66	26/30	87	84	27/30	90	86
-8	.1019	13/30	43	34	17/30	57	47	25/30	83	77
1-0	.1381	13/30	43	34	22/30	73	67	27/30	90	86
		/			/			/		
		/			/			/		
		/			/			/		
		/			/			/		
CONTROL (C)		4/31	13		6/31	19		8/31	26	

REMARKS:  
Chk'd for  
computer analysis

(1) (2)

SBA = Spruce bud worm adult  
(From field collected material)

Note: Corr. % Mort.  
=  $\frac{I-C}{100-C} \times 100$   
(Abbott's Formula)

TABLE 2

CORRECTED PERCENTAGE MORTALITY

Experiment Number SJS-108

Date Sprayed 7-8-75

Insecticide NRDC-143 Chipman

Concentration 0.05%

GPA	Dosage µg/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
-1	0.0051	1/30	3	0	4/30	13	6	4/30	13	6
-2	0.01	3/30	10	7	7/30	23	17	9/30	30	25
-4	0.0278	14/30	47	45	15/30	50	46	18/30	60	57
-6	0.0305	14/30	47	45	14/30	47	43	14/30	47	43
-8	0.0374	15/30	50	48	19/30	63	60	19/30	63	60
1-0	0.0495	21/30	70	69	23/30	77	75	25/30	83	82
		/			/			/		
		/			/			/		
		/			/			/		
		/			/			/		
CONTROL (C)		1/30	3		2/30	7		2/30	7	

REMARKS:  
 Chk'd for  
 computer analysis

(1) (2)

SJS = Swaine Jack-pine Sawfly  
 IV Instar

Note: Corr. % Mort.  

$$= \frac{I-C}{100-C} \times 100$$
 (Abbott's Formula)

TABLE 3

CORRECTED PERCENTAGE MORTALITY

Experiment Number RPS=120

Date Sprayed 14-7-75

Insecticide NRDC-143 Chipman

Concentration 0.08%

GPA	Dosage µg/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
.1	10064	4/30	13	10	/			9/30	27	16
.2	10133	7/30	23	21	/			17/30	57	51
.4	10244	21/30	70	69	/			27/30	90	89
.6	10401	27/30	90	90	/			30/30	100	100
.8	10538	30/30	100	100	/			30/30	100	100
1.0	10673	28/30	93	93	/			30/30	100	100
		/			/			/		
		/			/			/		
		/			/			/		
		/			/			/		
CONTROL (C)		1/30	3		/			4/30	13	

REMARKS:  
Chk'd for  
computer analysis

(1) (2)

RPS = Red-headed pine saw fly  
IV instar

Note: Corr. % Mort.  
=  $\frac{I-C}{100-C} \times 100$   
(Abbott's Formula)

TABLE 4

CORRECTED PERCENTAGE MORTALITY

Experiment Number RPS-126

Date Sprayed 24-7-75

Insecticide MRDC-143 chymom

Concentration 0.05%

GPA	Dosage µg/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
.1	.0042	3/29	10		9/29	31		10/29	34	
.2	.0076	4/30	13		8/30	27		9/30	30	
.4	.0162	3/30	10		4/30	13		7/30	23	
.6	.028	15/30	50		20/30	67		23/30	77	
.8	.0359	18/30	60		19/30	63		20/30	67	
1.0	.0503	21/30	70		21/30	70		24/30	80	
		/			/			/		
		/			/			/		
		/			/			/		
		/			/			/		
CONTROL (C)		0/30	0		0/30	0		0/30	0	

REMARKS:

Chk'd for  
computer analysis

(1) (2)

RPS = Red-headed pine sawfly  
TV instar

Note: Corr. % Mort.  
=  $\frac{I-C}{100-C} \times 100$   
(Abbott's Formula)

