Comparative Contact Toxicity of Insecticides Against Fourth-instar Red-headed Pine Sawfly Larvae, *Neodiprion lecontei* (Fitch)

Project No. CC-006 Formerly CC-4

by

P. C. Nigam

Chemical Control Research Institute

Ottawa, Ontario

Information Report CC-X-7

Canadian Forestry Service

Department of Fisheries and Forestry

April 1971

CONTENTS

ABBREVIATIONS

Mort.	=	Mortality (%)
Corr. Mort.	=	Corrected Mortality by Abbott's formula
D/T	=	Dead/Total
gpa	=	gallons per acre
RPS	=	Red-headed pine sawfly
$\mu g/cm^2$	=	Microgram per square centimeter
b	=	Slope
FL	=	Fiducial limits (95%)
ld-p	=	Log dosage-probit mortality regression line

Introduction

Red pine, Pinus resinosa Ait., in reforestation areas of southwestern Quebec have been damaged by the red-headed pine sawfly, Neodiprion lecontei (Fitch) during recent years (Martineau and Ouellette 1969). The Quebec Department of Lands and Forests has carried out chemical control programs for a number of years (Martineau & Desaulniers 1970). DDT was primarily used in these operations as this was the most effective and economical insecticide against this species (Benjamin 1955, Anonymous 1957, Kirby 1961, MacAloney and Wilson 1964, Wilson and Reeks 1967, Martineau and Desaulniers 1970). The Interdepartmental Committee on Forest Spraying Operations in 1969 recommended that DDT should not be used and insecticides which are safer to the forest ecosystem should be tested for control of this species along with a nuclear polyhedrosis virus (Martineau and Lavallée 1970). This report describes the comparative contact toxicity study of 21 new insecticidal compounds against fourth-instar larvae of red-headed pine sawfly, carried out under laboratory conditions during 1970.

Methods and Materials

The details of the methods and materials are described in earlier reports (Nigam 1970a and b). The insecticides and their formulations used in this study are presented in Table 25, with their chemical names, sources and common names. The original designation for the insecticide used by the supplier is referred in the report for simplicity. The spraying of insecticide was

carried out as described in previous reports (Nigam 1968a, 1969a and 1970a). The technique for maintaining fourth-instar larvae culture of red-headed pine sawfly was the same as described in 1970 (1970a). The plan of each experiment is described individually. The post-treatment observations were carried out at 24, 48 and 72 hour intervals (Tables 1-21). The mortality data was analyzed by probit analysis using a Univac 1108 computer and program S103 prepared by Canada Department of Agriculture. The relative potencies and toxicity indices of the insecticides were calculated using fenitrothion as the standard insecticide.

Experiments and Results

Twenty-one experiments were carried out using carbofuran, Matacil, Cidial, Bay 77488, fenitrothion, methomyl, Baygon, S4084, Dursban, Surecide, Dupont 1642, Hopcide, Ciba 17974, F-6957, Dylox, Fitios, Pyrocide, Imidan, DDT, allethrin, and Pyrix 20 (Expts. 1-21). The concentration of insecticides and their rates of application are presented in the plan of each experiment. The mortality data are presented in Tables 1-21 and were subjected to probit analysis. The summary of probit analysis for each period of observation is tabulated at the end of each experiment giving LD_{50} and LD_{95} values with their fiducial limits and slopes (Expts. 1-21). The probit regression lines for 24, 48 and 72 hours of each insecticide are presented in Figs. 1-21 and comparative probit regression lines of different insecticides for each period of observation are presented in Figs. 22-27. The insecticides and the experiments are arranged in descending order of toxicity on the basis of LD_{50} values. The comparative contact

toxicity study of different insecticides at 24, 48 and 72 hours is presented in Tables 22, 23 and 24 along with their relative potency and toxicity index taking LD_{50} and LD_{95} values of fenitrothion as one.

There was a slight increase in mortality from 24 to 72 hours observation but the data for different periods of observation were not significantly different because the 95% fiducial limits in the most cases overlapped (Tables 22, 23 and 24). The fiducial limits of Baygon, Ciba 17974 and Pyrocide were not computed at the three periods of observations due to heterogenous mortality response (Expts. 7, 13, 17). The fiducial limits of Dupont 1642 at 24 and 48 hours were not computed (Expt. 11), while allethrin at 48 hours had no fiducial limits (Expt. 20). Bay 77488, Fitios and Imidan had no fiducial limits at 72 hours observation period (Expts. 4, 16 and 18).

Carbofuran was the most effective insecticide at the LD_{50} level, while at the LD_{95} level Matacil gave the highest toxicity. Cidial was in third place. The fiducial limits of these three insecticides overlap at 72 hours i.e. their LD_{50} and LD_{95} values were not significantly different and the toxicity of these insecticides was the same to this species. Fenitrothion was used as the standard insecticide because it is now being used in field operations against a number of insects (Nigam 1971). It was 1.5 to 2 times less toxic than carbofuran and Matacil, but it was 50 times more toxic than DDT at the 72 hours observation (Table 24). It appears from this data that fenitrothion can be used effectively against this species in the

field. Allethrin and Pyrix 20 which are very safe insecticides to the forest ecosystem were the least effective against this species.

Summary

Twenty-one insecticides were tested against red-headed pine sawfly during 1970. Carbofuran and Matacil were very effective insecticides and allethrin and Pyrix 20 were the least effective. Fenitrothion showed 50 times more toxicity than DDT and can be used effectively against this species under field conditions.

Acknowledgement

The author is grateful to Dr. James J. Fettes, Director, Chemical Control Research Institute, for encouragement and interest in the project. The technical assistance of Mr. A. S. Danard, Mr. C. Jackson, Miss B. O'Connell and Miss J. Thomson is gratefully acknowledged. Sincere thanks are due to the staff of Forest Insect and Disease Survey for the collection of sawfly larvae and to the various firms for the supply of insecticide samples.

References

(1) Anonymous. 1957. The red-headed pine sawfly in Ontario. Can. Dept. Agric. Pub. 1002, 2 p.

(2) Benjamin, D. M. 1955. The biology and ecology of the red-headed pine sawfly. U. S. Dept. Agric. Tech. Bull. 1118, 57 p.

(3) Kirby, C. S. 1961. The red-headed pine sawfly, Neodiprion lecontei (Fitch). Can. Dept. For. 2 p.

(4) MacAloney, H. J. and L. F. Wilson. 1964. The red-headed pine sawfly. U. S. Dept. Agric. Forest Pest Leaflet 14, 5 p., December 1964.

(5) Martineau, R. and G. B. Ouellette. 1969. Quebec Region - Important forest insects - Red-headed pine sawfly, Neodiprion lecontei (Fitch). In Annual report of the forest insect and disease survey for 1969, pp. 39-40. Can. Dept. Fish. and For., Can. For. Ser. 1970.

(6) Martineau, R. and A. Lavallée. 1970. Quebec Region - Important forest insects - Red-headed pine sawfly, Neodiprion lecontei (Fitch). In Annual report of the forest insect and disease survey for 1970, pp. 34-35. Can. Dept. Fish. and For., Can. For. Ser. 1971.

(7) Martineau, R. and R. Desaulniers. 1970. 2. The Problem. In Virus trials to control red-headed pine sawfly in Quebec plantations, pp. 3-7. Can. Dept. Fish. and For., Can. For. Ser. Information Report DPC-X-1.

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

(9) 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. Ser., Information Report CC-X-1, 45 p., Sept. 1969.

(10) Nigam, P. C. 1970a. Toxicity of insecticides against sawfly larvae. 1. Contact toxicity of organophosphates and carbamates to Neodiprion pratti banksianae Roh., N. swainei Midd., and Pristiphora erichsonii Htg. Journ. Econ. Ent. 63(2): 620-624.

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

(12) Nigam, P. C. 1971. Evaluation of fenitrothion against forest insect pests and other components of the forest ecosystem (Abstract). Proc. Ent. Soc. Ont. 102: (in press).

(13) Wilson, L. F. and W. A. Reeks. 1967. Red-headed pine sawfly, Neodiprion lecontei (Fitch). pp. 130-133. In Davidson and Prentice (eds.). Important forest insects and diseases of mutual concern to Canada, the United States and Mexico. Can. Dept. For. and Rural Dev. Pub. No. 1180.

EXPERIMENT NO. 1

Object: To determine the contact toxicity of Carbofuran against fourth instar Red-Headed Pine Sawfly.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.05%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten.

Exptal Code: RPS 9-70 Computer Code: RPS-N12-(79-81)

Table No. 1

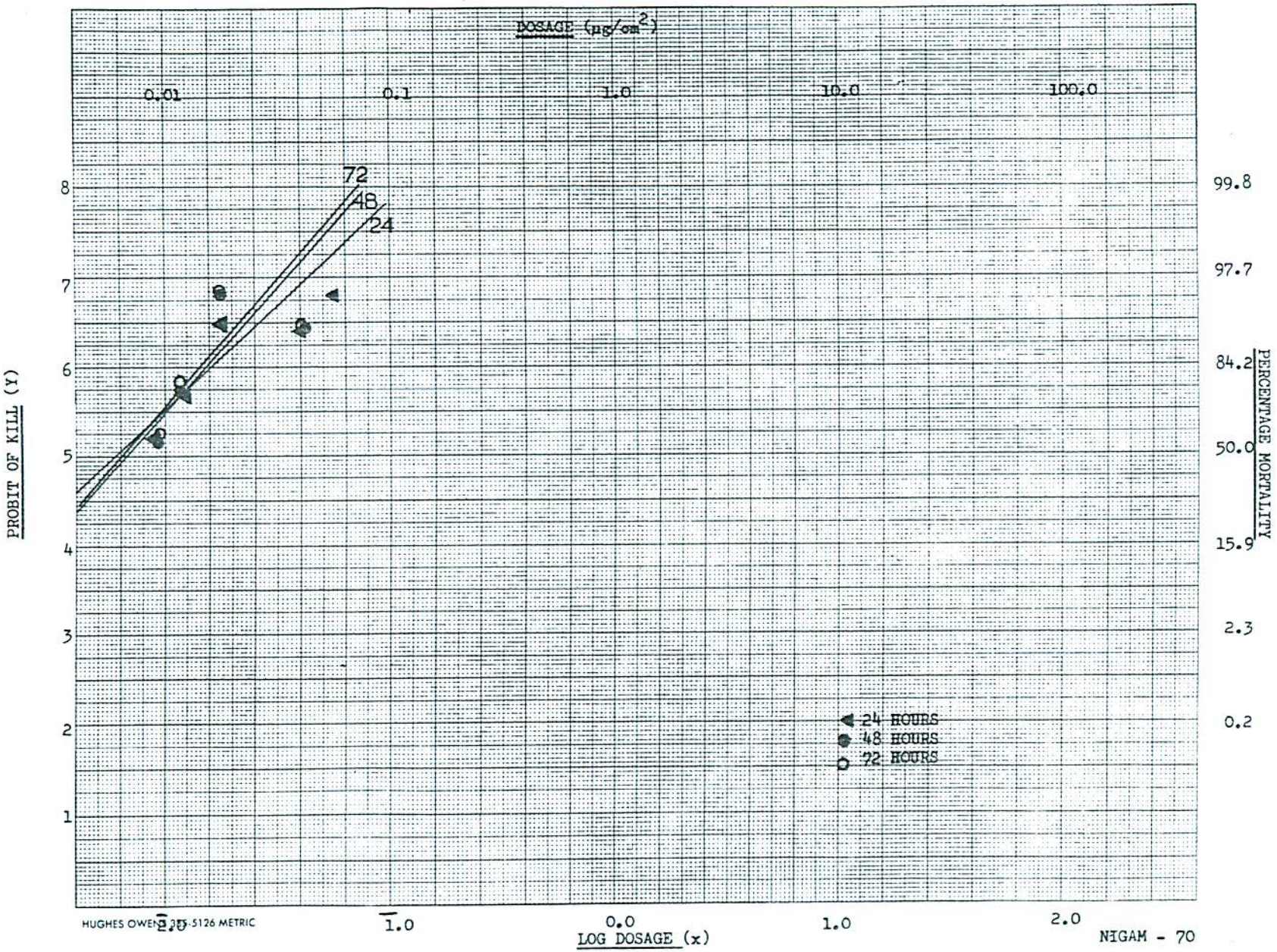
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.009	18/30	60	59	18/30	60	59	18/30	60	59
0.2	0.012	23/30	77	76	23/30	77	76	24/30	80	79
0.4	0.018	28/30	93	93	29/30	97	97	29/30	97	97
0.6	0.033	30/30	100	100	30/30	100	100	30/30	100	100
0.8	0.039	28/30	93	93	28/30	93	93	28/30	93	93
1.0	0.054	29/30	97	97	30/30	100	100	30/30	100	100
Control		1/29	3		1/29	3		1/29	3	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	2.32	.61-02	.26-02-.89-02	.31-01	.23-01-.62-01
48 hours	2.87	.68-02	.35-02-.91-02	.25-01	.20-01-.44-01
72 hours	2.82	.65-02	.32-02-.89-02	.25-01	.19-01-.44-01

Remarks: The regression lines are given in fig. 1.

FIG. 1. Ld-p LINES OF CARBOFURAN AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY)
24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 2

Object: To determine the contact toxicity of Matacil against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.025%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten.

Exptal Code: RPS 11-70 Computer Code: RPS-MAT-(85-87)

Table No.2

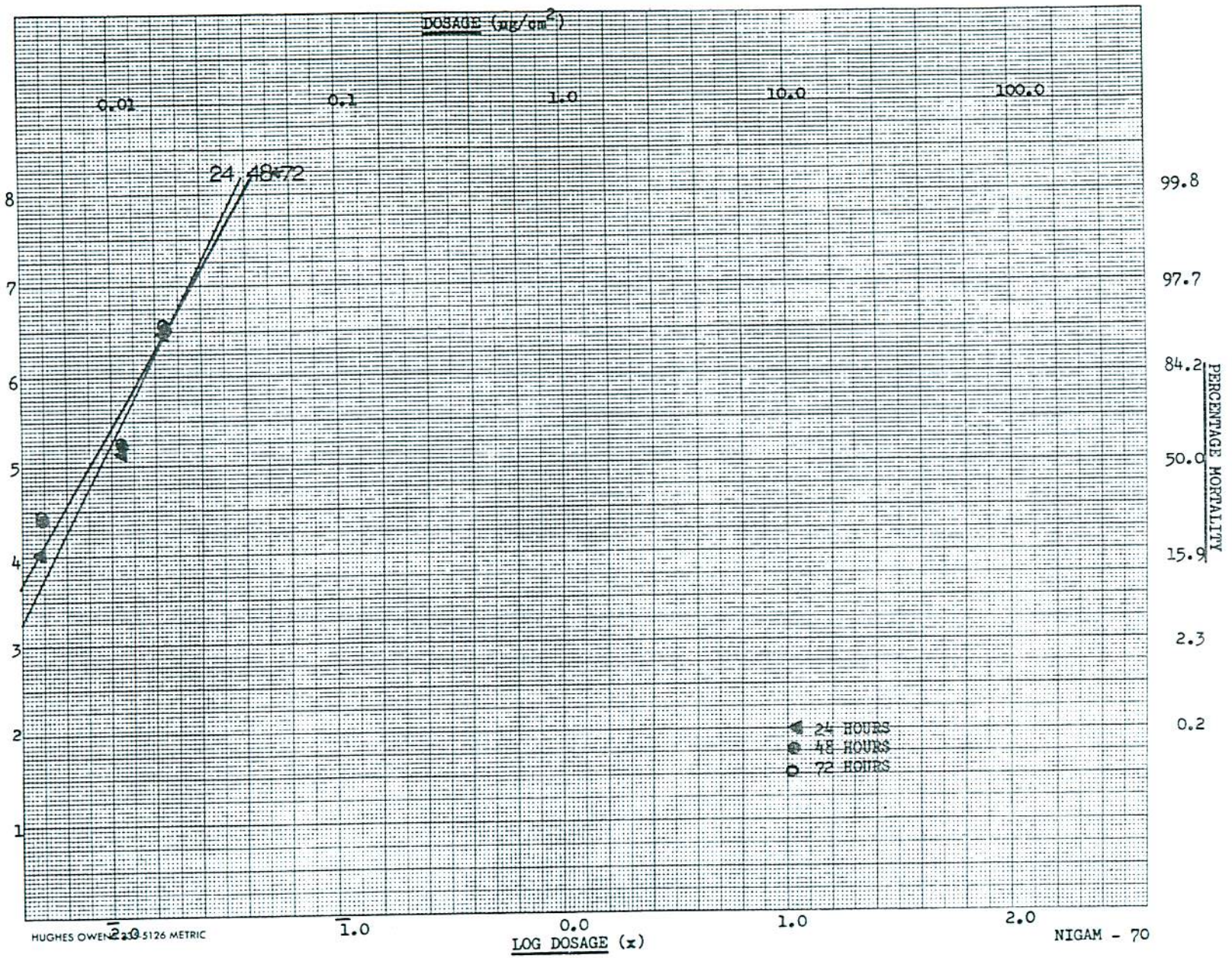
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.003	0/29	0	0	1/29	3	0	1/29	3	0
0.2	0.005	6/30	20	17	9/30	30	28	9/30	30	28
0.4	0.011	17/30	57	55	18/30	60	59	18/30	60	59
0.6	0.017	28/30	93	93	28/30	93	93	28/30	93	93
0.8	0.021	30/30	100	100	30/30	100	100	30/30	100	100
1.0	0.027	29/29	100	100	29/29	100	100	29/29	100	100
Control		1/29	3		1/29	3		1/29	3	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	5.18	.90-02	.75-02-.10-01	.19-01	.16-01-.24-01
48 hours	4.43	.81-02	.67-02-.94-02	.19-01	.16-01-.25-01
72 hours	4.43	.81-02	.67-02-.94-02	.19-01	.16-01-.25-01

Remarks: The regression lines are given in fig. 2.

FIG. 2. Ld-p LINES OF MATACIL AGAINST FOURTH INSTAR NEODIPRION LECONTEI(FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 3

Object: To determine the contact toxicity of Cidial against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.05%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten.

