EXPERIMENTS IN PREVENTIVE TREATMENT OF DOUGLAS FIR AGAINST ATTACK BY THE AMBROSIA BEETLE *(TRYPODENDRON LINEATUM)* (OLIV.) USING BENZENE HEXACHLORIDE METHYL TRITHION AND OTHER INSECTICIDES

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Experiments in Preventive Treatment of Douglas fir against attack by the Ambrosia Beetle, *Trypodendron lineatum* (Oliv.), using Benzene Hexachloride, Methyl Trithion and other Insecticides

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Introduction

The ambrosia beetle, *Trydodendron lineatum* (Oliv.) causes considerable loss to the softwood industry of coastal British Columbia.

In recent years, studies have been conducted on the nature and extent of damage and on methods of preventing loss. McBride and Kinghorn (1960) showed that degrade lumber is the most important of several types of damage caused by the ambrosia beetle. Dyer and Chapman (1965), in a study to determine relationship between time of felling of trees and attractiveness to the ambrosia beetle, showed that trees felled in the fall and early winter are preferred by the beetle. Loss can be reduced by keeping low inventories of logs felled during this period. Kinghorn (1956) has shown that BHC can be used with success as a preventive treatment. However, since this insecticide is toxic to young fish, it is necessary to find one not harmful to fish for use on log booms in water. Methyl Trithion, less toxic to fish, has been used with success against the ambrosia beetle (Richmond 1969). The current study was conducted to compare the effectiveness of Methyl Trithion 4E[1] with that of BHC .84E Gamma Isomer[2] as a preventive treatment. Zectran[3], Matacil[4], Lannate[5] and C 9491[6], which have shown promise, were tried on a preliminary basis.

Methods and Materials

The study was conducted at Cowichan Lake, B.C. Ten Douglas-fir Pseudotsuga menziesii (Mirb.) Franco trees were felled on 11 December 1968. The trees, lettered A to J, were cut into four-foot sections and numbered 1 to 12 from the butt upward.

In April 1969, sections were raised from the ground and placed in pairs 30 inches apart (Fig. 1). From the butt, all odd-numbered sections were placed on the right and even numbered on the left.

The main objective of the study was to compare the effectiveness of the emulsifiable concentrate of Methyl Trithion with that of BHC against the ambrosia beetle Trypodendron lineatum. A secondary objective

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1/ Methyl Trithion
S - [[(p - chlorophenyl) thio] methyl] O, O - dimethyl phosphorodithioate
$C_9 H_{12} ClO_2 PS_4$

2/ Benzene Hexachloride
1, 2, 3, 4, 5, 6, - Hexachlorocylohexane
$C_6 H_6 Cl_6$

3/ Zectran
4 - dimethylamino - 3, 5 - xylyl N - methylcarbamate
$C_{12} H_{18} N_2 O_2$

4/ Matacil
4 - dimethyl - amino - 3 - methylphenyl N - methylcarbamate
$C_{11} H_{16} N_2 O_2$

5/ Lannate (Experimental product)
methyl O - (methylcarbamyl) thiolacetohydroxamate

6/ C - 9491 (Experimental product)
O, O - dimethyl - O - 2, 5 - dichloro - 4 - iodophenyl phosphate
$C_8 H_8 O_3 Cl_2 IPS$

was to obtain preliminary comparative data on the effectiveness of solutions of Zectran, Matacil, Lannate and C 9491 with that of oil solutions of BHC and MT.

All insecticides were prepared at a concentration of 0.05% active ingredient and applied with a 2-gallon compression-type garden sprayer. Odd-numbered sections were sprayed to wetting; even numbered were left untreated. Oil solutions were mixed in acetone; Zectran and Matacil were first dissolved in dimethyl sulfoxide. The emulsifiable concentrates and wettable powder (Lannate) were mixed in water.

On 29 April, trees A, B and C were sprayed with Methyl Trithion emulsion and tree D with BHC emulsion. Other treatments applied the same day are listed in Table 1.