TABLE 5

CORRECTED PERCENTAGE MORTALITY

Experiment Number LSQ-161

Date Sprayed 9-7-75

Insecticide NRDC-143 chymum

Concentration 0.08%

GPA	Dosage µg/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
.1	.0095	0/30	0		0/30	0		0/30	0	
.2	.0131	0/30	0		1/30	3		3/30	10	
.4	.0226	9/30	30		10/30	33		11/30	37	
.6	.0344	24/30	80		25/30	83		25/30	83	
.8	.0476	21/30	70		21/30	70		21/30	70	
1.0	.0631	26/31	84		27/31	87		28/31	90	
		/			/			/		
		/			/			/		
		/			/			/		
		/			/			/		
CONTROL (C)		0/30	0		0/30	0		0/30	0	

REMARKS:

Chk'd for  
computer analysis

(1)

(2)

LSQ = Larch saw fly V instar

Note: Corr. % Mort.

$$= \frac{I-C}{100-C} \times 100$$

(Abbott's Formula)

TABLE 6

CORRECTED PERCENTAGE MORTALITY

Experiment Number LSQ-176

Date Sprayed 14-7-75

Insecticide NRDC-143

Concentration 0.08%

GPA	Dosage µg/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
•1	.0091	1/30	3	0	3/30	10	3	3/30	10	3
•2	.0148	2/30	7	4	2/30	7	0	3/30	10	3
•4	.0292	3/30	10	7	3/30	10	3	3/30	10	3
•6	.0425	6/30	20	18	8/30	27	22	9/30	30	25
•8	.0543	17/30	57	56	20/30	67	65	20/30	67	65
1.0	.0746	26/30	87	87	26/30	87	86	27/30	90	89
		/			/			/		
		/			/			/		
		/			/			/		
		/			/			/		
CONTROL (C)		1/30	3		2/30	7		2/30	7	

REMARKS:

Chk'd for  
computer analysis

(1) (2)

LSQ = Larch saw fly *†* instar

Note: Corr. % Mort.

$$= \frac{I-C}{100-C} \times 100$$

(Abbott's Formula)

TABLE 7

CORRECTED PERCENTAGE MORTALITY

Experiment Number LSQ-189

Date Sprayed 21-7-75

Insecticide NRDC-143 Chlormequat

Concentration 0.08%

GPA	Dosage µg/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
.1	.0084	1/30	3	0	1/30	3	0	2/30	7	0
.2	.0133	0/30	0	0	2/30	7	0	6/30	20	11
.4	.0266	0/30	0	0	0/30	0	0	2/30	7	0
.6	.0419	22/30	73	72	23/30	77	75	26/30	87	86
.8	.0543	24/30	80	79	25/30	83	82	27/30	90	89
1.0	.0789	18/30	60	59	20/30	67	65	21/30	70	67
		/			/			/		
		/			/			/		
		/			/			/		
		/			/			/		
CONTROL (C)		1/30	3		2/30	7		3/30	10	

REMARKS:

Chk'd for  
computer analysis

(1) (2)

LSQ = Larch saw fly ♀ instar

Note: Corr. % Mort.

$$= \frac{I-C}{100-C} \times 100$$

(Abbott's Formula)



TABLE 8

CORRECTED PERCENTAGE MORTALITY

Experiment Number LSF-153

Date Sprayed 7-7-75

Insecticide NRDC-143 chipman

Concentration 0.04 %

GPA	Dosage ug/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
.1	10033	0/30	0		0/30	0		0/30	0	
.2	10062	1/30	3		1/30	3		2/30	7	
.4	10121	1/30	3		2/30	7		4/30	13	
.6	10176	13/30	43		14/30	47		17/30	57	
.8	10272	25/30	83		27/30	90		27/30	90	
1.0	10373	30/30	100		30/30	100		30/30	100	
		/			/			/		
		/			/			/		
		/			/			/		
		/			/			/		
CONTROL (C)		0/30	0		0/30	0		0/30	0	

REMARKS:

Chk'd for  
computer analysis

(1) (2)

LSF = Larch saw fly IV instar

Note: Corr. % Mort.