Exptal Code: RPS 7-70 Computer Code: RPS-CDL-(76-78)

Table No. 3

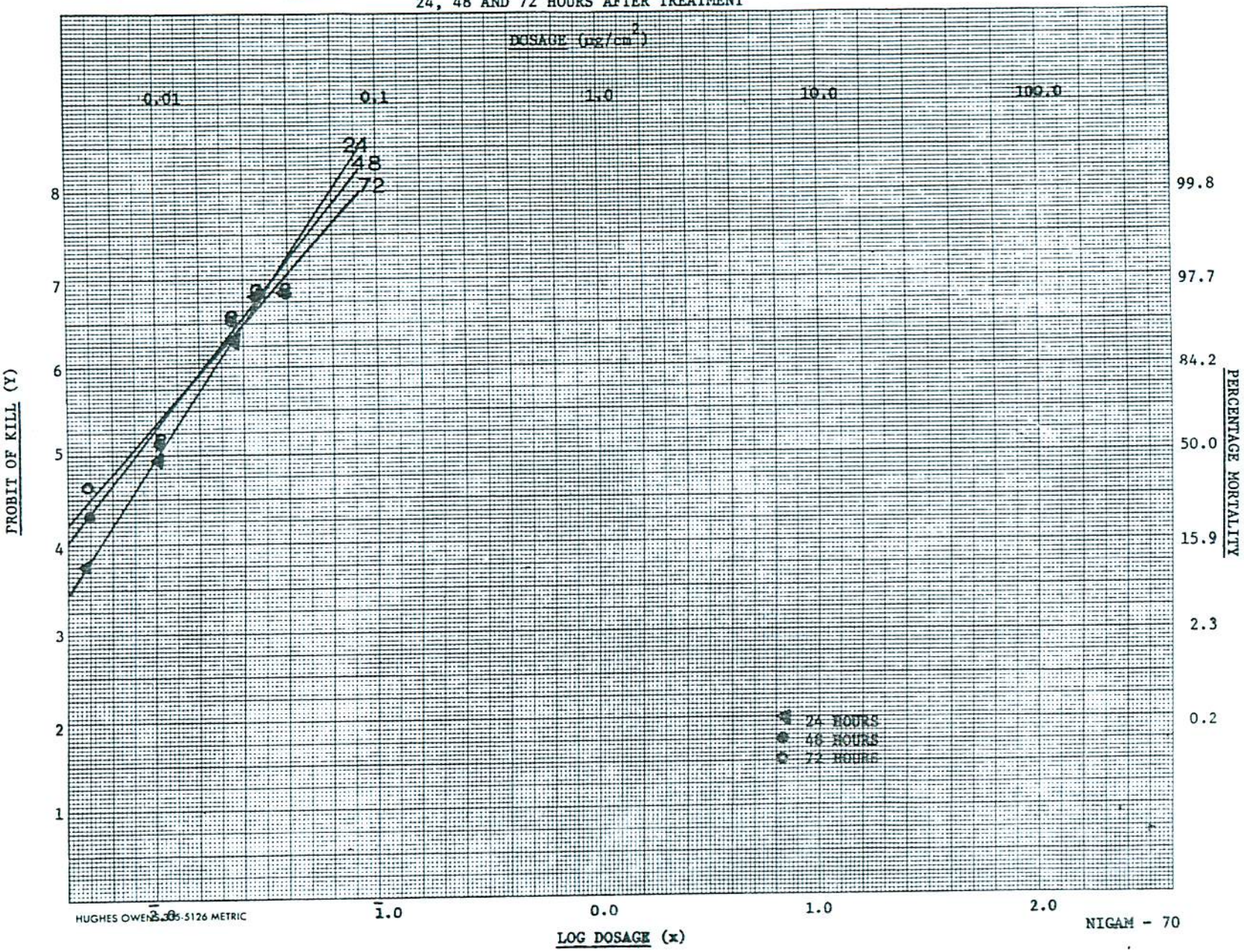
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.005	3/29	10	10	7/29	24	24	10/29	34	34
0.2	0.010	13/27	48	48	15/27	56	56	15/27	56	56
0.4	0.022	27/30	90	90	28/30	93	93	28/30	93	93
0.6	0.030	29/30	97	97	29/30	97	97	29/30	97	97
0.8	0.038	29/30	97	97	29/30	97	97	29/30	97	97
1.0	0.053	30/30	100	100	30/30	100	100	30/30	100	100
Control		0/30	0		0/30	0		0/30	0	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	3.81	.10-01	.85-02-.12-01	.28-01	.23-01-.39-01
48 hours	3.25	.85-02	.66-02-.10-01	.27-01	.21-01-.39-01
72 hours	3.43	.89-02	.53-02-.12-01	.27-01	.21-01-.41-01

Remarks: The regression lines are given in fig. 3.

FIG. 3. Ld-p LINES OF CIDIAL AGAINST FOURTH INSTAR NEODIPRION LECONTEI(FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 4

Object: To determine the contact toxicity of Bayer 77488 against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.05%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 4 -70 Computer Code: RPS-B78-(70-72)

Table No. 4

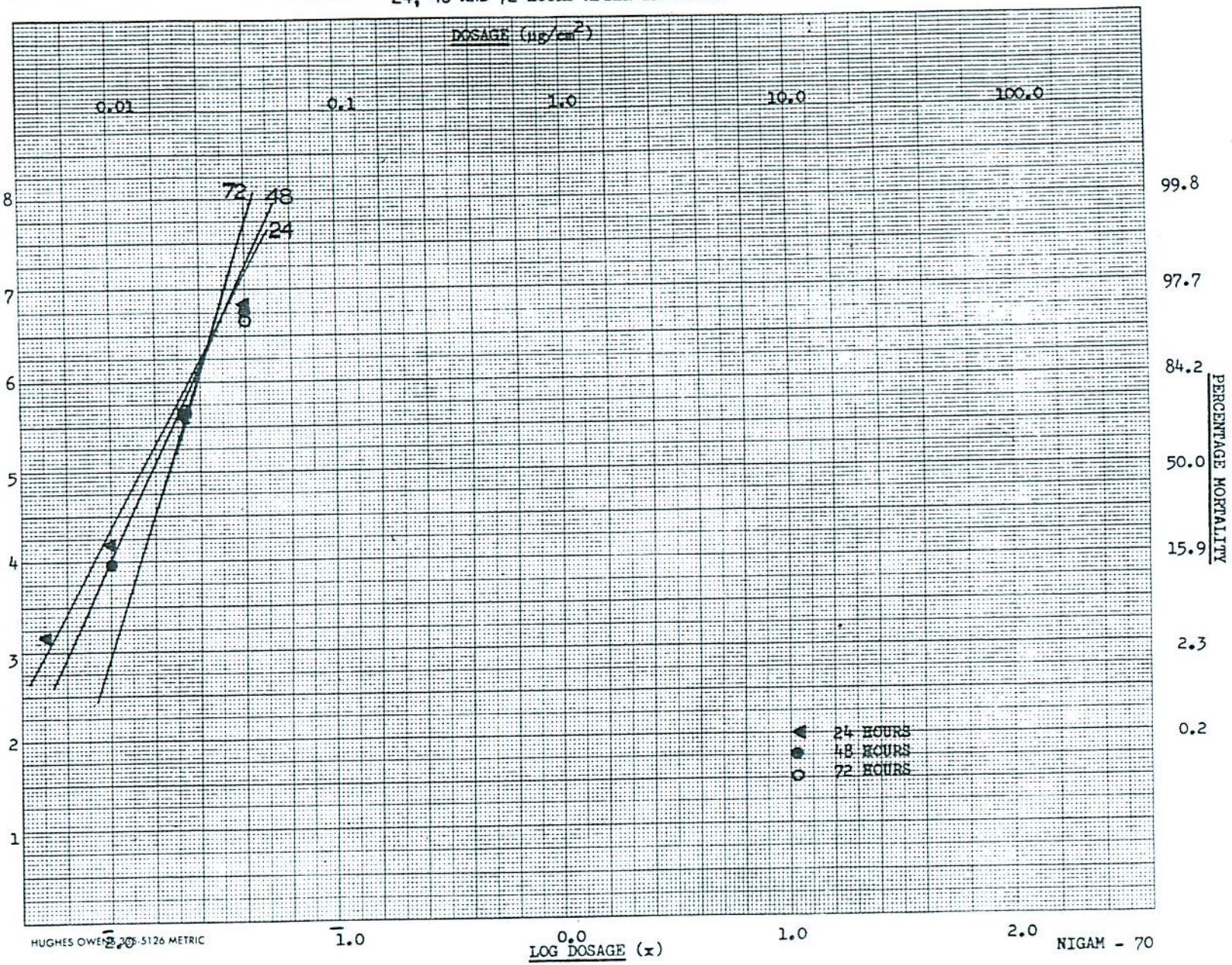
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.005	1/29	3	3	1/29	3	0	2/29	7	0
0.2	0.010	6/30	20	20	8/30	27	15	8/30	27	0
0.4	0.021	20/27	74	74	21/27	78	74	22/27	81	74
0.6	0.032	30/30	100	100	30/30	100	100	30/30	100	100
0.8	0.039	29/30	97	97	29/30	97	96	29/30	97	95
1.0	0.048	30/30	100	100	30/30	100	100	30/30	100	100
Control		0/29	0		4/29	14		8/29	28	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	4.79	.14-01	.12-01-.16-01	.31-01	.26-01-.41-01
48 hours	5.67	.16-01	.12-01-.18-01	.31-01	.26-01-.40-01
72 hours	8.01	.19-01		.30-01	

Remarks: The regression lines are given in fig. 4.

FIG. 4. Ld-p LINES OF BAYER 77488 AGAINST FOURTH INSTAR NEODIPRION LECONTEI (RITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 5

Object: To determine the contact toxicity of Fenitrothion against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.10%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten.

Exptal Code: RPS 10-70 Computer Code: RPS-SUM-(82-84)

Table No. 5

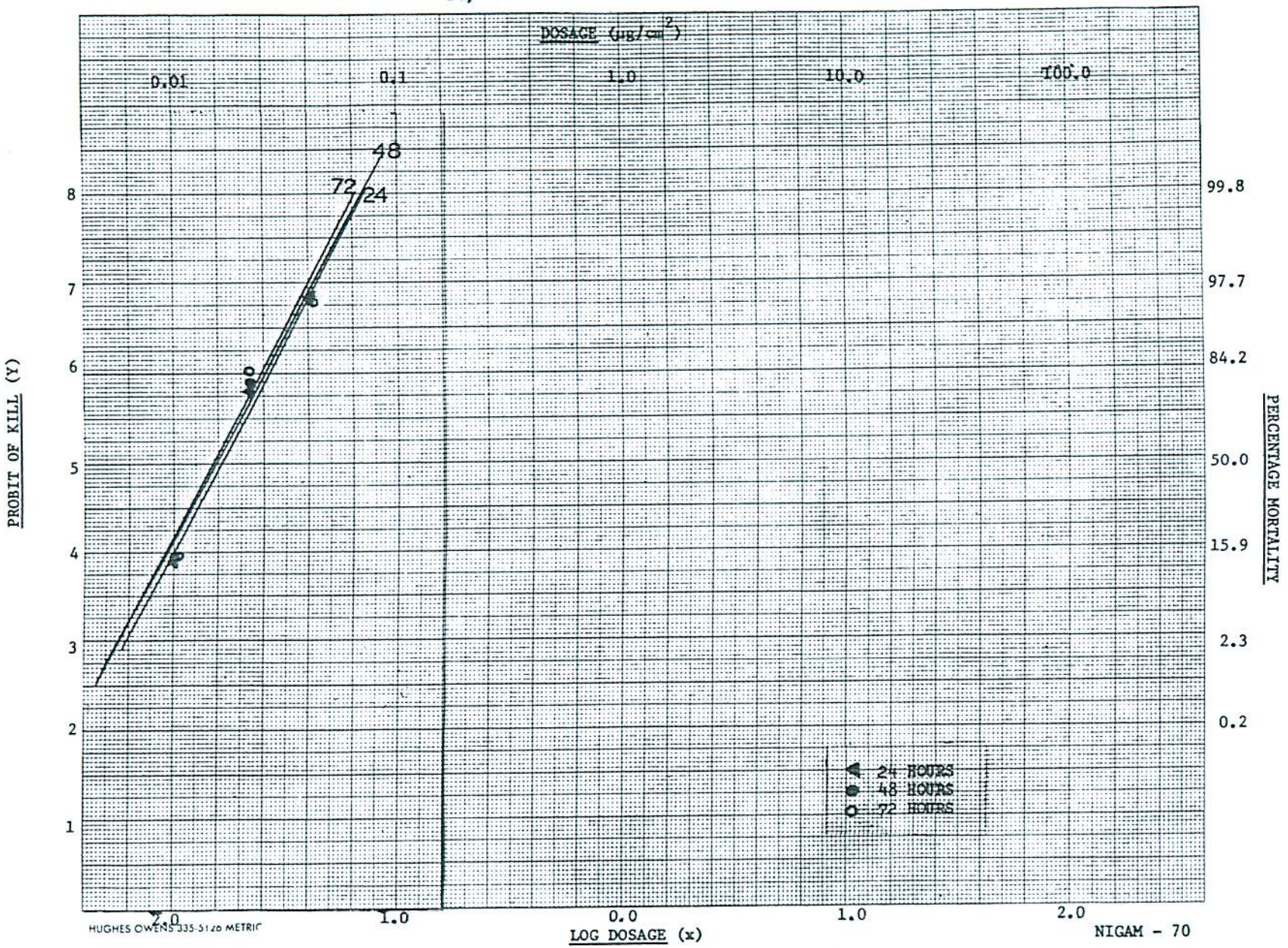
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.010	4/30	13	13	6/30	20	14	6/30	20	14
0.2	0.022	22/28	79	79	23/28	83	81	24/28	86	85
0.4	0.041	29/30	97	97	29/30	97	96	29/30	97	96
0.6	0.062	29/29	100	100	29/29	100	100	29/29	100	100
0.8	0.088	31/31	100	100	31/31	100	100	31/31	100	100
1.0	0.110	29/29	100	100	29/29	100	100	29/29	100	100
Control		0/30	0		2/30	7		2/30	7	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	4.75	.16-01	.13-01-.19-01	.36-01	.29-01-.52-01
48 hours	4.59	.16-01	.12-01-.19-01	.36-01	.28-01-.54-01
72 hours	4.69	.15-01	.12-01-.18-01	.34-01	.27-01-.50-01

Remarks: The regression lines are given in fig. 5.

FIG. 5. Ld-p LINES OF FENITROTHION AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 6

Object: To determine the contact toxicity of Methomyl against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.10%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal. Code: RPS 13-70 Computer Code: RPS-MML-(88-90)

Table No. 6

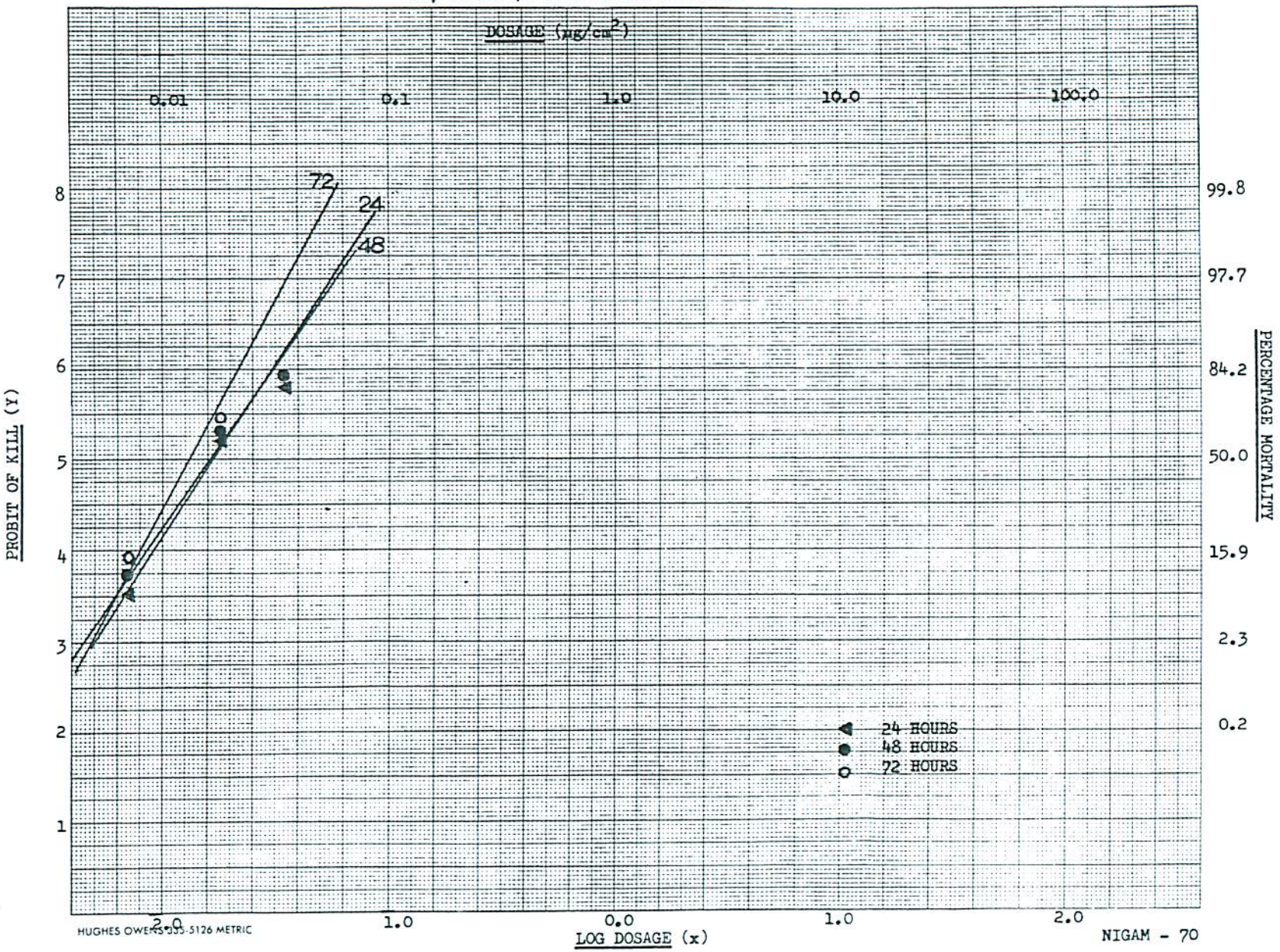
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.007	2/30	7	7	4/30	13	10	5/30	17	14
0.2	0.018	17/29	59	59	18/29	62	61	20/29	69	68
0.4	0.035	24/30	80	80	25/30	83	83	30/30	100	100
0.6	0.062	30/30	100	100	30/30	100	100	30/30	100	100
0.8	0.075	30/30	100	100	30/30	100	100	30/30	100	100
1.0	0.100	30/30	100	100	30/30	100	100	30/30	100	100
Control		0/30	0		1/30	3		1/30	3	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	3.79	.17-01	.14-01-.21-01	.47-01	.37-01-.66-01
48 hours	3.62	.16-01	.12-01-.19-01	.45-01	.36-01-.66-01
72 hours	4.41	.13-01	.10-01-.16-01	.31-01	.25-01-.44-01

Remarks: The regression lines are given in fig. 6.

