THE EFFECTS OF FENITROTHION ON NON-TARGET ARTHROPODS

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TABLE OF CONTENTS

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LIST OF TABLES

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LIST OF FIGURES

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ABSTRACT

Population studies on non-target arthropods were conducted at selected sites during the 1973 Blackheaded Budworm Control Operation on northern Vancouver Island. Three classes of arthropods were monitored. The Insecta, represented by 10 Orders, were the most numerous. A significant reduction in numbers of some Orders of non-target insects was observed shortly after spray application. There was indication that this could be attributed to fenitrothion. Possible long term effects were not investigated.

1. INTRODUCTION

Application of a pesticide to a habitat sometimes not only controls the target pests but also affects non-target species. During the 1973 Blackheaded Budworm Operation a monitoring program was conducted to investigate the impact of fenitrothion on non-target arthropods. In the following report results obtained are presented and discussed.

2. MATERIALS AND METHODS

2.1. Sampling Locations:

Specimens were collected from ten locations (Figure 1). A short description of each site follows:

(a) Neroutsos Inlet; coastal saline estuary, edge of spruce and hemlock forest, grasses, etc., along stream banks:

(i) Site No. 1 -- Teeta Creek Inlet (Control).

(ii) Site No. 2 -- Near shoreline of Neroutses inlet, ½ mile north of Cayuse Creek Inlet (Control).

(iii) Sites No. 3 and 4 -- Confluence of Colonial and Cayeghle Creeks (Treated).

(b) Keogh Lake area; higher elevation (500' - 1000'), consisting of juvenile alder, ferns, grasses, salmonberry, edges of spruce and hemlock forest, etc., along creeks:

(iv) Sites No. 5, 6, and 7 -- Second growth north of Keogh Lake (Controls).

(v) Site No. 8 -- Mature forest, north of Three Isle Lake (Treated).

(vi) Site No. 9 -- Mature forest, north of Maynard Lake (Treated).

(vii) Site No. 10 -- Mature forest, north of Iron Lake (Treated).

2.2. Sampling Methods:

Two methods of sampling were employed, net-sweeping, and light trapping. Net-sweeping was carried out on grass and brush where walking was feasible. The sweep net consisted of a muslin bag with circular opening 14 inches in diameter. Sampling was conducted between 1000 and 1500 hours. Two hundred sweeps per sample were made along a distance of approximately 100 yards. One complete set of samples was taken on June 19,20-1973, one week prior to treatment. Post-spray samples were collected 5 - 12 hours after treatment on June 22, 1973. Ten samples were taken from the control and ten from the treated areas. All material collected was preserved in formalin and retained for identification and counts in the laboratory.

Two Rothamsted light traps were used to sample flying insects in one control plot (No. 1) and one treated plot (No. 4). They

were modified for operation with two HD-4D 12V Marine batteries; two units of 12V sealed beam (Volkswagen) were employed as the light emitting source. To protect the traps from rain, wind and large animals, they were placed in wooden sheds. The traps were operated from 2200 to 0800 hours for five consecutive nights -- 3 nights before (June 16, 17, 18- 1973) and 2 nights following the day of spraying (June 23, 24-1973).

3. RESULTS AND DISCUSSION

Tables 1 and 2 present the composition of arthropods obtained by net-sweeping and light trapping from control and treated plots. Three classes of arthropods were found in the sweep-net samples: Arachnida (spiders, ticks and mites), Diplopoda (millipedes) and Insecta (insects). Some Mollusca (slugs and snails) were also collected. Only the Insecta were caught in the light traps. The majority of the arthropods collected belonged to ten insect Orders.

The total number collected in the control plots (1, 2, 5, 6, 7) after spraying was twice that collected before spraying. This was due to large increases in numbers of the Arachnida and Diptera, even though populations of Diplopoda, Ephemeroptera, Hemiptera, Hymenoptera, Lepidoptera, Mollusca and Tricoptera decreased (Table 1).

In the treated plots (3, 4, 8, 9, 10) the post-spray population was approximately one third the pre-spray estimation. Most notable decrease

in numbers was in the Diptera, Ephemeroptera, Hemiptera, Hymenoptera, Lepidoptera and Trichoptera. An increase in numbers was recorded in the Arachnida, Mollusca, and Thysanoptera (Table 1).

Light trap catches of arthropods obtained after treatment were similar to those caught before treatment for both the control and treated plots (Table 2).