Table 1

Spray Schedule Preventive Treatment Against

Attack by *T. lineatum*, Cowichan Lake, B. C. 1969

Date of Application	Insecticide	Formulation	Tree	No. of Sections Treated
April 29	Methyl Trithion	e.c.	A	6
	Methyl Trithion	e.c.	B	6
	Methyl Trithion	e.c.	C	6
	BHC	e.c.	D	6
	Methyl Trithion	oil	J	4
	BHC	oil	I	4
	Zectran	oil	G	4
	Matacil	oil	H	4
	Lannate	w.p.	G&H	4
May 8	Methyl Trithion	e.c.	B	6
	Methyl Trithion	e.c.	C	6
	Methyl Trithion	e.c.	E	6
	Methyl Trithion	e.c.	F	6
	Methyl Trithion	oil	I	4
	C 9491	e.c.	J	4

Immediately after spraying, an 18 x 18-inch cloth tray was suspended below each treated and check section (Fig. 2). Beetles were collected regularly from these trays for comparative data on knockdown effect of different treatments. They were classified as dead, moribund or living.

On 8 May, a second treatment, identical to the first, was applied to trees B and C. Trees E and F, previously enclosed in polyethylene sleeves to prevent beetle attack prior to treatment, were sprayed with Methyl Trithion e.c. Trees C and F were scheduled for another treatment about 22 May, but this was cancelled because beetle flight was continuous and ended early.

On 6, 7 and 8 May, during periods of maximum temperature, beetle activity counts were made on all sections. Each was examined for one minute and the number of beetles stationary, walking, landing, leaving, mating or boring was recorded.

On 12 and 13 May, about 2 weeks after the initial beetle attack, counts were made of boring dust piles on 4 half-square-foot sample areas on each section.

In June, when beetle flight was essentially over, a one-foot piece was cut 6 inches from the butt end of each section and the bark removed; all entry holes were tallied and a few galleries were excavated to determine total length.

Results

Beetles commenced flying on 5 May, and because of warm weather flight was continuous and heavy.

Flight traps were cleared daily from 6 to 12 May. Trays were cleared during the same period and indicated a flight pattern (Fig. 3) similar to that shown by flight traps (Fig. 4). Activity counts, made on 6, 7 and 8 May, showed that beetles were active on all sections. Maximum flight occurred on 6 May (Fig. 4), followed by about a week of reduced, but fairly high-level activity, after which it subsided.

Boring dust counts, made on 12 and 13 May, showed attack to be uniformly heavy on all logs, averaging 21 attacks per square foot (Fig. 5). At most holes active boring was indicated by fresh piles of white sapwood dust. At a few entry holes, brown bark dust indicated either fresh attacks or that beetles had died shortly after entering. The dust counts indicated that logs were attacked equally in early stages of beetle flight, with little variation between different treatments and check logs (Table 2). However, the numbers of beetles taken from trays below treated sections of D (BHC e.c. treatment) were much larger and continued for a much longer period than those from trays at other treatments or check sections. Subsequent examinations of beetle catches showed that most were males (Fig. 3). Apparently BHC was sufficiently more toxic than MT that males were knocked down into trays before being able to locate and enter galleries. Because of this, females remained unpaired in galleries and secondary attraction remained high (Nijholt 1970). Males were continually attracted to these sections and tray catches remained high until successful pairings were accomplished and log attractiveness subsided. For data on dead beetles collected from the trays beneath all Methyl Trithion treated sections and the effectiveness of this treatment in relation to those sections treated with BHC, see Appendix.

Examination of barked one-foot sections showed infestations to be higher than when dust counts were made. Counts on A, B, C and D on 12, 13 May, indicated average attack density of 22 per sq ft (treated) and 20 per sq ft (untreated). Final counts on barked logs (Table 3) were 53 per sq ft (treated) and 47 per sq ft (untreated). Much of the difference between early and late counts was probably due to continued beetle attack; some was undoubtedly due to difficulty in making precise counts from dust piles. Excavations showed no appreciable difference in gallery length between treatments and check logs.