FIG. 6. Ld-p LINES OF METHOMYL AGAINST FOURTH INSTAR NEODIPRION LECONTEI(FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 7

Object: To determine the contact toxicity of Baygon against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.05%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 16-70 Computer Code: RPS-BAY-(94-96)

Table No. 7

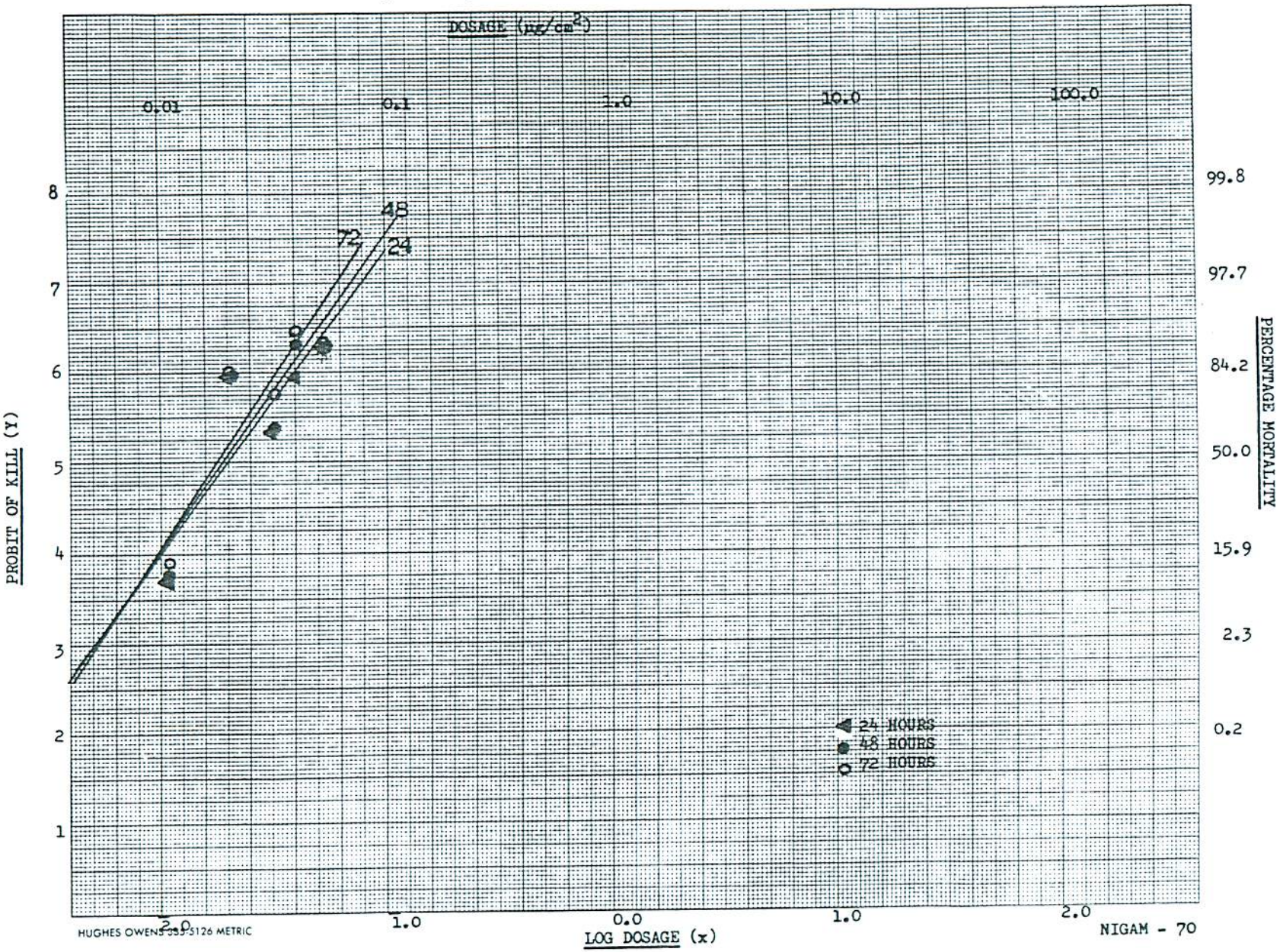
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.005	0/30	0	0	0/30	0	0	0/30	0	0
0.2	0.011	3/30	10	10	3/30	10	10	4/30	13	13
0.4	0.020	25/30	83	83	25/30	83	83	25/30	83	83
0.6	0.032	19/30	63	63	19/30	63	63	25/32	78	78
0.8	0.041	24/29	83	83	26/29	90	90	27/29	93	93
1.0	0.052	27/30	90	90	27/30	90	90	27/30	90	90
Control		0/30	0		0/30	0		0/30	0	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	3.36	.20-01		.61-01	
48 hours	3.54	.19-01		.56-01	
72 hours	3.76	.18-01		.48-01	

Remarks: The regression lines are given in fig. 7.

FIG. 7. Ld-p LINES OF BAYGON AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 8

Object: To determine the contact toxicity of S4084 against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.10%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten.

Exptal. Code: RPS 5-70 Computer Code: RPS-S44-(73-75)

Table No. 8

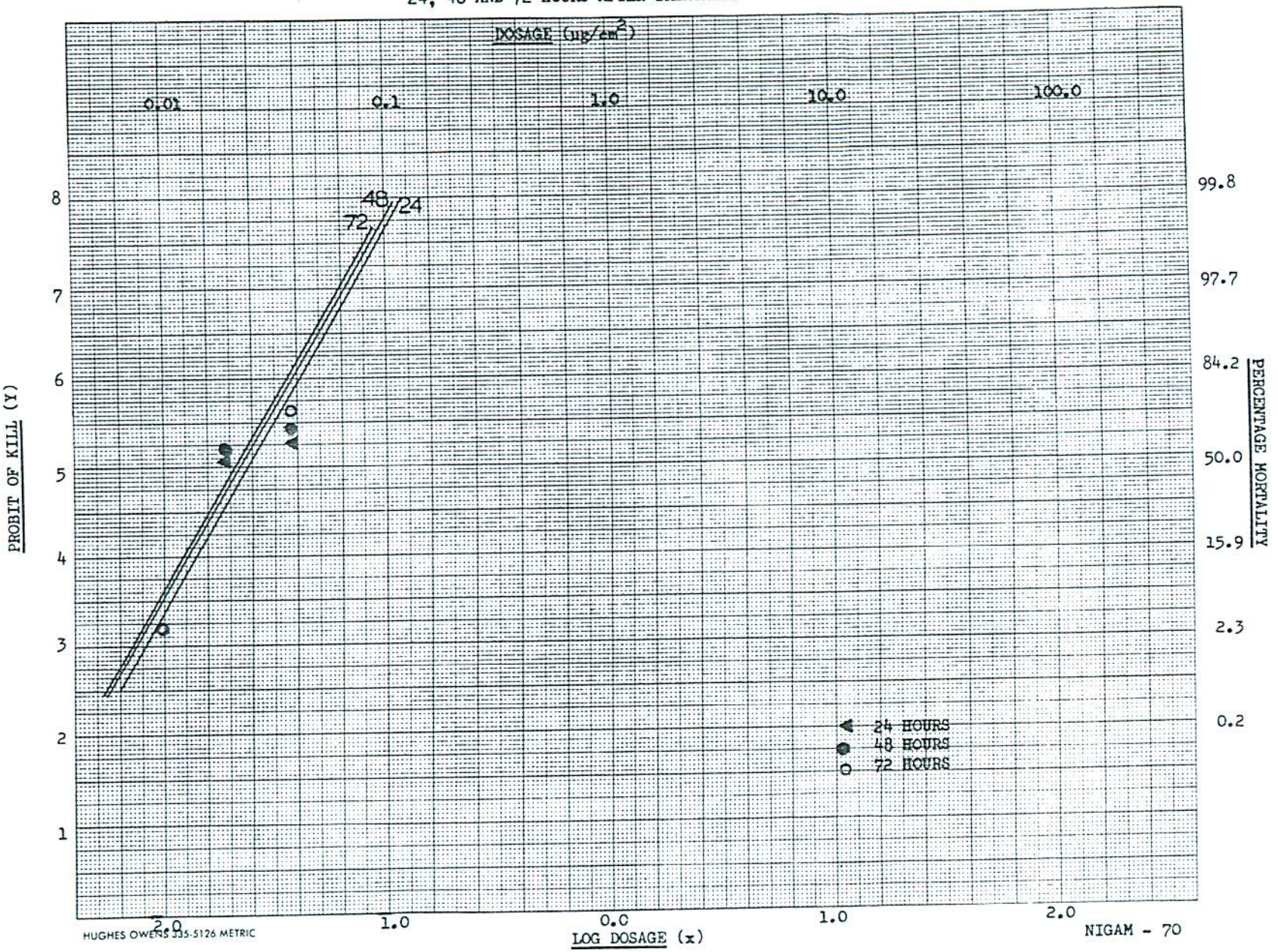
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.010	0/30	0	0	1/30	3	0	2/30	7	3
0.2	0.019	16/29	55	54	17/29	59	57	17/29	59	57
0.4	0.038	17/28	61	59	19/28	68	67	21/38	75	74
0.6	0.063	30/30	100	100	30/30	100	100	30/30	100	100
0.8	0.082	30/30	100	100	30/30	100	100	30/30	100	100
1.0	0.105	29/29	100	100	29/29	100	100	29/29	100	100
Control		1/30	3		1/30	3		1/30	3	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	4.31	.24-01	.78-02-.42-01	.58-01	.36-01-.81
48 hours	4.22	.22-01	.11-01-.35-01	.55-01	.35-01-.27
72 hours	4.24	.21-01	.17-01-.25-01	.51-01	.41-01-.72-01

Remarks: The regression lines are given in fig. 8.

FIG. 8. Ld-p LINES OF S 4084 AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY)
24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 9

Object: To determine the contact toxicity of Dursban against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.10%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten.

Exptal Code: RPS 17-70 Computer Code: RPS-DUR-(97-99)

Table No. 9

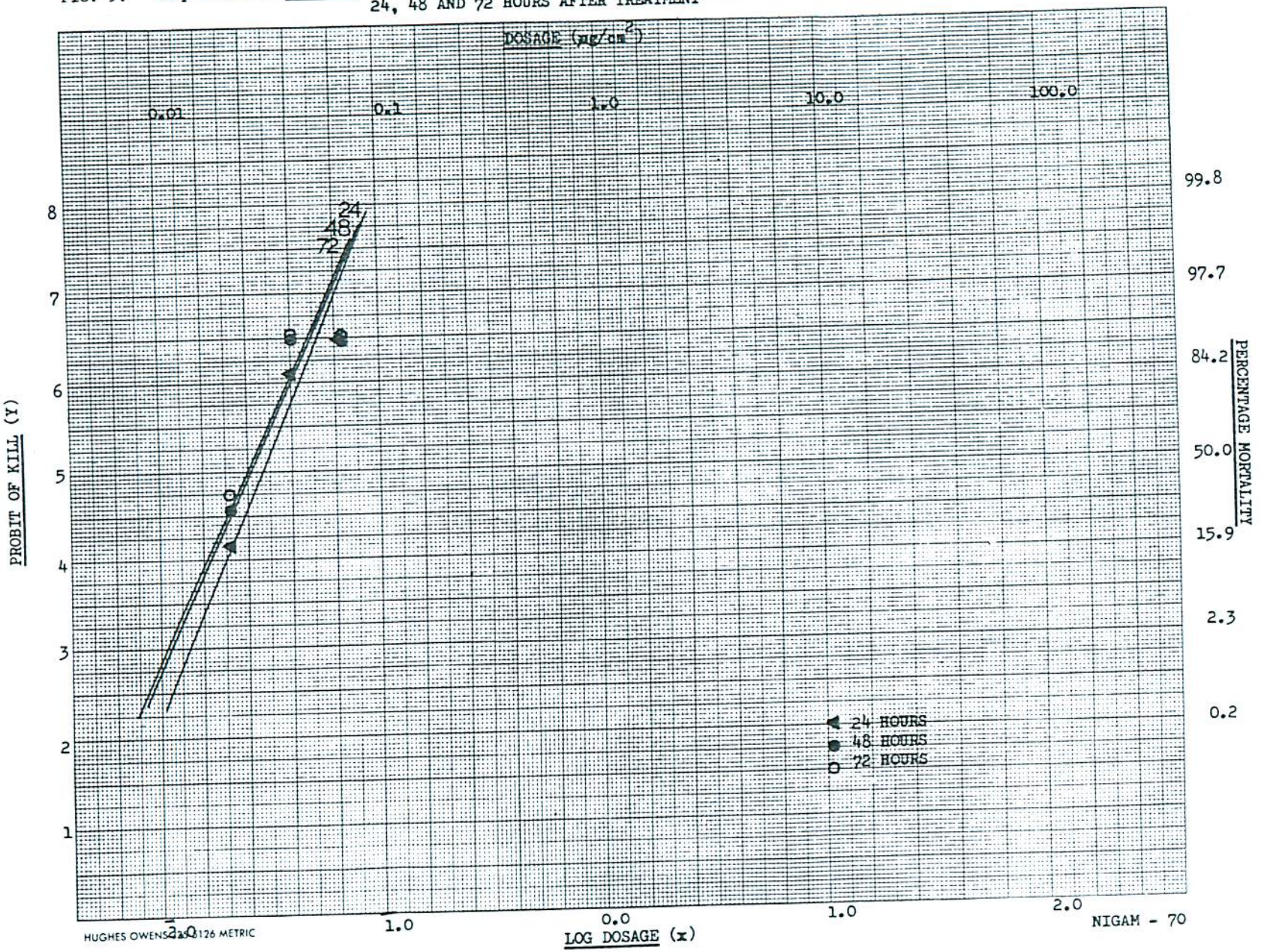
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.013	0/30	0	0	0/30	0	0	0/30	0	0
0.2	0.021	6/30	20	20	10/30	33	33	12/30	40	40
0.4	0.041	26/30	87	87	28/30	93	93	28/30	93	93
0.6	0.066	28/30	93	93	28/30	93	93	28/30	93	93
0.8	0.082	30/30	100	100	30/30	100	100	30/30	100	100
1.0	0.107	29/29	100	100	29/29	100	100	29/39	100	100
Control		0/30	0		0/30	0		0/30	0	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	5.84	.30-01	.26-01-.34-01	.57-01	.48-01-.73-01
48 hours	5.57	.26-01	.19-01-.37-01	.52-01	.37-01-.13
72 hours	5.37	.26-01	.17-01-.37-01	.52-01	.36-01-.15

Remarks: The regression lines are given in fig. 9.