The most significant change in population post spraying was the Arachnida and Diptera. There was a 17 and 3 fold increase of Arachnida and Diptera respectively in Control plots. However, in the treated plots, the Arachnida only increased by a factor of 2.5, while the Diptera decreased by 69 percent. The apparent population explosion in the control could be ascribed to egg hatching in Arachnida and adult emergence from pupae in Diptera. The significantly smaller population increase in Arachnida and a reduction in Diptera in the treated plots could be attributed to the effects of fenitrothion since this chemical is claimed to be a selective acaricide and a contact insecticide, (Spencer, 1968; Martin, 1972; Krehm, 1973).

The populations of Mollusca and Thysanoptera experienced increases after spraying in treated plots. However, the total numbers of these two groups of arthropods were relatively small and hence might not reflect a reliable picture.

At Cayeghle Creek (with a large part of its watershed within the spray plots) some moribund adult dipteran and hymenopteran insects were observed drifing downstream approximately five hours after

spray application. Analyses carried out on samples of these insects by the Chemical Control Research Institute, Ottawa, yielded a residue of 0.20 ppm fenitrothion in the insect tissues. This represented a substantial amount of chemical residue, and therefore it must be assumed that the mortality of the insects collected from the stream was related to the spray. Aquatic organisms, particularly juvenile salmonid fishes, were observed feeding on these insects.

The reduction in numbers and mortality of some Orders of non-target insects following spray application of treated plots could be taken as an indication that fenitrothion had immediate short term effects on some groups of non-target arthropods. However, it is difficult at present to determine the extent of impact attributed to the insecticide. Weather changes, habitat variation, sampling techniques, natural mortality, emergence and migration of arthropods could also cause fluctuation in numbers. The possibility of long term effects of the chemical was not investigated.

4. SUMMARY AND CONCLUSION

Results from the present studies indicate that there was a significant reduction in the numbers of some Orders of non-target Arthropoda, particularly the arachnida and diptera, in the treated plots after insecticide application. Mortality of some diptera and hymenoptera attributed to fenitrothion was also noted at Cayeghle Creek shortly after one aerial chemical spraying.

5. ACKNOWLEDGEMENTS

The field work in this report could not have been carried out without the assistance of the Fisheries Service in two regards: (1) the services of Messrs. Robert Taylor and David Froese, and (2) the provision of transport and other logistic requirements. I am grateful to Mr. R.H. Kussat, my supervisor, and other staff of the Environmental Protection Service for their encouragement and useful comments on the project. I would also like to thank Dr. P.C. Oloffs of the Pestology Centre, Simon Fraser University, and Dr. J.R. Carrow of the Canadian Forestry Service, Victoria, for their valuable constructive suggestions in the manuscript.

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TABLE 15. Changes in Net-sweep Arthropod Populations in Unsprayed Plots and in Plots Sprayed with Fenitrothion.

ARTHROPODS[a]	CHECK PLOTS			SPRAYED PLOTS		
	Number Collected		Change[b]	Number Collected		Change[b]
	Pre-spray (June 19)	Post-spray (June 26)		Pre-spray (June 20)	Post-spray (June 26)	
Arachnida	19	329	17.32	85	226	2.54
Coleoptera	41	46	1.12	23	27	1.17
Diplopoda	4	1	-	1	0	-
Diptera	145	453	3.12	701	221	0.31
Ephemeroptera	3	1	-	2	1	-
Hemiptera	140	63	0.45	7975	2433	0.30
Hymenoptera	95	59	0.63	43	33	0.76
Lepidoptera	13	3	0.23	79	21	0.26
Neuroptera	1	0	-	1	1	-
Mollusca	3	2	-	1	2	-
Plecoptera	0	1	-	1	0	-
Thysanoptera	4	7	1.75	2	5	2.50
Trichoptera	5	2	0.40	3	1	-
Total Numbers[c]	473	967	2.04	8917	2941	0.33

a Immature and Adult stages

b Change - $\frac{\text{post-spray numbers}}{\text{pre-spray number}}$; >1 = increase <1=decrease; change involving populations less than 3 considered insignificant.

c Ten plots per sampling date.

TABLE 16: Changes in Light Trap Arthropod Populations in Unsprayed Plot and Plot Sprayed with Fenitrothion.