Table 2

Average No. of Attacks per sq ft* on Treated and Untreated Sections Based on Dust Counts, Cowichan Lake, 12-13 May 1969

	Tree Number and Treatment						
	A MT e.c.	B MT e.c.	C MT e.c.	D BHC e.c.	E MT e.c.	F MT e.c.	Average
Treated	29.33	22.58	9.41	27.83	14.09	20.08	22.22
Untreated	24.33	23.00	19.58	26.08	14.00	16.33	20.55

* Averaged on 12 sq ft per category

Table 3

Average No. of Holes per sq ft* on Treated and Untreated 1-ft Sections, Cowichan Lake, June 1969

	Tree Number and Treatment						
	A	B	C	D	E	F	
	MT e.c.	MT e.c.	MT e.c.	BHC e.c.	MT e.c.	MT e.c.	Average
Treated	55.6	50.1	54.6	63.7	35.8	60.7	53.41
Untreated	46.4	51.5	52.8	53.2	39.1	39.2	47.03

* Averaged on actual sq ft per piece

Discussion and Conclusions

The main object of this study was to determine the relative effectiveness of Methyl Trithion and Benzene Hexachloride in protecting Douglas-fir logs against attack by Trypodendron. At the rates of application used, BHC was considerably more effective as it appreciably delayed the rate of attack. Had both materials been applied at correspondingly slightly heavier rates, BHC would probably have given control and MT would perhaps have given results similar to those obtained from BHC in this experiment. MT must be applied at a rate greater than that of BHC before comparable results can be expected. Although results of this type of experiment are not directly applicable to use on log booms in water, they provide information on comparative effectiveness of insecticides and a good basis from which to determine log-boom spray schedules.

Zectran, Matacil, Lannate and C 9491 were not effective.

Based on the results of this experiment, we make the following recommendations as guidance in further studies:

1. Use BHC emulsifiable concentrate as a base from which to compare effectiveness of other insecticides. Apply at 0.05% active ingredient and spray to dripping.

2. Use MT emulsifiable concentrate. Apply at 0.075% active ingredient and spray to dripping. Vary range of application dates for information on duration of effectiveness.

3. If used, Zectran, Matacil, Lannate and C 9491 should be applied at the same concentration as MT.

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Literature Cited

1. Dyer, E.D.A. and J.A. Chapman. 1965. Flight attack of the ambrosia beetle, *Trypodendron lineatum* (Oliv.) in relation to felling date of logs. Can. Ent. (1): 42-57.

2. Kinghorn, J.M. 1956. Preventive treatment of Douglas-fir and western hemlock logs against attack by the lined ambrosia beetle *Trypodendron lineatum* (Oliv.). Interim Rept. 1954-5. Forest Biology Lab., Victoria, B. C.

3. McBride, C.F. and J.M. Kinghorn. 1960. Lumber degrade caused by ambrosia beetles. B. C. Lumberman 44(7): 40-52.

4. Nijholt, W.W. 1970. The effect of mating and the presence of the male ambrosia beetle *Trypodendron lineatum* (Oliv.) on "secondary" attraction. Can. Ent. In press.

5. Richmond, H.A. 1969. A new chemical for the protection of logs from ambrosia beetle attack. Report to Council of Forest Industries of British Columbia.

APPENDIX

No. of Dead[1/] *T. lineatum* Adults Collected from Catch Trays Under Treated and Untreated Sections. Caycuse Creek. 1969.

Tree No.	A		B		C		D		E		F	
Treatment sections	MTec		MTec		MTec		BHCec		MTec		MTec	
Collection Date	T	UT	T	UT	T	UT	T	UT	T	UT	T	UT
May 6	3	2	2	1	1	1	14	0				
7	9	1	15	2	6	1	56	0				
8[2/]	19	9	15	4	19	1	158	7				
9	34	16	137	8	207	2	251	5	1	0	7	0
10	16	10	59	8	60	4	108	6	5	0	18	0
12	22	11	46	14	47	3	235	18	29	2	28	17
13	25	10	28	11	5	0	59	9	28	6	20	11
15	11	4	14	5	12	1	69	4	15	0	27	8
20	2	1	11	1	8	1	82	0	8	7	6	5
26	0	0	2	1	8	2	50	1	3	1	4	2
June 2	5	4	7	4	15	4	64	0	10	4	5	4

Comparative Effectiveness of MT and BHC[3/]. Treated Sections only

% Effective[4/]

Collection Date	A	B	C	D	E
May 6	21	14	7		
7	16	27	11		
8	12	9	12		
9	13	54	82	0	3
10	15	55	55	5	17
12	9	19	20	12	12
13	42	47	8	47	34
15	16	20	17	22	39
20	2	13	10	10	7
26	0	4	16	6	8
June 2	8	11	23	16	8

1/ Includes moribund

2/ Date of second application to A, B, and C and first application to E and F

3/ BHC considered to be 100% effective

4/ $\frac{\text{No. adults killed by MT}}{\text{No. adults killed by BHC}}$ X 100 = % effective

Fig. 1 Log sections raised from ground in pairs with cloth trays in place.