FIG. 9. Ld-p LINES OF DURSBAN AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 10

Object: To determine the contact toxicity of Surecide against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.15%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 32-70 Computer Code: RPS-SUR-(130-132)

Table No. 10

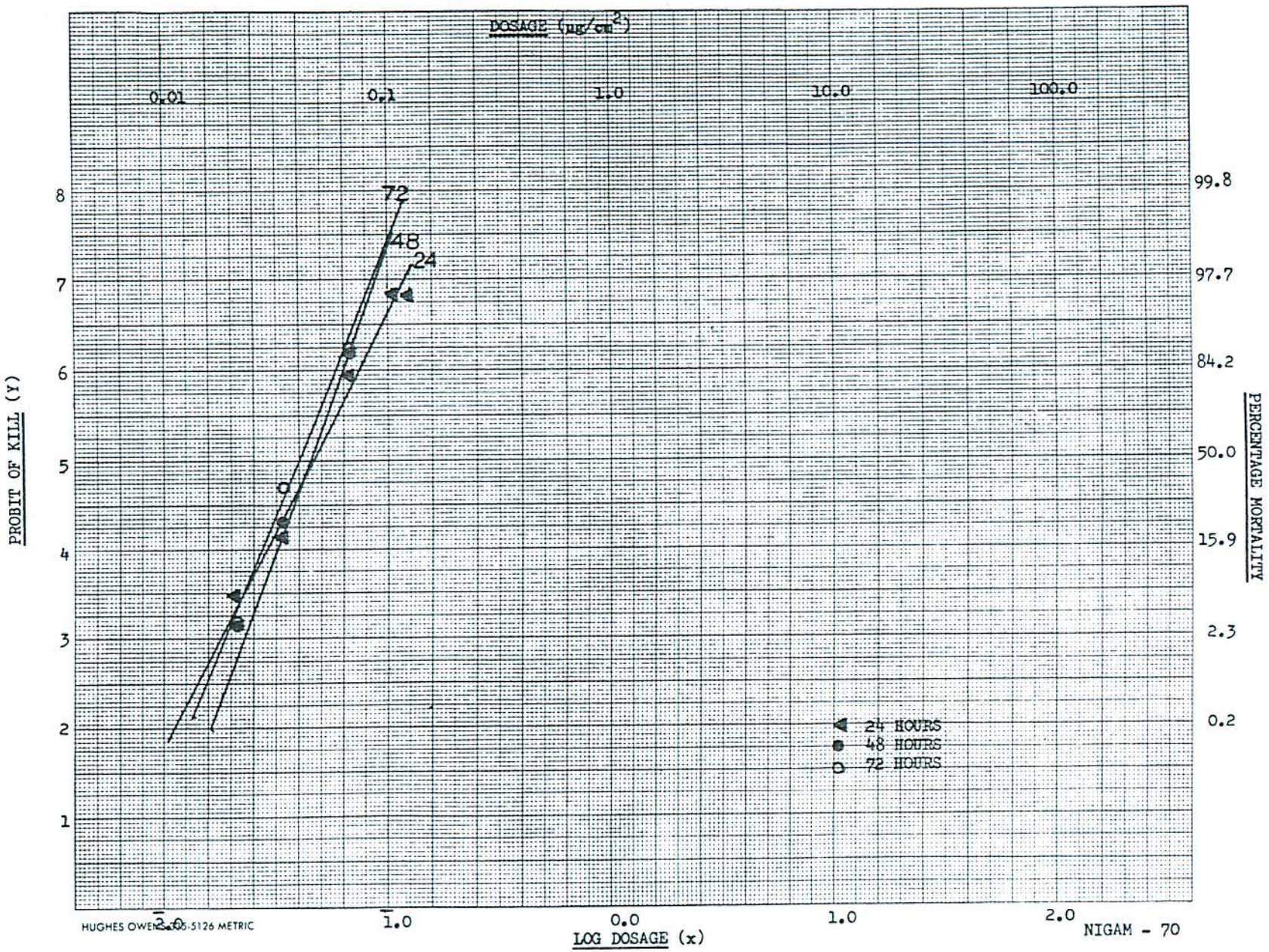
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.021	2/31	6	6	2/31	6	3	2/31	6	3
0.2	0.035	6/30	20	20	8/30	27	24	12/30	40	38
0.4	0.069	24/29	83	83	26/29	90	89	26/29	90	89
0.6	0.106	29/30	97	97	30/30	100	100	30/30	100	100
0.8	0.126	29/30	97	97	30/30	100	100	30/30	100	100
1.0	0.159	30/30	100	100	30/30	100	100	30/30	100	100
Control		0/30	0		1/30	3		1/30	3	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	4.94	.47-01	.41-01-.54-01	.10	.85-01-.13
48 hours	6.72	.44-01	.38-01-.50-01	.78-01	.66-01-.10
72 hours	6.02	.40-01	.35-01 .46-01	.76-01	.63-01-.10

Remarks: The regression lines are given in fig. 10.

FIG. 10. Ld-p LINES OF SURECIDE AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 11

Object: To determine the contact toxicity of Dupont 1642 against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.15%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 21-70 Computer Code: RPS - D12-(106-108)

Table No. 11

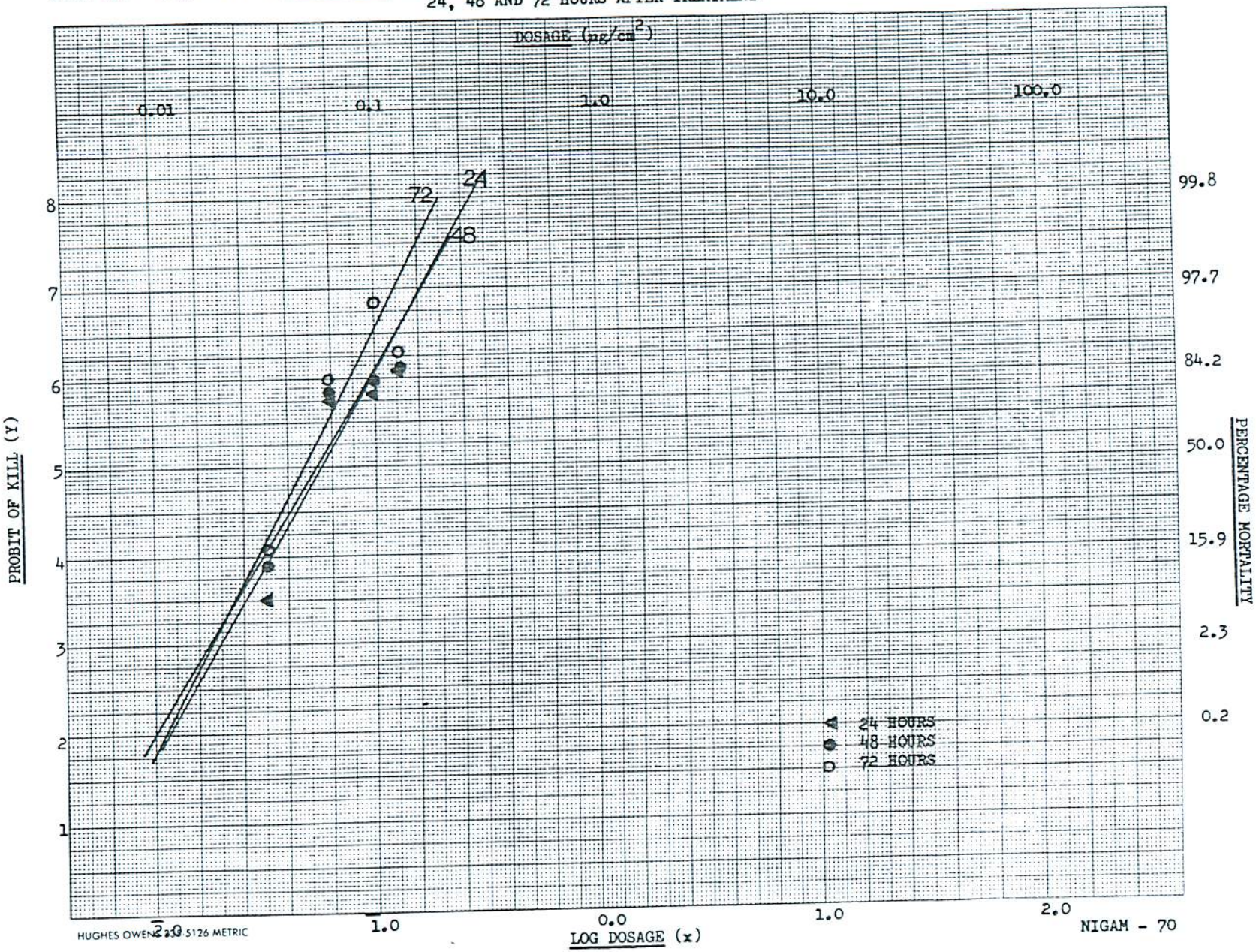
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.016	0/30	0	0	0/30	0	0	0/30	0	0
0.2	0.032	2/30	7	7	4/30	13	13	5/30	17	17
0.4	0.062	23/30	77	77	24/30	80	80	25/30	83	83
0.6	0.098	24/30	80	80	25/30	83	83	29/30	97	97
0.8	0.134	26/30	87	87	26/30	87	87	27/30	90	90
1.0	0.167	30/30	100	100	30/30	100	100	30/30	100	100
Control		0/30	0		0/30			0/30	0	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	4.35	¿58-01		.14	
48 hours	4.10	.53-01		.13	
72 hours	4.63	.48-01	.25-01-.73-01	.11	.71-01-.46

Remarks: The regression lines are given in fig. 11.

FIG. 11. Ld-p LINES OF DUPONT 1642 AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO.12

Object: To determine the contact toxicity of Hopcide against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.10%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 23-70 Computer Code: RPS-HOP-(112-114)

Table No. 12

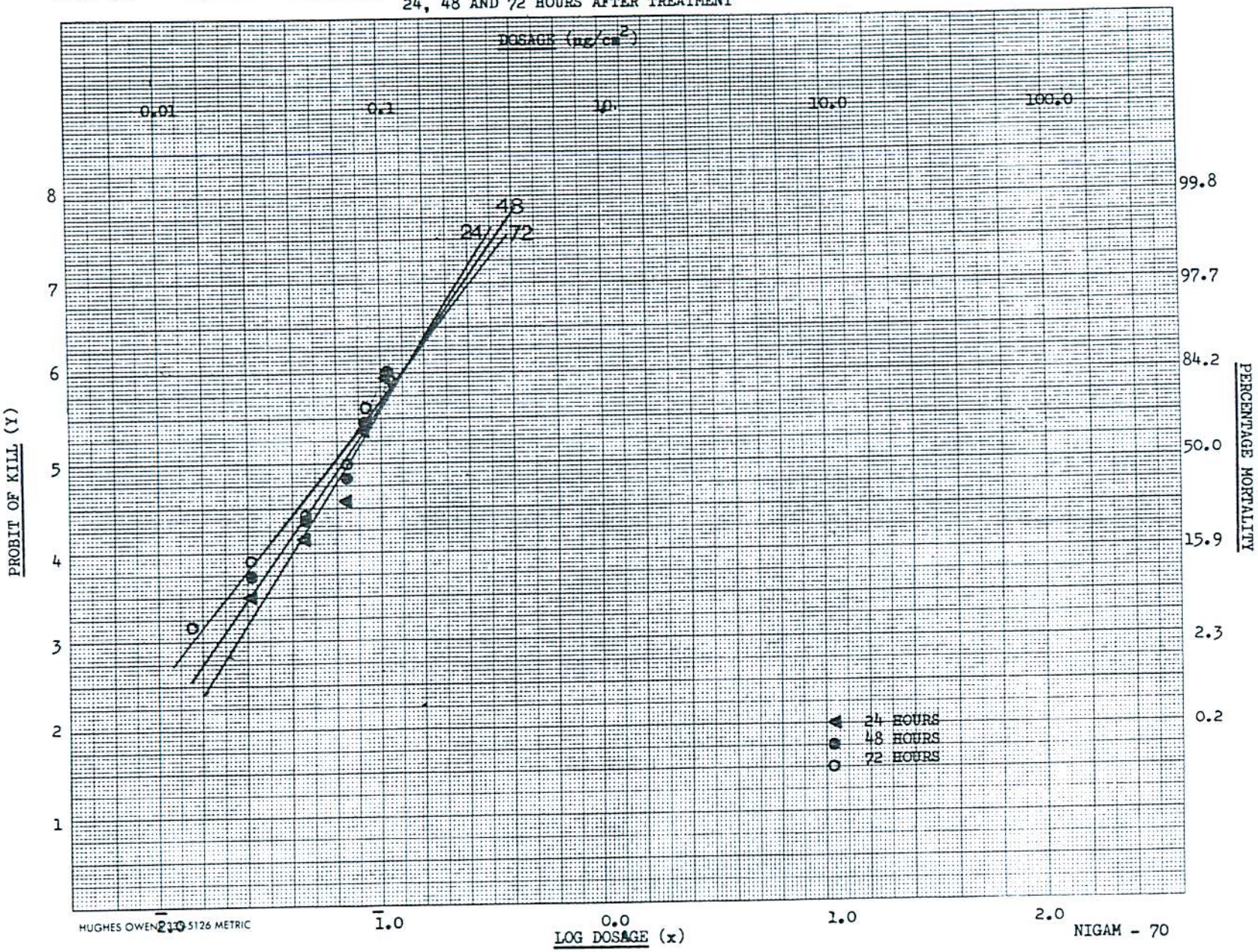
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.014	0/30	0	0	0/30	0	0	1/30	3	3
0.2	0.026	2/30	7	7	3/30	10	10	4/29	14	14
0.4	0.046	6/30	20	20	8/30	27	27	8/30	27	27
0.6	0.071	11/30	37	37	13/30	43	43	15/30	50	50
0.8	0.086	19/30	63	63	20/30	67	67	22/30	73	73
1.0	0.110	25/30	83	83	25/30	83	83	25/30	83	83
Control		0/30	0		0/30	0		0/30	0	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	4.05	.73-01	.64-01-.84-01	.19	.14-.29
48 hours	3.67	.67-01	.58-01-.78-01	.19	.14-.30
72 hours	3.22	.62-01	.53-01-.73-01	.20	.15-.33

Remarks: The regression lines are given in fig. 12.

FIG. 12. Ld-p LINES OF HOPCIDE AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 13

Object: To determine the contact toxicity of Ciba 17974 against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.10%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 28-70 Computer Code: RPS-C14-(118-120)

Table No. 13

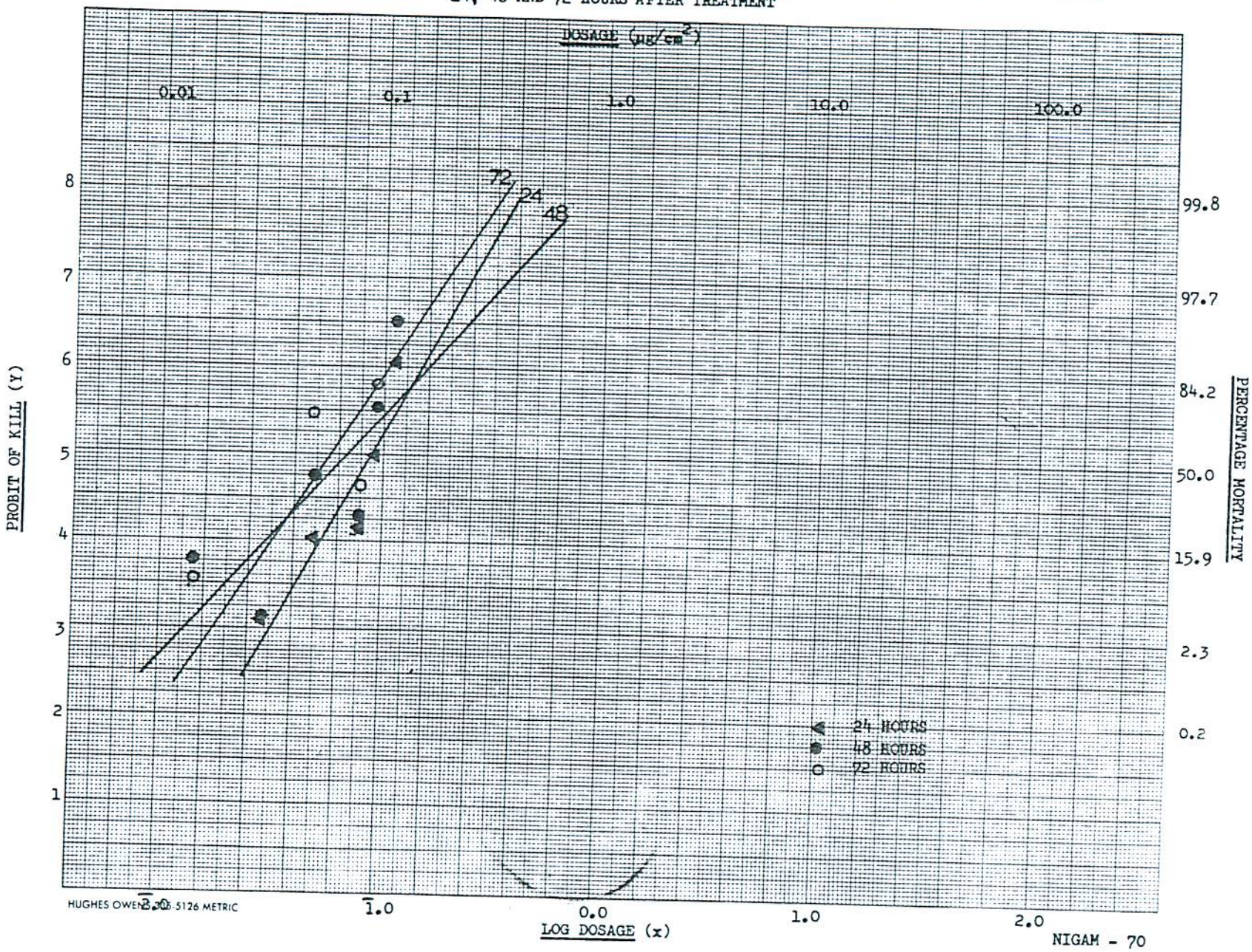
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.014	0/30	0	0	3/30	10	10	4/30	13	7
0.2	0.029	1/30	3	3	1/30	3	3	2/30	7	0
0.4	0.048	5/30	17	17	12/30	40	40	21/30	70	68
0.6	0.079	6/30	20	20	7/30	23	23	12/30	40	36
0.8	0.093	15/30	50	50	21/30	70	70	24/30	80	79
1.0	0.116	26/30	87	87	28/30	93	93	30/30	100	100
Control		0/29	0		0/29	0		2/29	7	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	4.50	.88-01		.20	
48 hours	2.76	.70-01		.27	
72 hours	3.81	.58-01		.16	

Remarks: The regression lines are given in fig. 13.