$$= \frac{I-C}{100-C} \times 100$$

(Abbott's Formula)

TABLE 9

CORRECTED PERCENTAGE MORTALITY

Experiment Number JPS-144

Date Sprayed 14-6-75

Insecticide NRDC-143 chymotrypsin

Concentration 0.06%

GPA	Dosage µg/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
·1	·0039	0/29	0		4/29	14	11	4/29	14	8
·2	·0088	2/31	7		4/31	13	10	4/31	13	6
·4	·0165	9/30	30		15/30	50	48	15/30	50	46
·6	·0267	19/30	63		25/30	83	82	25/30	83	82
·8	·038	16/29	53		19/29	63	62	19/29	63	61
1·0	·0476	20/30	69		25/30	83	82	25/30	83	82
		/			/			/		
		/			/			/		
		/			/			/		
		/			/			/		
CONTROL (C)		0/30	0		1/30	3		2/30	7	

REMARKS:

Chk'd for  
computer analysis

(1) (2)

JPS = Jack-pine Saw Fly

Note: Corr. % Mort.  
=  $\frac{I-C}{100-C} \times 100$   
(Abbott's Formula)

TABLE 10

CORRECTED PERCENTAGE MORTALITY

Experiment Number JPS-162

Date Sprayed 23-6-75

Insecticide VRDC-143 chymecan

Concentration 0.1%

GPA	Dosage µg/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
.1	.005	4/30	13	6	6/30	20	0	9/30	30	0
.2	.0141	21/30	70	68	23/30	77	70	24/30	80	70
.4	.0249	23/30	77	75	27/30	90	87	27/30	90	85
.6	.0463	29/30	97	97	29/30	97	96	29/30	97	96
.8	.0637	30/30	100	100	30/30		100			100
1.0	.082	30/30	100	100	30/30		100			100
CONTROL (C)		2/30	7		7/30	23		10/30	33	

REMARKS:

Chk'd for  
computer analysis

(1) (2)

JPS = Jack-pine Saw Fly  
TV instar

Note: Corr. % Mort.

$$= \frac{I-C}{100-C} \times 100$$

(Abbott's Formula)

TABLE 11

CORRECTED PERCENTAGE MORTALITY

Experiment Number JPX-6

Date Sprayed 26-6-75

Insecticide NRDC-143

Concentration 0.1%

GPA	Dosage µg/cm <sup>2</sup>	24 HOURS			48 HOURS			72 HOURS		
		Dead/ Total	% Mort. (T)	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.	Dead/ Total	% Mort.	Corr. % Mort.
1	.0084	0/30	0		0/30	0		2/30	7	
2	.0172	8/30	27		10/30	33		13/30	43	
4	.0243	19/32	59		21/32	66		25/32	78	
6	.0385	19/30	63		25/30	83		27/30	90	
8	.0525	30/30	100		30/30	100			100	
10	.0692	28/30	93		30/30	100			100	
		/			/			/		
		/			/			/		
		/			/			/		
		/			/			/		
CONTROL (C)		0/30	0		0/30	0		0/30	0	

REMARKS:  
Chk'd for  
computer analysis

(1) (2)

JPX = Jack-pine Saw fly  
U instar

Note: Corr. % Mort.  
=  $\frac{I-C}{100-C} \times 100$   
(Abbott's Formula)

TABLE 12 ( 1975 ) RESIDUAL TOXICITY OF *Chipman NRDC 143* TO 4<sup>th</sup> INSTAR *JACK PINE SAWFLY*

CORRECTED PERCENTAGE MORTALITY AFTER 24, 48, AND 72 HOURS EXPOSURE TO TREATED *JACK PINE*..... FOLIAGE

INSECTS RELEASED  
INDICATED NUMBER  
OF DAYS AFTER  
SPRAY \*

	24	48	72
0 (3 ± 1 hr)	100.0	100.0	100.0
1	100.0	100.0	100.0
3	98.3	100.0	100.0
5	81.1	91.3	100.0
10	72.7	88.0	100.0

\* Trees sprayed at the rate of 1 gallon per acre. The insecticide solution(s) had 1 % of active ingredient.