Fig. 2 Pair of log sections and trays.

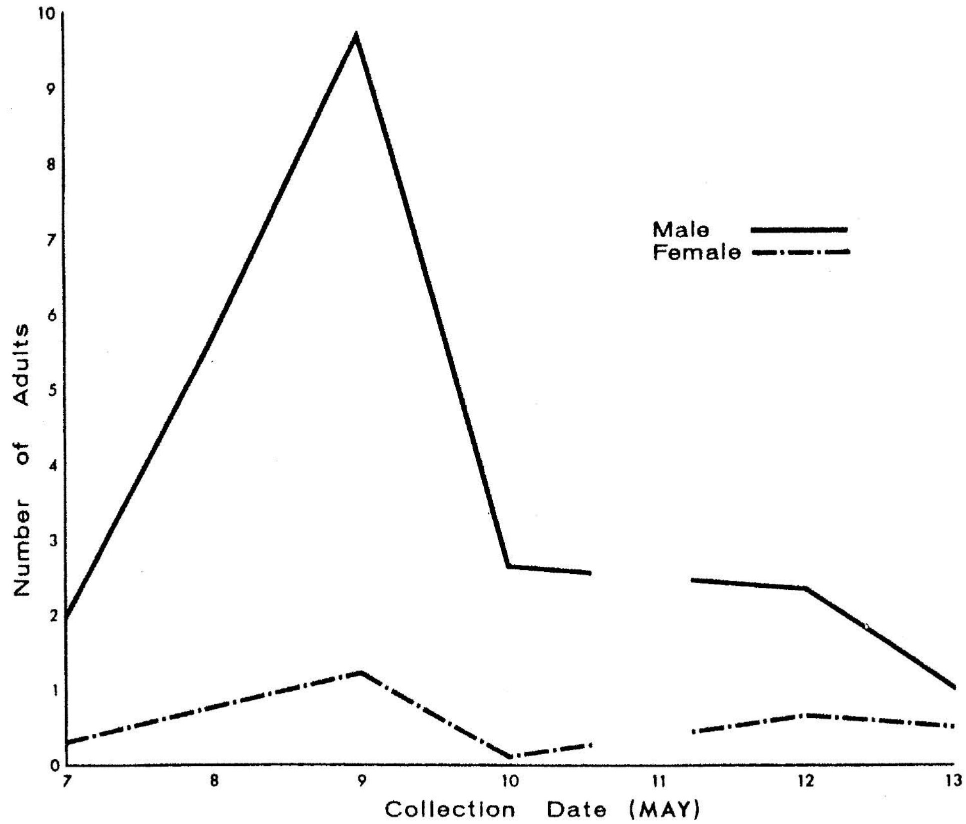

Fig. 3 Graph showing average number of beetles taken per trap per day.