FIG. 13. Ld-p LINES OF CIBA 17974 AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY)
24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 14

Object: To determine the contact toxicity of F-6957 against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - o.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.05%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 26-70 Computer Code: RPS-F67-(115-117)

Table No. 14

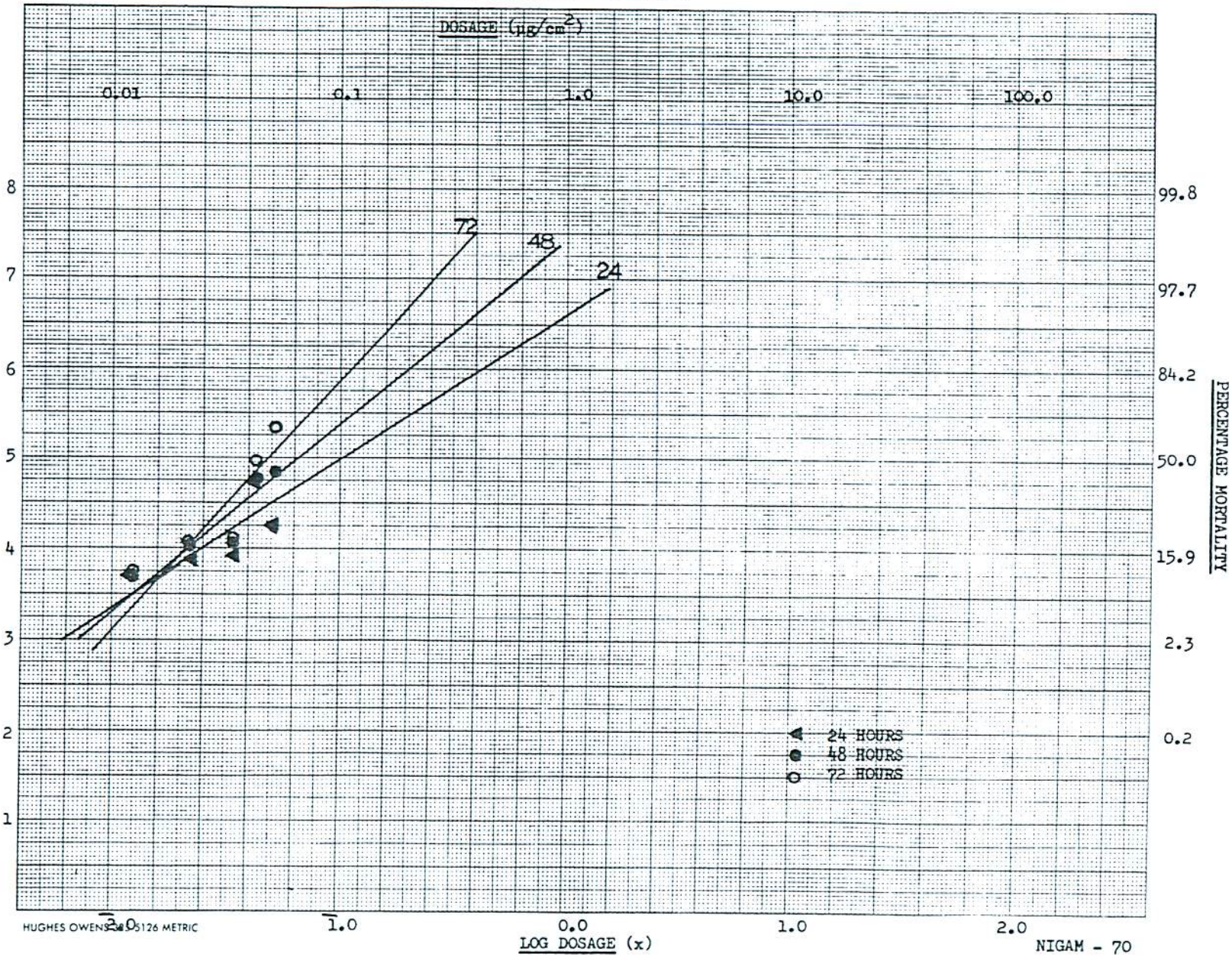
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.006	0/29	0	0	0/29	0	0	0/29	0	0
0.2	0.012	3/30	10	10	3/30	10	10	3/30	10	10
0.4	0.022	4/30	13	13	5/30	17	17	5/30	17	17
0.6	0.035	4/29	14	14	5/29	17	17	5/29	17	17
0.8	0.043	12/39	41	41	12/29	41	41	14/29	48	48
1.0	0.053	7/30	23	23	13/30	43	43	19/30	63	63
Control		0/30	0		0/30	0		0/30	0	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	1.63	.10	.63-01-.51	1.07	.29-85.89
48 hours	2.09	.66-01	.48-01-.13	.40	.18-3.22
72 hours	2.70	.49-01	.40-01-.68-01	.20	.12-.60

Remarks: The regression lines are given in fig. 14.

FIG. 14. Ld-p LINES OF F-6957 AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 15

Object: To determine the contact toxicity of Dylox against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.20%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten.

Exptal. Code: RPS 15-70 Computer Code: RPS-DLX-(91-93)

Table No. 15

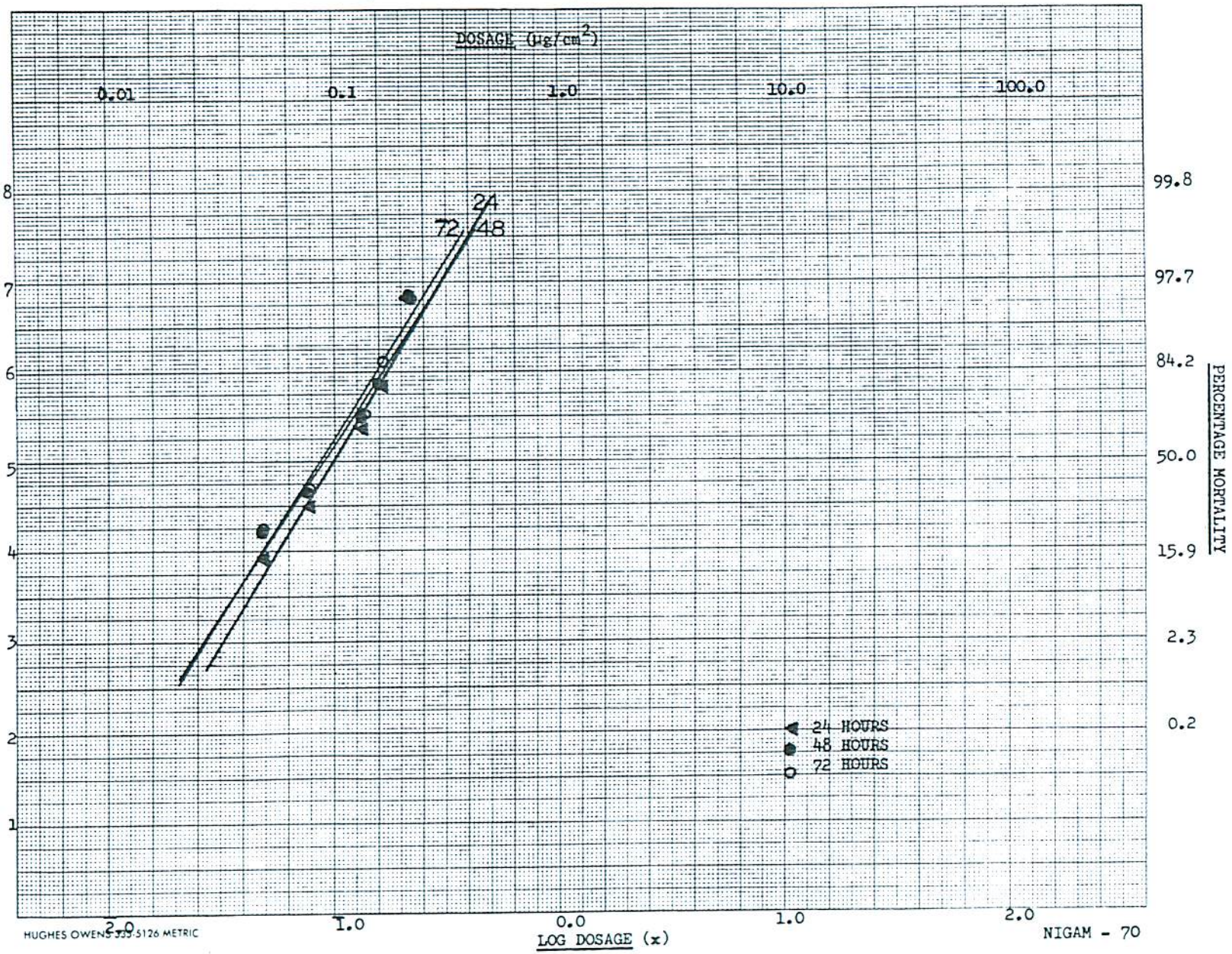
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.023	0/30	0	0	0/30	0	0	0/30	0	0
0.2	0.047	4/28	14	14	6/28	21	21	6/28	21	21
0.4	0.078	9/30	30	30	11/30	37	37	11/30	37	37
0.6	0.131	19/30	63	63	21/30	70	70	21/30	70	70
0.8	0.164	24/30	80	80	24/30	80	80	26/30	87	87
1.0	0.211	29/30	97	97	29/30	97	97	29/30	97	97
Control		0/30	0		0/30	0		0/30	0	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	4.13	.99-01	.85-01-.11	.25	.20-.34
48 hours	3.77	.90-01	.77-01-.10	.25	.20-.34
72 hours	3.96	.88-01	.75-01-.10	.23	.19-.31

Remarks: The regression lines are given in fig. 15.

FIG. 15. Ld-p LINES OF DYLOX AGAINST FOURTH INSTAR NEODIPRION LECONTEI(FITCH) (RED-HEADED PINE SAWFLY)
24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 16

Object: To determine the contact toxicity of Fitios against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.50%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten.

Exptal. Code: RPS 22-70 Computer Code: RPS-FIT-(109-111)

Table No. 16

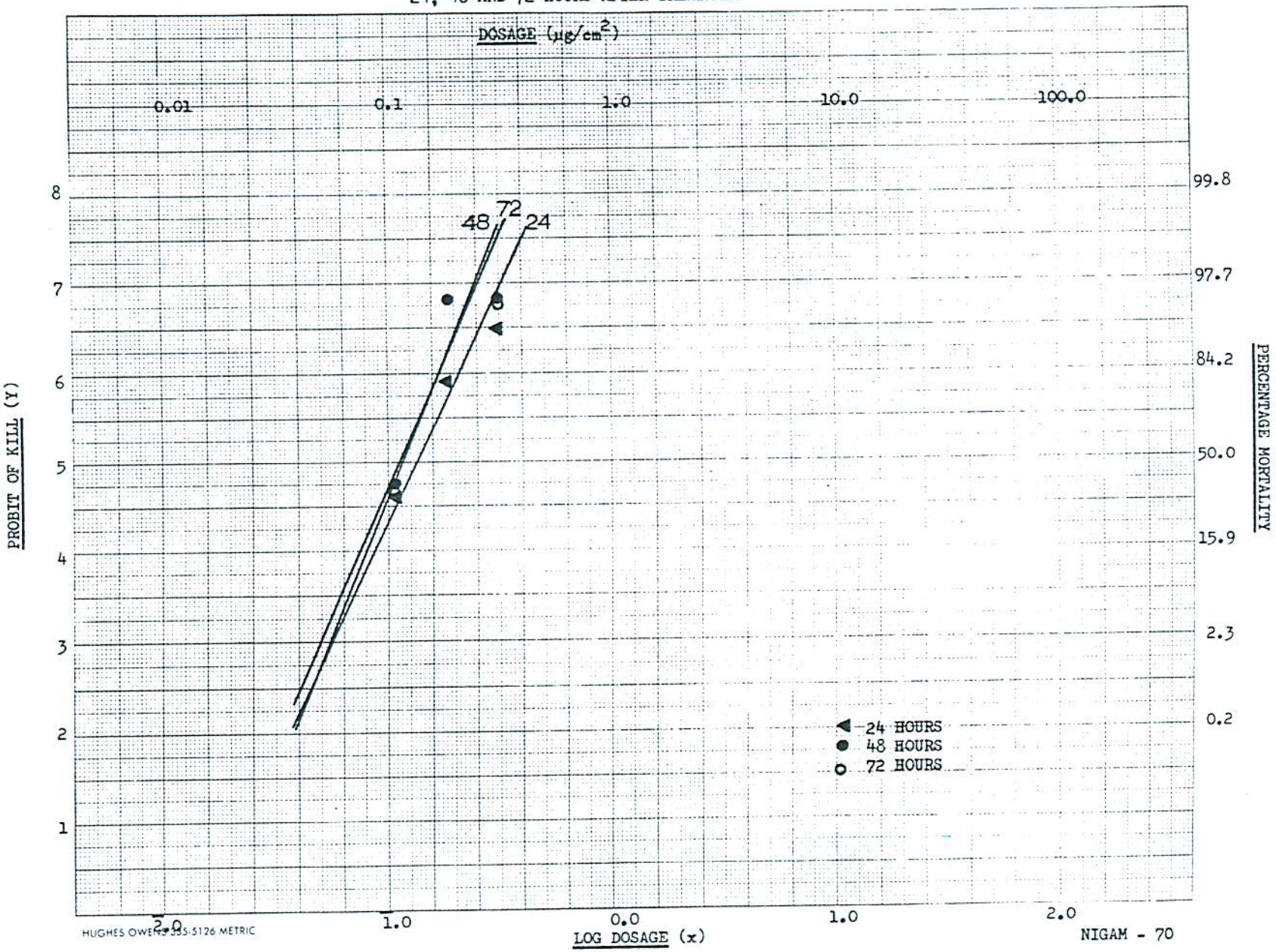
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.056	0/30	0	0	1/30	3	0	2/30	7	0
0.2	0.106	11/30	37	34	13/30	43	39	13/30	43	37
0.4	0.186	24/29	83	82	28/29	97	96	29/29	100	100
0.6	0.325	28/30	93	93	29/30	97	96	29/30	97	96
0.8	0.403	30/30	100	100	30/30	100	100	30/30	100	100
1.0	0.509	30/30	100	100	30/30	100	100	30/30	100	100
Control		1/30	3		2/30	7		3/30	10	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	5.14	.13	.11-.15	.28	.23-.38
48 hours	6.06	.12	.33-01-.18	.22	.15-11.07
72 hours	5.98	.12		.22	

Remarks: The regression lines are given in fig. 16.

FIG. 16. Ld-p LINES OF FITIOS AGAINST FOURTH INSTAR NEODIPRION LECONTEI(FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 17

Object: To determine the contact toxicity of Pyrocide against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.10%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 29-70 Computer Code: RPS-PYR-(121-123)

Table No. 17

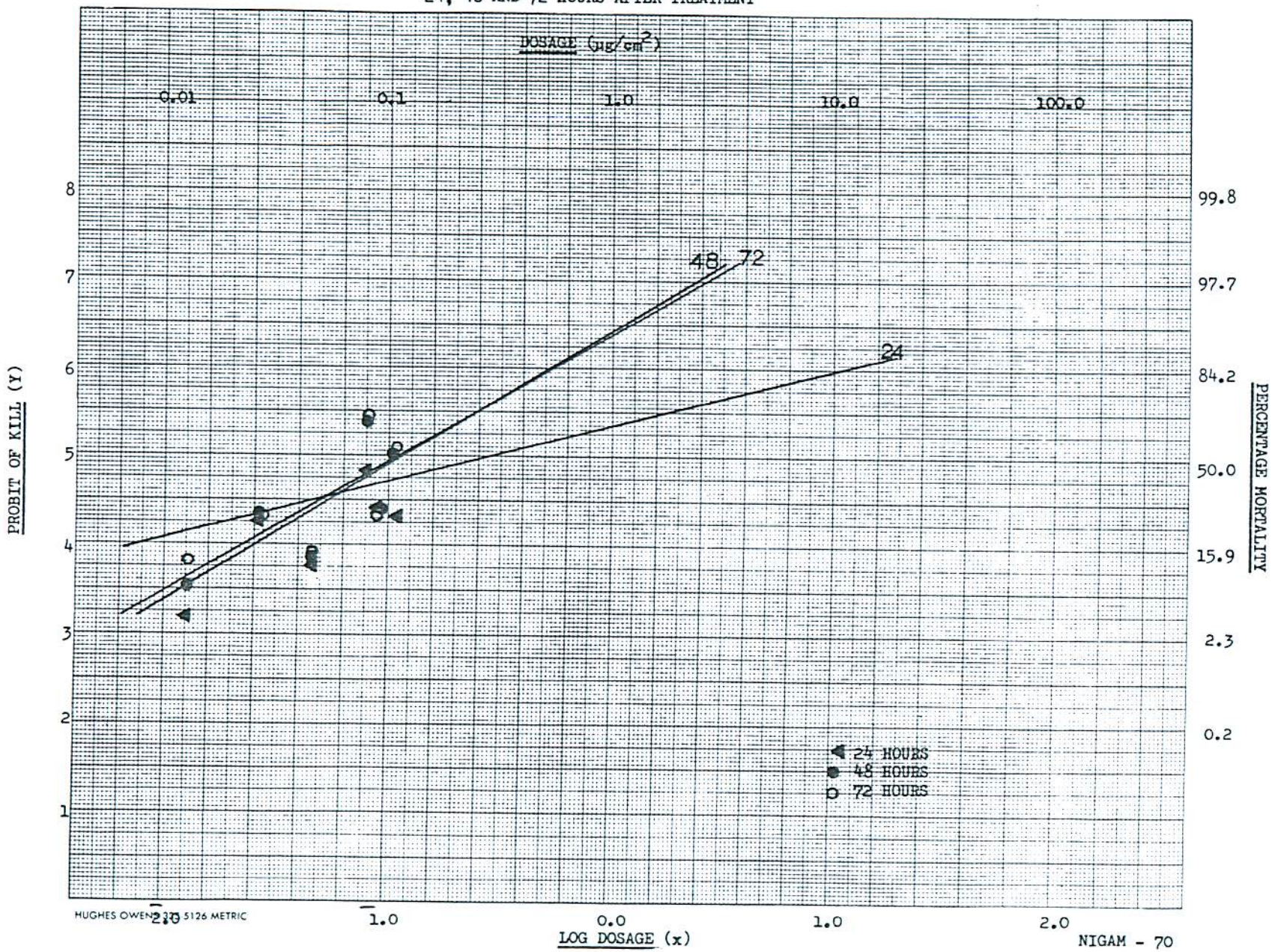
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.013	3/30	10	4	4/30	13	7	6/30	20	11
0.2	0.026	8/30	27	21	9/30	30	25	9/30	30	22
0.4	0.047	5/30	17	11	5/30	17	11	6/29	21	12
0.6	0.081	14/30	47	43	20/30	67	64	21/30	70	67
0.8	0.089	9/28	32	27	9/28	32	27	9/28	32	25
1.0	0.110	9/30	30	25	16/30	53	50	17/30	57	52
Control		2/30	7		2/30	7		3/30	10	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	1.06	.29		10.36	
48 hours	1.51	.11		1.42	
72 hours	1.45	.11		1.56	

Remarks: The regression lines are given in fig. 17.