\*\*

CONTROL MORTALITY: 0.0% to 18.6 %

NUMBER OF TREES USED: 10 + 10 FOR CONTROL

NUMBER OF INSECTS USED: 300 + 300 FOR CONTROL

WEATHER DATA FOR 10 DAY TEST PERIOD

	Average or Total
Temperature.....	68°F ..... 20.4 °C
Dew Point.....	57°F ..... 13.9 °C
Rain.....	0.36 in ..... 9.1 mm
Sunshine.....	88.8 hr

TABLE 13 ( 1975 ) RESIDUAL TOXICITY OF *Chipman NRDC 143* TO 5<sup>th</sup> INSTAR *Spruce Budworm*.

CORRECTED PERCENTAGE MORTALITY AFTER 24, 48, AND 72 HOURS EXPOSURE TO TREATED *White Spruce* FOLIAGE

INSECTS RELEASED  
INDICATED NUMBER  
OF DAYS AFTER  
SPRAY \*

	24	48	72
0 ( 3±1 hr)	81.7	100.0	100.0
1	100.0	100.0	100.0
3	100.0	100.0	100.0
5	39.0	83.4	98.1
10	40.0	84.6	100.0

\* Trees sprayed at the rate of 1 gallon per acre. The insecticide solution(s) had 2 % of active ingredient.

\*\*

CONTROL MORTALITY: 0.0% to 26.7%

NUMBER OF TREES USED: 10 + 10 CONTROL

NUMBER OF INSECTS USED: 300 + 300 FOR CONTROL

WEATHER DATA FOR 10 DAY TEST PERIOD	Average or Total
Temperature.....	68°F..... 20.4°C.....
Dew Point.....	57°F..... 13.9°C.....
Rain.....	0.36 in..... 9.1 mm.....
Sunshine.....	88.8 hr.....

DURING...1970, 1972, 1974.....

Year	Insect Species	Tree Species (Host)	Conc. of Insec. %	Rate of Applicat GPA	Days after Treatment	Corrected Percentage Mortality (hours after insect addition)			Weather Data for Test Period Aver. or Total
						24 HR	48 HR	72 HR	
1970	Jack Pine Sawfly iv <sup>th</sup> Instar	Jack Pine	1	1	0 (4±2 hr)	100.0	100.0	100.0	Temp. 65°F 18.3°C
					1	100.0	100.0	100.0	D.Pt. 50°F 10.0°C
					3	100.0	100.0	100.0	Rain .09" 2.3 mm
					5	6.8	33.3	50.0	Sun 108.6 hr
					10	0.0	3.4	13.9	
1972	Jack Pine Sawfly	Jack Pine	1	1	0 (4±2 hr)	100.0	100.0	100.0	Temp. 61°F 16.1°C
					1	100.0	100.0	100.0	D.Pt. 47°F 8.3°C
					3	98.2	100.0	100.0	Rain .97" 24.6 mm
					5	16.1	80.4	92.6	Sun 69.7 hr
					10	0.0	5.5	23.3	
1974	Jack Pine Sawfly	Jack Pine	1	1	0 (4±2 hr)	85.0	100.0	100.0	Temp. 57°F 13.9°C
					1	100.0	100.0	100.0	D.Pt. 47°F 8.3°C
					3	76.3	100.0	100.0	Rain .96" 24.4 mm
					5	1.7	15.0	36.8	Sun 54.4 hr
					10	15.5	41.2	60.8	
1970-72-74 Jack Pine Sawfly Jack Pine						AVERAGE MORTALITY			
			1	1	0 (4±2 hr)	95.0	100.0	100.0	
					1	100.0	100.0	100.0	
					3	91.5	100.0	100.0	
					5	8.2	42.9	59.8	
					10	5.2	16.7	32.7	
TREES SPRAYED AT 1.6 oz active ingredient per acre.									