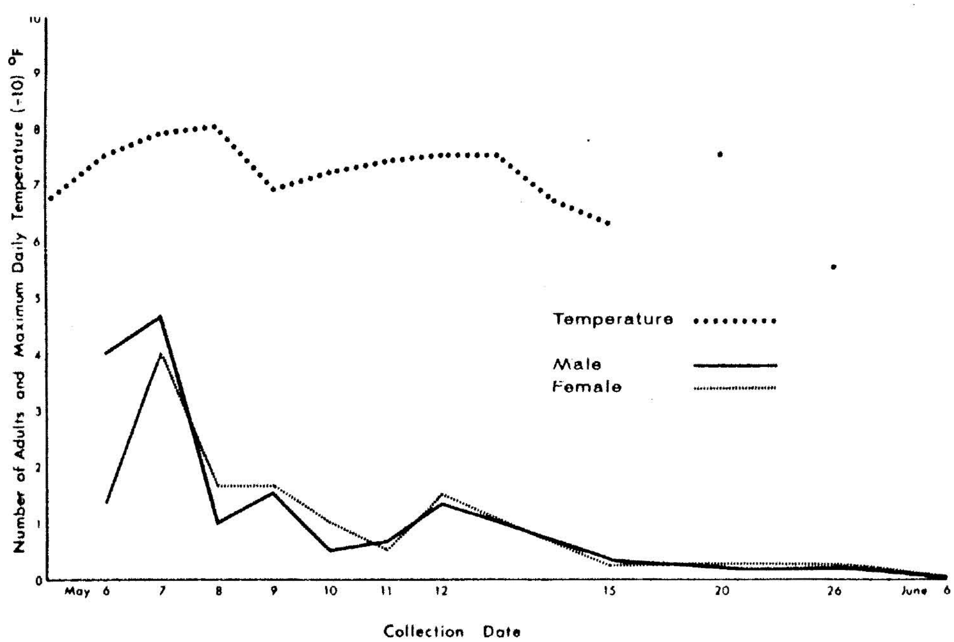

Fig. 4 Graph showing average number of beetles collected daily in trays, and daily temperature.

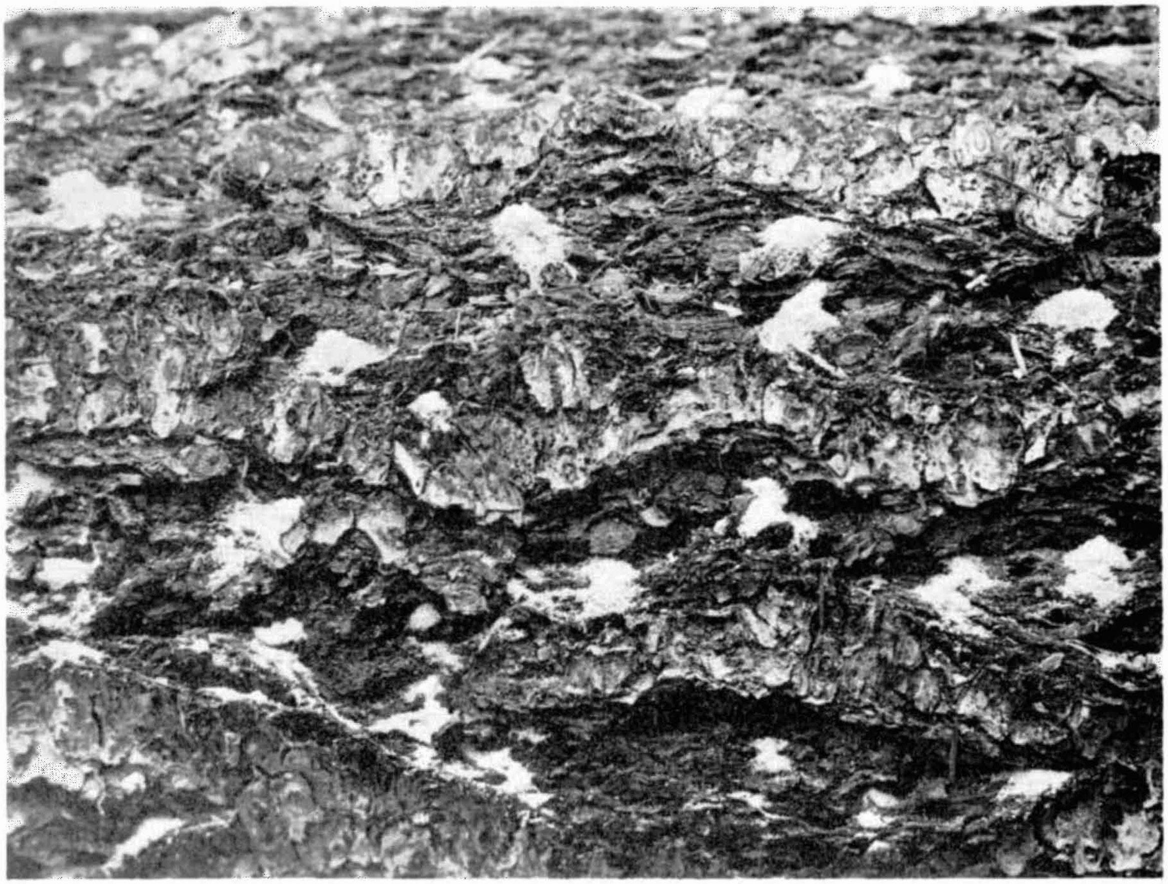

Fig. 5 Douglas-fir log showing ambrosia beetle boring dust.