FIG. 17. Ld-p LINES OF PYROCIDE AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 18

Object: To determine the contact toxicity of Imidan against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 0.50%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 19-70 Computer Code: RPS-IMI-(103-105)

Table No. 18

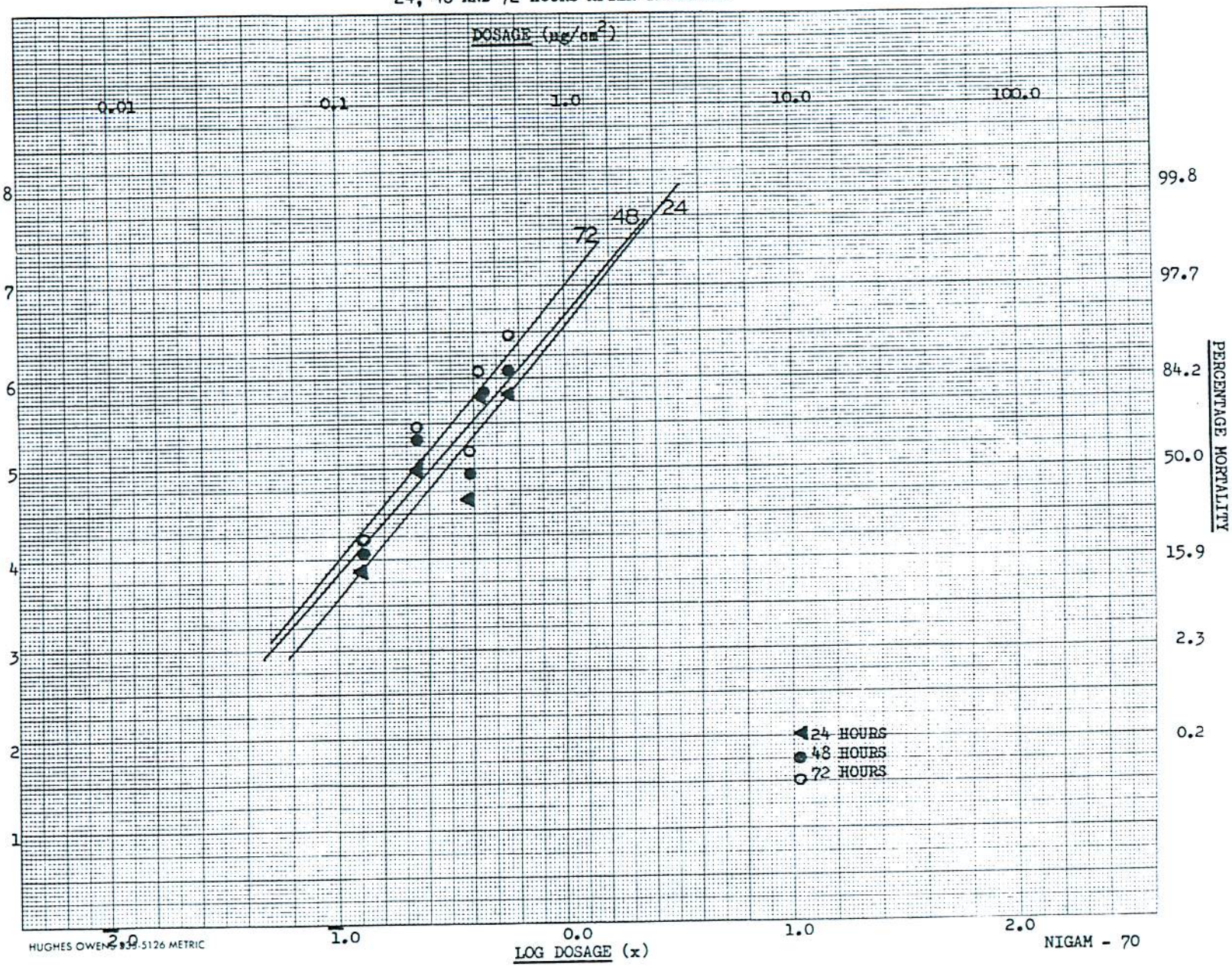
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.068	0/30	0	0	1/30	3	0	2/30	7	0
0.2	0.126	4/30	13	13	6/30	20	17	8/30	27	21
0.4	0.222	15/30	50	50	19/30	63	62	21/30	70	68
0.6	0.381	11/30	37	37	15/30	50	48	18/30	60	57
0.8	0.430	24/30	80	80	24/30	80	79	26/30	87	86
1.0	0.568	24/30	80	80	26/30	87	86	28/30	93	93
Control		0/30	0		1/30	3		2/30	7	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	2.97	.30	.59-01-2.86	1.08	.50-.17+13
48 hours	2.88	.26	.24-01-.67	.95	.47-.11+08
72 hours	3.10	.22		.75	

Remarks: The regression lines are given in fig. 18.

FIG. 18. Ld-p LINES OF IMIDAN AGAINST FOURTH INSTAR NEODIPRION LECONTEI(FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 19

Object: To determine the contact toxicity of DDT against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 5.00%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 18-70 Computer Code: RPS-DDT (100-102)

Table No. 19

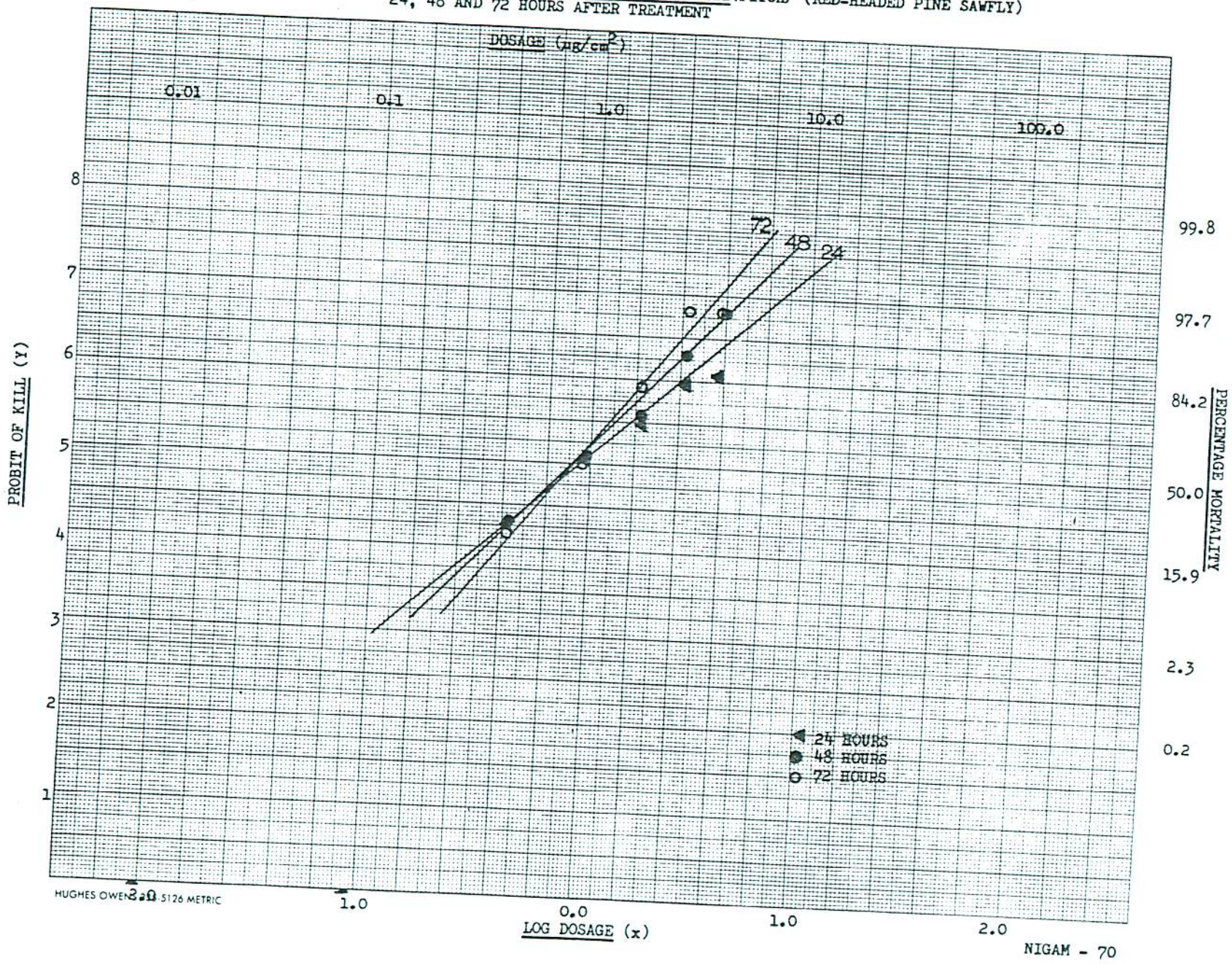
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.420	7/30	23	23	7/30	23	23	7/30	23	21
0.2	0.940	16/30	53	53	16/30	53	53	16/30	53	52
0.4	1.689	20/30	69	69	21/29	72	72	24/29	83	82
0.6	2.681	25/30	83	83	27/30	90	90	29/30	97	97
0.8	3.819	25/29	86	86	28/29	97	97	28/29	97	96
1.0	4.680	30/30	100	100	30/30	100	100	30/30	100	100
Control		0/29	0	0	0/29	0		1/29	3	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	2.20	.92	.67-1.16	5.13	3.63-9.07
48 hours	2.67	.86	.65-1.06	3.54	2.67-5.46
72 hours	3.11	.84	.64-1.02	2.83	2.19-4.19

Remarks: The regression lines are given in fig. 19.

FIG. 19. Ld-p LINES OF DDT AGAINST FOURTH INSTAR NEODIPRION LECONTEI(FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 20

Object: To determine the contact toxicity of Allethrin against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 2.50%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 30-70 Computer Code: RPS-ALL-(124-126)

Table No. 20

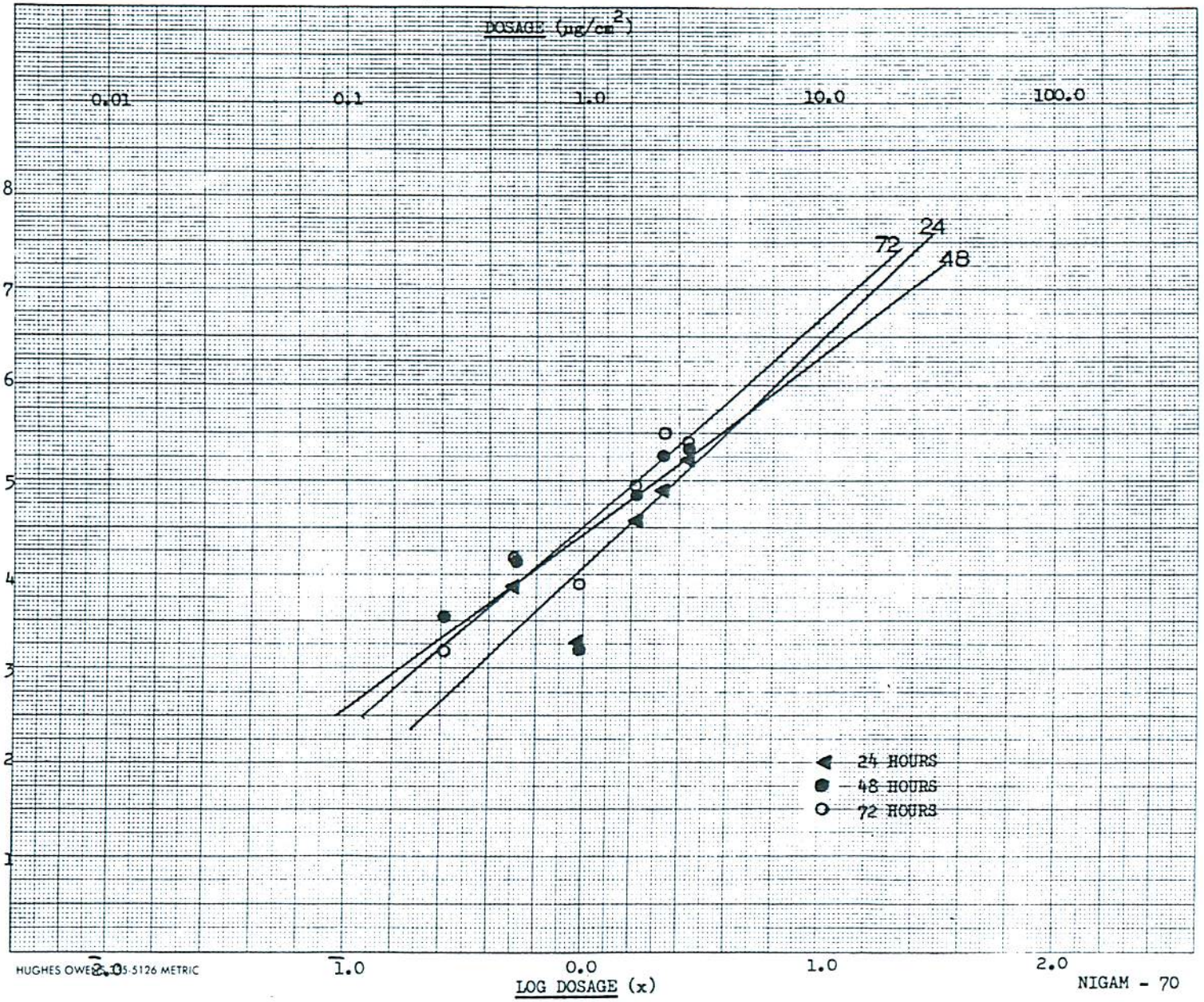
Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.254	0/29	0	0	2/29	7	7	2/29	7	3
0.2	0.508	4/30	13	13	6/30	20	20	7/30	23	20
0.4	0.983	1/30	3	3	1/30	3	3	5/30	17	14
0.6	1.715	10/30	33	33	13/30	43	43	15/30	50	48
0.8	2.186	14/30	47	47	18/30	60	60	21/30	70	69
1.0	2.748	17/29	59	59	18/29	62	62	19/29	66	64
Control		0/29	0		0/28	0		1/28	4	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	2.38	2.50	1.98-3.64	12.24	6.82-42.43
48 hours	1.87	2.11		16.04	
72 hours	2.18	1.75	1.38-2.35	9.92	5.65-33.43

Remarks: The regression lines are given in fig. 20.

FIG. 20. Ld-p LINES OF ALLETHRIN AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT



EXPERIMENT NO. 21

Object: To determine the contact toxicity of Pyrix 20 against fourth instar Red-Headed Pine Sawfly larvae.

Plan of Experiment:

Treatment: Seven (six rates of application - 0.1, 0.2, 0.4, 0.6, 0.8, 1.0 gpa and control)

Concentration of insecticide: 3.0%

Replications: Three

No. of larvae per treatment: Thirty

Total No. of larvae utilized: Two hundred and ten

Exptal Code: RPS 31-70 Computer Code: RPS-PRX-(127-129)

Table No.21

Insecticide		Mortality Counts After								
		24 Hours			48 Hours			72 Hours		
gpa	Dosage ug/cm^2	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.	D/T	% Mort.	Corr. Mort.
0.1	0.329	3/30	10	7	3/30	10	4	5/30	17	7
0.2	0.639	3/30	10	7	4/30	13	7	5/30	17	7
0.4	1.190	11/30	37	34	13/30	43	39	15/30	50	44
0.6	1.954	7/30	23	21	11/30	37	32	12/31	39	32
0.8	2.441	14/30	47	45	16/30	53	50	18/30	60	56
1.0	3.099	19/30	63	62	23/30	77	75	25/30	83	81
Control		1/30	3		2/30	7		3/30	10	

Findings: The summary of probit analysis is as follows:

Period	b	LD 50 ug/cm^2	FL	LD 95 ug/cm^2	FL
24 hours	1.86	2.84	2.12-9.47	21.84	9.47-200.4
48 hours	2.40	2.14	1.70-2.87	10.34	5.93-40.46
72 hours	2.42	1.92	1.51-2.51	9.17	5.40-33.99

Remarks: The regression lines are given in fig. 21.

FIG. 21. Ld-p LINES OF PYRIX 20 AGAINST FOURTH INSTAR NEODIPRION LECONTEI(FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT

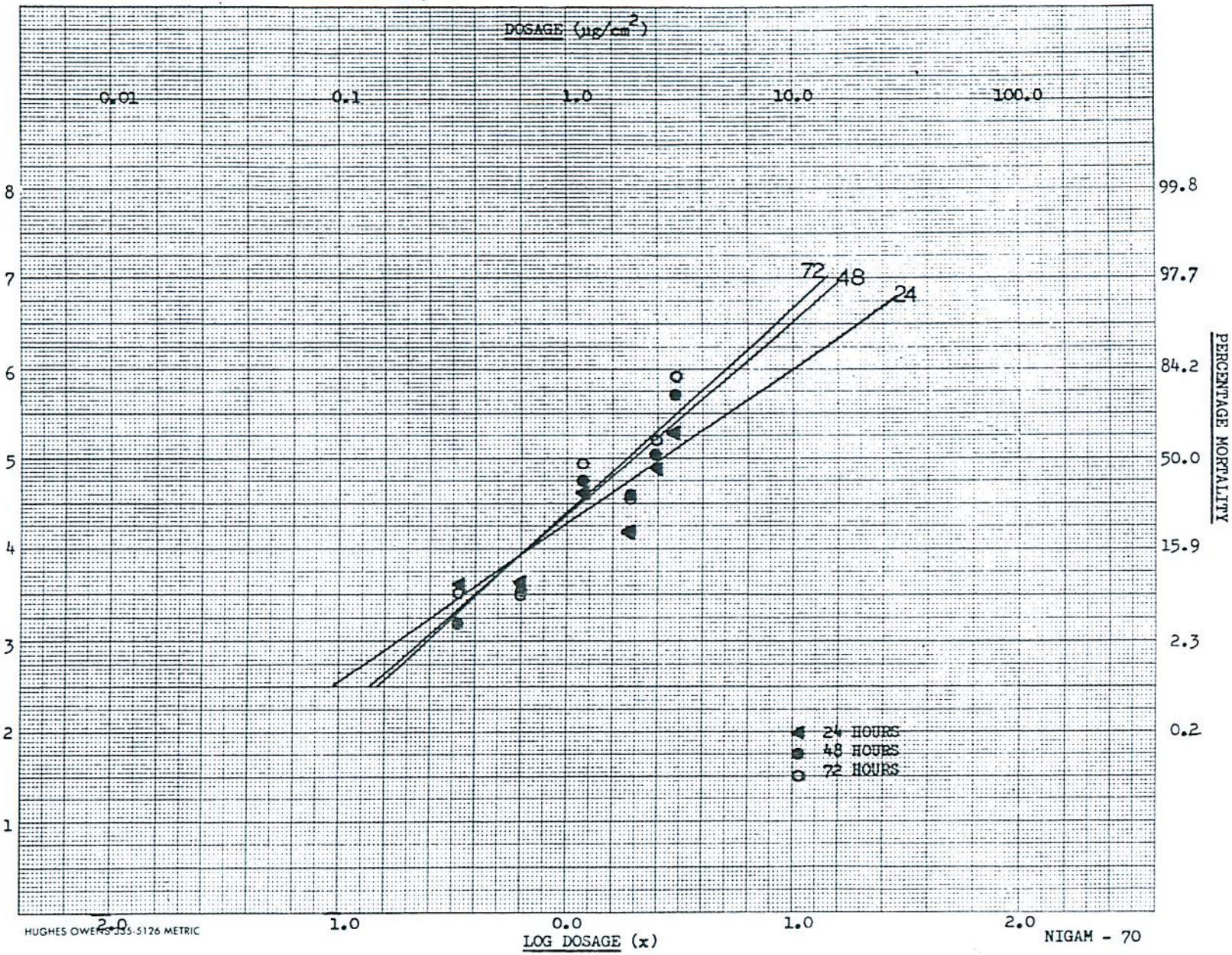


Table 22: Toxicity of Insecticides to Fourth Instar Neodiprion lecontei (Fitch) at 24 Hours after Treatment

Insecticide	LD 50 ug/cm^2	Fiducial Limits	Relative Potency	Toxicity Index	LD 95 ug/cm^2	Fiducial Limits	Relative Potency
Carbofuran	.006	.003- .009	2.67	267	.031	.023- .062	1.16
Matacil (Aminocarb)	.009	.008- .010	1.78	178	.019	.016- .024	1.89
Cidial	.010	.009-.012	1.60	160	.028	.023- .039	1.29
Bayer 77488	.014	.012- .016	1.14	114	.031	.026- .041	1.16
Fenitrothion (Sumithion)	.016	.013- .019	1.00	100	.036	.029- .052	1.00
Methomyl	.017	.014- .021	.94	94	.047	.037- .066	.77
Baygon (Propoxur)	.020	-	.80	80	.061	-	.59
S4084 (Cyanox)	.024	.008- .042	.67	67	.058	.036- .81	.62
Dursban	.030	.026- .034	.53	53	.057	.048- .073	.63
Surecide	.047	.041- .054	.34	34	.100	.085- .13	.36
Dupont 1642	.058	-	.28	28	.140	-	.26
Hopcide	.073	.064- .084	.22	22	.190	.140- .290	.19
CIBA 17974	.088	-	.18	18	.200	-	.18
F-6957	.100	.063- .510	.16	16	1.070	.290-85.89	.03
Dylox (Trichlorfon)	.099	.085- .110	.16	16	.250	.20 - .34	.14
Fitios	.130	.110- .150	.12	12	.280	.23 - .38	.13
Pyrocide	.290	-	.06	6	10.36	-	.003
Imidan	.300	.059-2.86	.05	5	1.08	.50- .17+13	.03
DDT	.920	.67 -1.16	.02	2	5.13	3.63-9.07	.007
Allethrin	2.50	1.98 -3.64	.006	.6	12.24	6.82-42.43	.003
Pyrix 20	2.84	2.12 -9.47	.006	.6	21.84	9.47-200.4	.002

FIG. 22. COMPARATIVE Ld-p LINES OF 9 ORGANOPHOSPHORUS INSECTICIDES AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH)(RED-HEADED PINE SAWFLY) FOR 24 HOURS AFTER TREATMENT

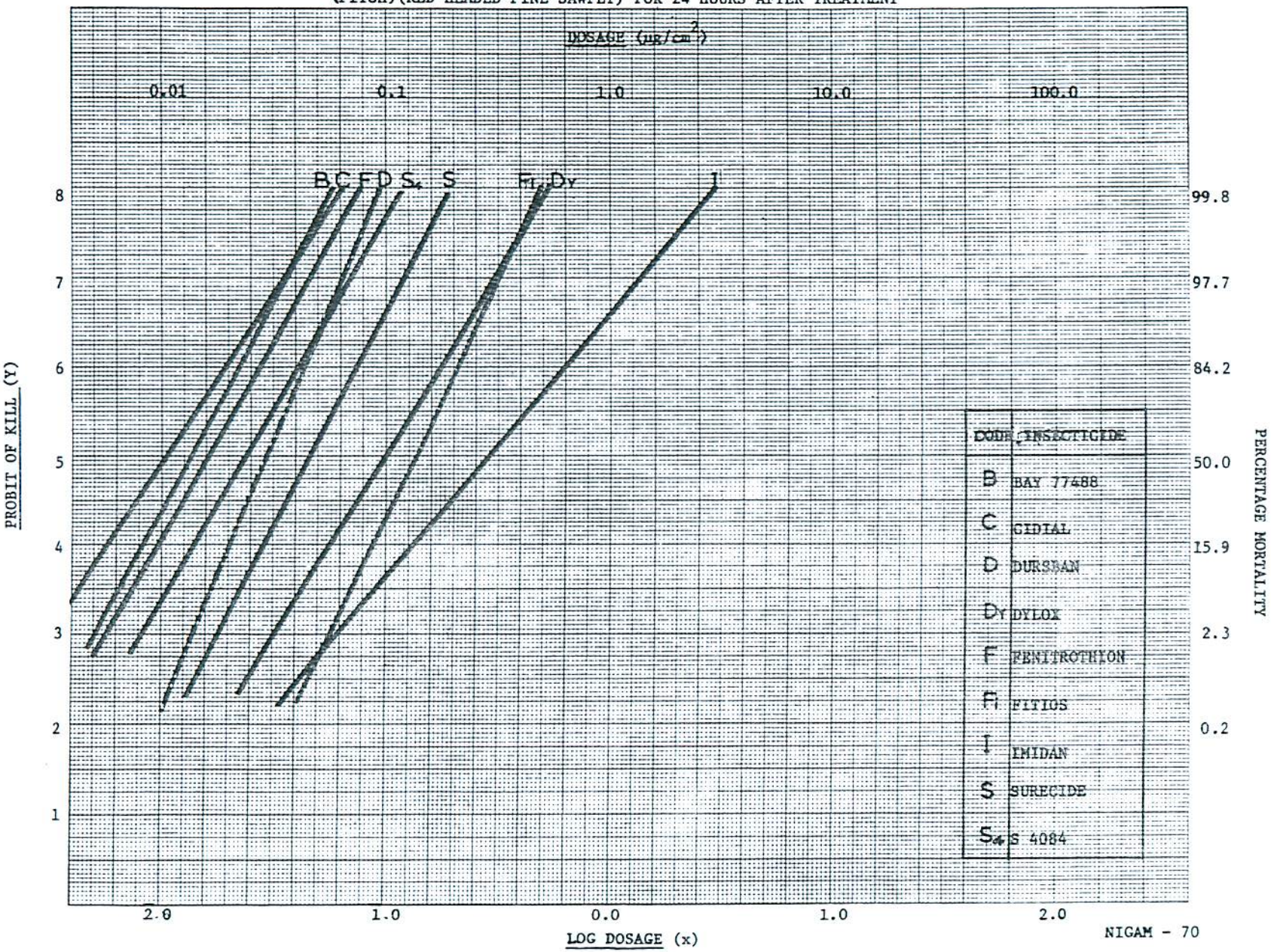


FIG. 23. COMPARATIVE Ld-p LINES OF 7 CARBAMATE AND 4 PYRETHRIN INSECTICIDES AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH)(RED-HEADED PINE SAWFLY) FOR 24 HOURS AFTER TREATMENT

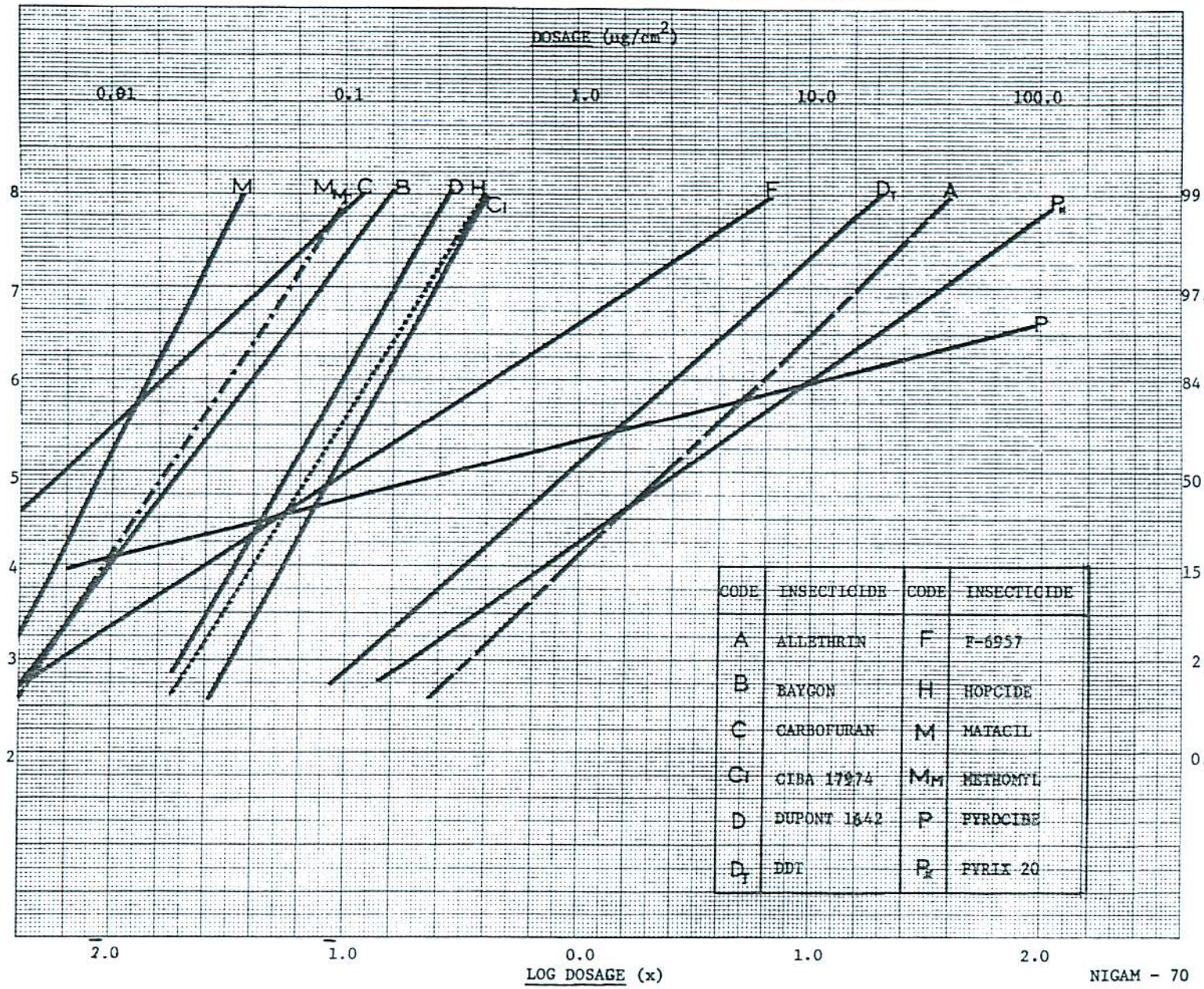


Table 23: Toxicity of Insecticides to Fourth Instar Neodiprion lecontei (Fitch) at 48 Hours after Treatment

Insecticide	LD 50 ug/cm^2	Fiducial Limits	Relative Potency	Toxicity Index	LD 95 ug/cm^2	Fiducial Limits	Relative Potency
Carbofuran	.007	.004- .009	2.29	229	.025	.019- .044	1.44
Matacil (Amihocarb)	.008	.007- .009	2.00	200	.019	.016- .025	1.89
Cidial	.009	.007- .010	1.78	178	.027	.021- .039	1.33
Bayer 77488	.016	.012- .018	1.00	100	.031	.026- .040	1.16
Fenitrothion (Sumithion)	.016	.012- .019	1.00	100	.036	.028- .054	1.00
Methomyl	.016	.012- .019	1.00	100	.045	.036- .066	.80
Baygon (Propoxur)	.019	-	.84	84	.056	-	.64
S 4084 (Cyanox)	.022	.011- .035	.73	73	.055	.035- .270	.65
Dursban	.026	.019- .037	.62	62	.052	.037- .130	.69
Surecide	.044	.038- .050	.36	36	.078	.066- .100	.46
Dupont 1642	.053	-	.30	30	.130	-	.28
Hopcide	.067	.058- .078	.24	24	.190	.140- .300	.19
F-6957	.066	.048- .130	.24	24	.40	.18 -3.22	.09
CIBA 17974	.070	-	.23	23	.27	-	.13
Dylox (Trichlorfon)	.090	.077- .100	.18	18	.25	.200- .340	.14
Pyrocide	.110	-	.15	15	1.42	-	.03
Fitios	.120	.033- .180	.13	13	.22	.15 -11.07	.16
Imidan	.260	.024- .670	.06	6	.95	.47 -.11+08	.04
DDT	.860	.65 -1.06	.019	2	3.54	2.67 -5.46	.01
Allethrin	2.11	-	.008	0.8	16.04	-	.002
Pyrix 20	2.14	1.70 -2.87	.007	0.7	10.34	5.93 -40.46	.003

FIG. 24. COMPARATIVE Ld-p LINES OF 9 ORGANOPHOSPHORUS INSECTICIDES AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) FOR 48 HOURS AFTER TREATMENT

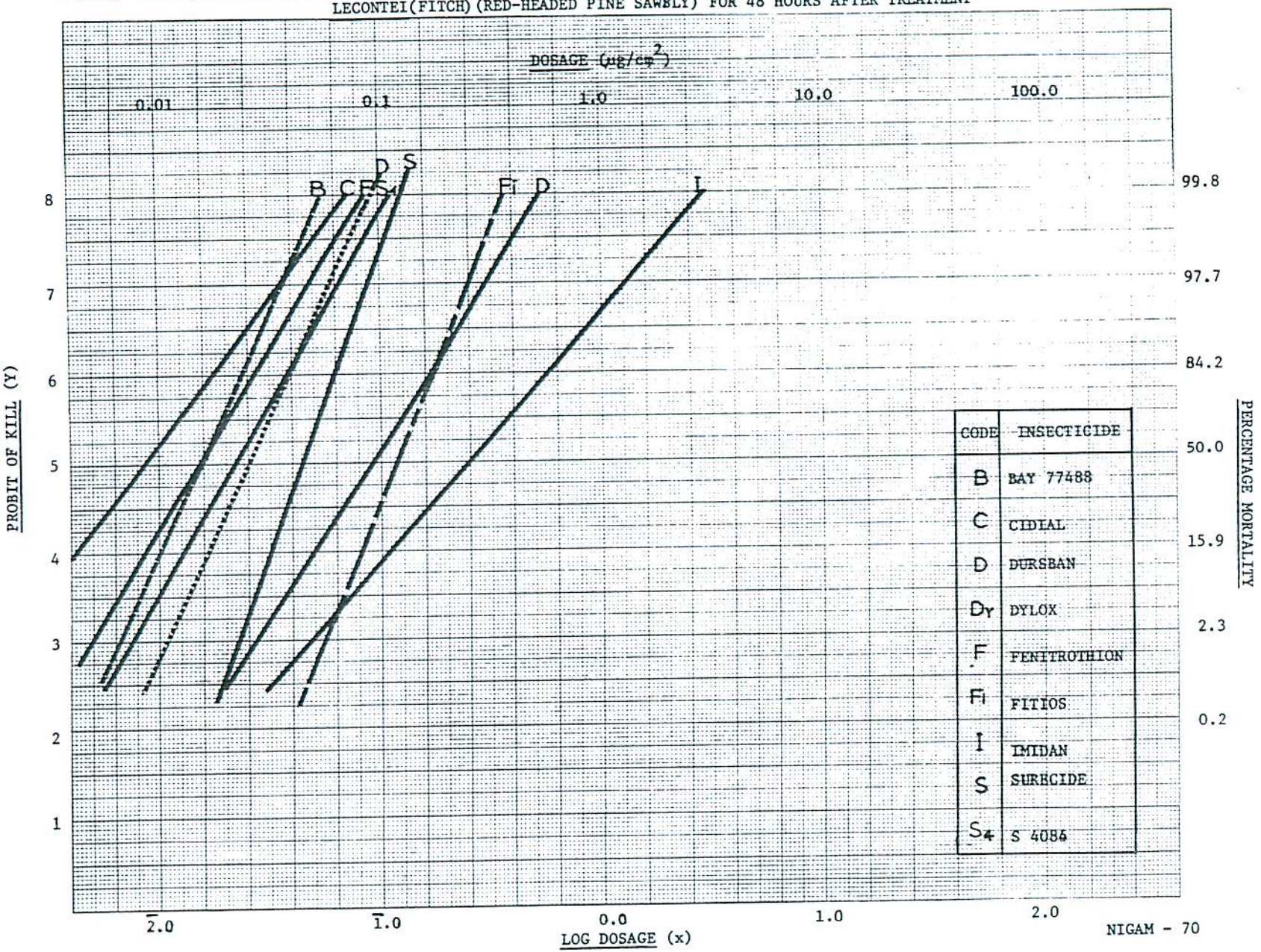


FIG.25. COMPARATIVE Ld-p LINES OF 7 CARBAMATE AND 4 PYRETHRIN INSECTICIDES AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) FOR 48 HOURS AFTER TREATMENT

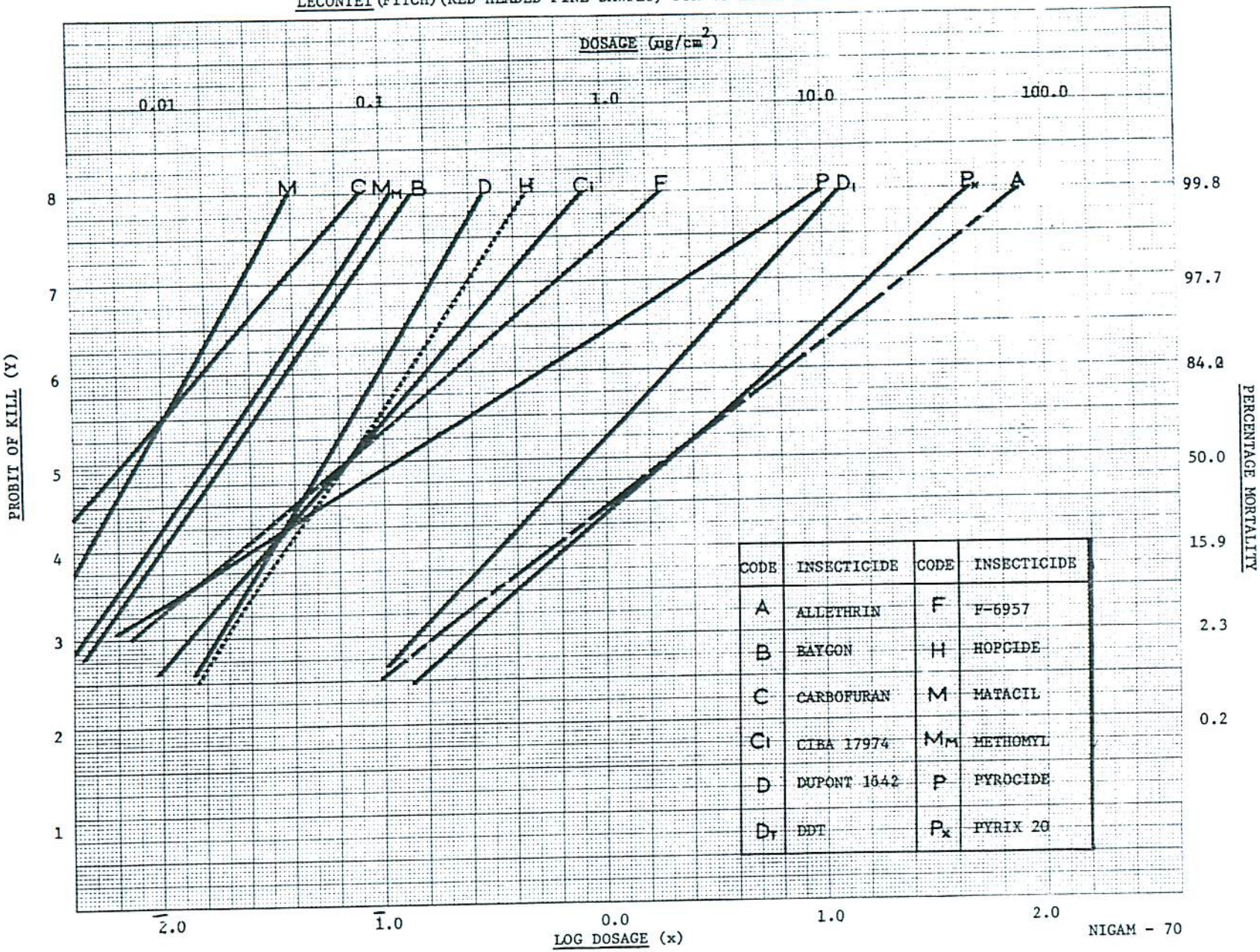


Table 24: Toxicity of Insecticides to Fourth Instar Neodiprion lecontei (Fitch) at 72 Hours after Treatment

Insecticide	LD 50 ug/cm^2	Fiducial Limits	Relative Potency	Toxicity Index	LD 95 ug/cm^2	Fiducial Limits	Relative Potency
Carbofuran	.007	.003- .009	2.14	214	.025	.019- .044	1.36
Matacil (Aminocarb)	.008	.007- .009	1.88	188	.019	.016- .025	1.79
Cidial	.009	.005- .012	1.67	167	.027	.021- .041	1.26
Methomyl	.013	.010- .016	1.15	115	.031	.025- .044	1.10
Fenitrothion (Sumithion)	.015	.012- .018	1.00	100	.034	.027- .050	1.00
Baygon (Propoxur)	.018	-	.83	83	.048	-	.71
Bayer 77488	.019	-	.79	79	.030	-	1.13
S 4084 (Cyanox)	.021	.017- .025	.71	71	.051	.041- .072	.67
Dursban	.026	.017- .037	.58	58	.052	.036- .150	.65
Surecide	.040	.035- .046	.38	38	.076	.063- .100	.45
Dupont 1642	.048	.025- .073	.31	31	.110	.071- .460	.31
F-6957	.049	.040- .068	.31	31	.200	.120- .600	.17
CIBA 17974	.058	-	.26	26	.160	-	.21
Hopcide	.062	.053- .073	.24	24	.200	.150- .330	.17
Dylox (Trichlorfon)	.088	.075- .100	.17	17	.230	.190- .310	.15
Pyrocide	.110	-	.14	14	1.56	-	.02
Fitios	.120	-	.13	13	.22	-	.15
Imidan	.220	-	.07	7	.75	-	.05
DDT	.84	.640-1.02	.02	2	2.83	2.19 -4.19	.01
Allethrin	1.75	1.38 -2.35	.01	1	9.92	5.65-33.43	.003
Pyrix 20	1.92	.151-2.51	.01	1	9.17	5.40-33.99	.004

FIG. 26 COMPARATIVE Ld-p LINES OF 9 ORGANOPHOSPHORUS INSECTICIDES AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH)(RED-HEADED PINE SAWFLY) FOR 72 HOURS AFTER TREATMENT

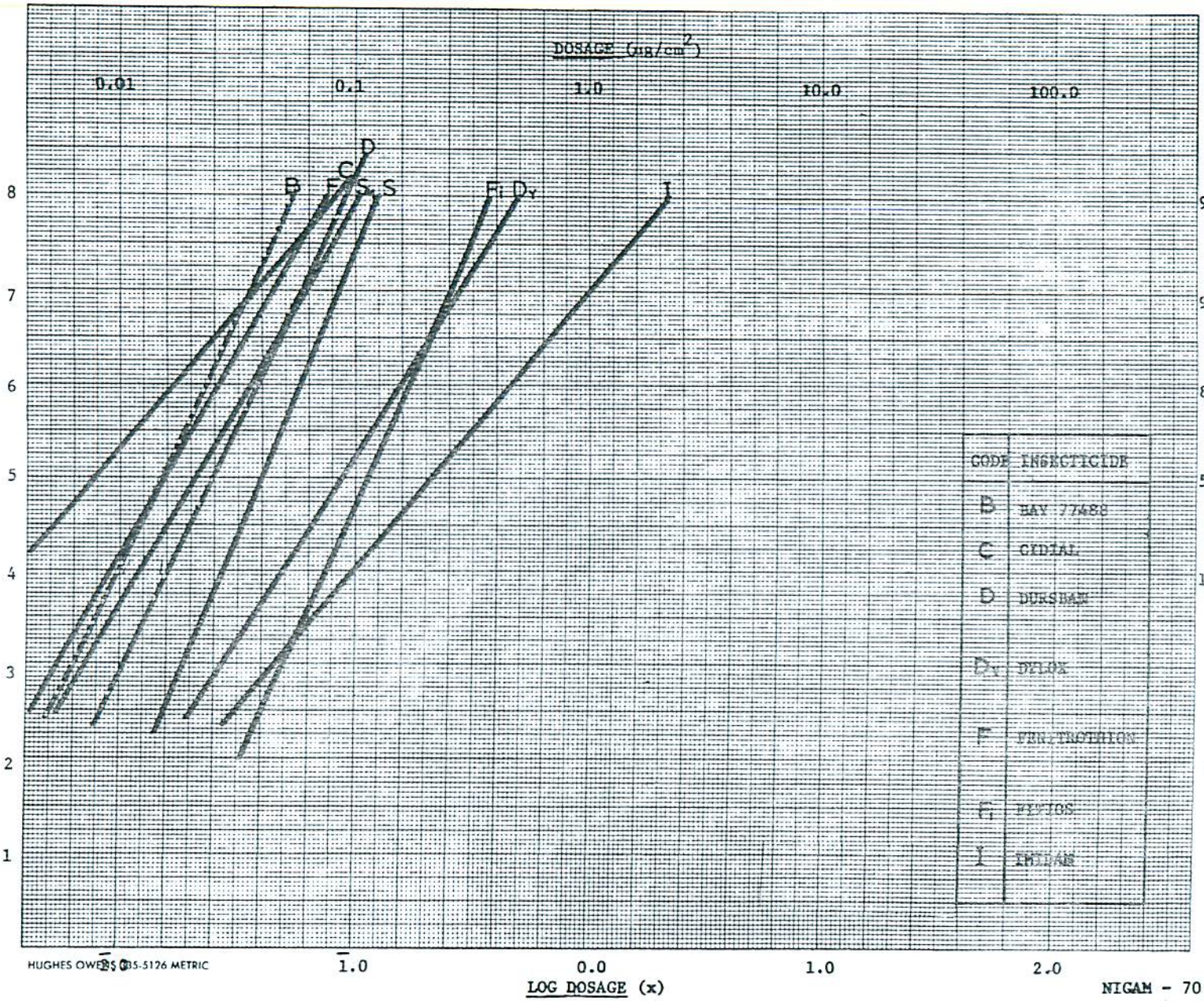
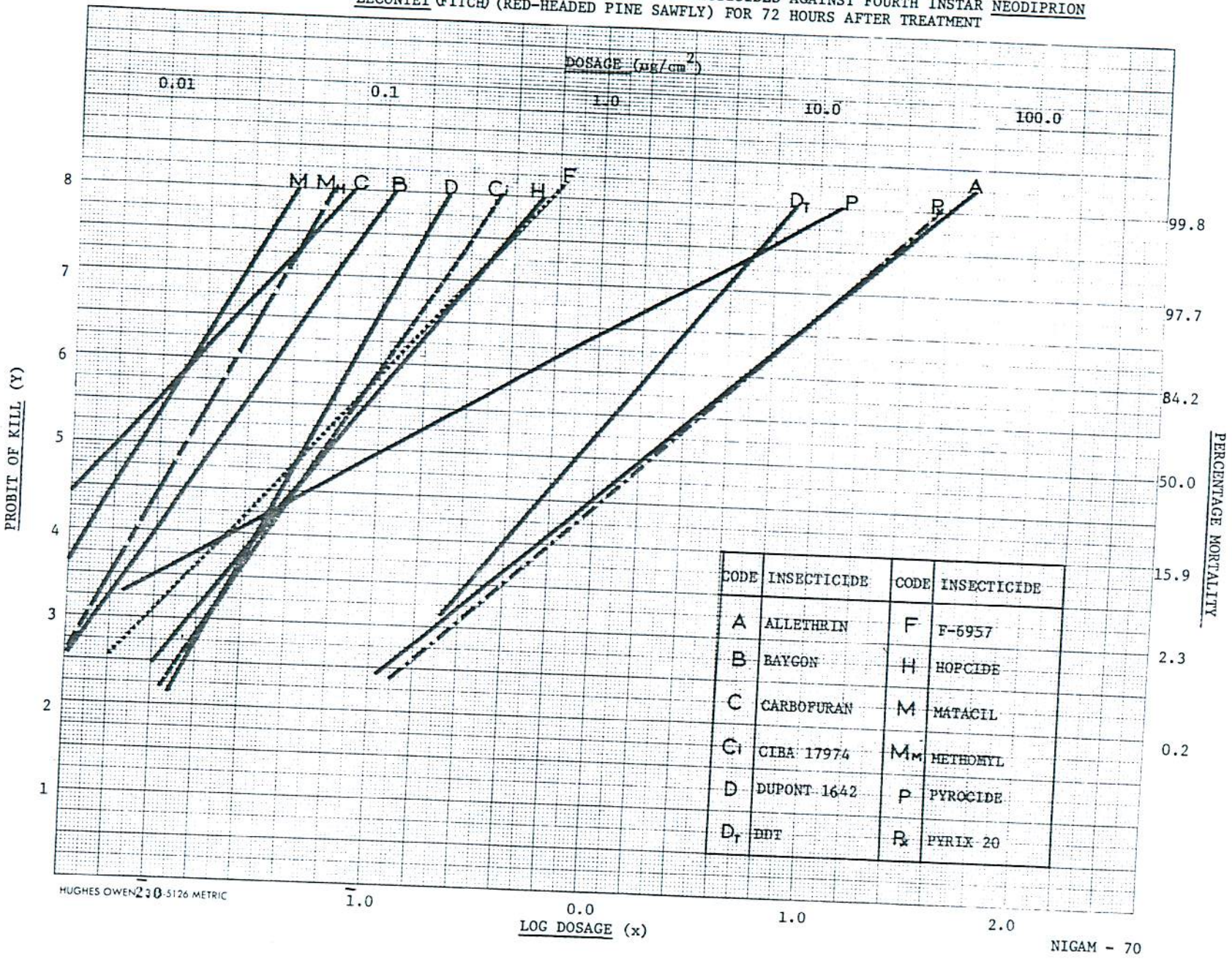


FIG.27 . COMPARATIVE Ld-p LINES OF 7 CARBAMATE AND 4 PYRETHRIN INSECTICIDES AGAINST FOURTH INSTAR NEODIPRION LECONTEI (FITCH) (RED-HEADED PINE SAWFLY) FOR 72 HOURS AFTER TREATMENT



CODE	INSECTICIDE	CODE	INSECTICIDE
A	ALLETHRIN	F	F-6957
B	BAYGON	H	HOPCIDE
C	CARBOFURAN	M	MATACIL
C_I	CIBA 17974	M_M	METHOMYL
D	DUPONT 1642	P	PYROCIDE
D_T	DDT	R_X	PYRIX 20

Table 25: List of insecticides and sources

Insecticide	Type	Chemical Name	Source
D-Trans-Allethrin 90% E.C.	Synethetic ester	2-allyl-4-hydroxy-3 methyl-2-cyclopenten-1-one ester of 2,2-dimethyl-3-(2-methylpropenyl)-cyclopropanecarboxylic acid	McLaughlin, Gormley King Co.
Bayer 77488 (Phoxim) 73% tech	Organo-phosphorus	phenylglyoxylonitrile oxime O,O-diethyl phosporothioate	Chemagro
Baygon^{R} (Propoxur) 13.9% E.C.	Carbamate systemic	o-isopropoxphenyl methyl-carbamate	Chemagro
CIBA 17974 40% E.C.	Carbamate		Ciba-Geigy
Cidial^{R} 50% E.C.	Organo-phosphorus	ethyl mercaptophenylacetate O,O-dimethyl phosphorodithioate	Ciba-Giegy
DDT 99%	Chorinated hydrocarbon	1,1,1-trichloro-2,2-bis(p-chlorophenyl) ethane	Math. Col. & Bell
DuPont 1642 99% tech.	Carbamate	S-methyl N-(carbamoyloxy) thioacetimidate	DuPont
Dursban^{R} 48% E.C.	Organo-phosphorus	O,O-diethyl O-(3,5,6-trichloro-2-pyridyl) phosphorothioate	Dow
Dylox^{R} (Trichlorfon) 39% E.C.	Organo-phosphorus	dimethyl (2,2,2-trichloro-1-hydroxyethyl) phosphonate	Chemagro
F-6957 (Stabilized pyrethrins) 2.4% Sol.	Botanical	Plant extract	McLaughlin, Gormley King Co.
Fitios^{R} B/77 20% E.C.	Organo-phosphorus systemic	S- [(ethylcarbamoyl) methyl] O O,(-dimethyl phosphorodithioate	Bombrini
Hopcide^{R} 20% E.C.	Carbamate	o-chlorophenyl methylcarbamate	Kumiai
Imidan^{R} 22.4% E.C.	Organo-phosphorus	O,O-dimethyl S-phthalimido-methyl phosphorodithioate	Stauffer
Matacil^{R} (Aminocarb) 34% Sol.	Carbamate contact	4-dimethylamino-m-tolyl methylcarbamate	Chemagro

Insecticide	Type	Chemical Name	Source
Methomyl 99% tech.	Carbamate	methyl-N- [(methylcarbamoyl) oxy] thioacetimidate	DuPont
NIA 10242 (Carbofuran) (Furadan®) 98% tech.	(Technical) Carbamate systemic	2,3 dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate	Niagara Chem.
Pyrix 20 20% E.C.	Pyrethrin extract	mixture of four compounds, pyrethrin I, pyrethrin II, cinerin I, cinerin II	Chemical Insecticide Corporation
Pyrocide 175 20% E.C.	Pyrethrin extract	"	McLaughlin, Gormley King Co.
S4084 (Cyanox) 40% E.C.	Organo-phosphorus	O-p-cyanophenyl O,O-dimethyl phosphorothioate	Sumitomo
Sumithion® (Fenitrothion) 50% E.C.	Organo-phosphorus	O,O-dimethyl O-(4-nitro-m-tolyl) phosphorothioate	Sumitomo
Surecide® 25% E.C.	Organo-phosphorus	O-p-cyanophenyl O-ethyl phenylphosphonothioate	Sumitomo

E.C. - Emulsifiable concentrate

Sol. - Solution

tech. - technical grade

FIG. 19. Ld-p LINES OF DDT AGAINST FOURTH INSTAR NEODIPRION LECONTEI(FITCH) (RED-HEADED PINE SAWFLY) 24, 48 AND 72 HOURS AFTER TREATMENT