ARTHROPODS[a]	CHECK PLOT			SPRAYED PLOT		
	Number Collected		Change[b]	Number Collected		Change[b]
	Pre-spray	Post-spray		Pre-spray	Post-spray	
Coleoptera	1	1	-	0	0	-
Diptera	175	158	0.90	8	9	1.02
Hymenoptera	1	1	-	2	3	-
Trichoptera	3	3	-	1	1	-
Total Numbers[3]	180	163	0.91	11	13	1.18

a Adults only.

b Change = $\frac{\text{post-spray number}}{\text{pre-spray number}}$; >1 = increase, <1 = decrease; change involving populations less than 3 considered insignificant.

c Average number per night.

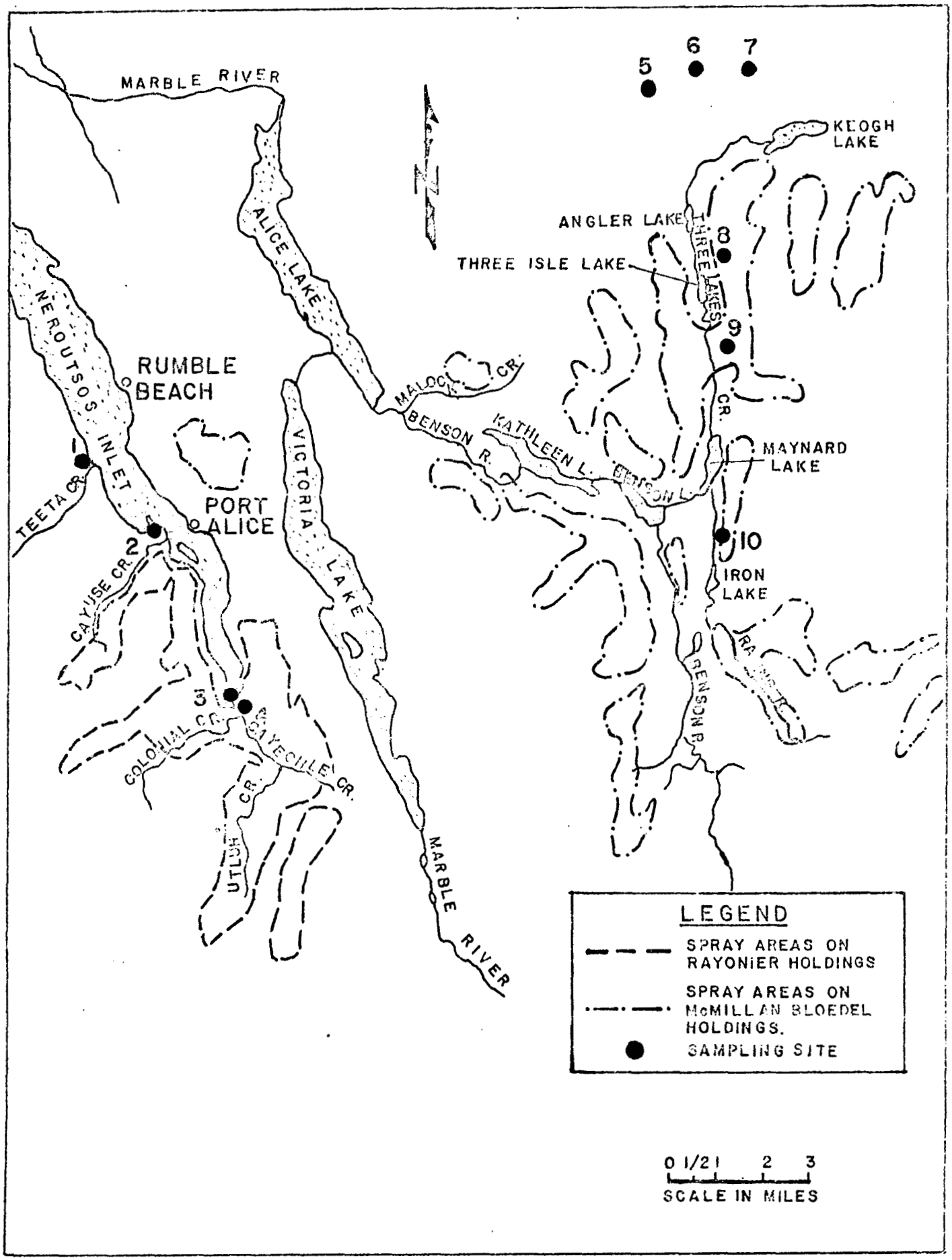

FIGURE 1.
LOCATIONS OF POPULATION SAMPLING OF NON-TARGET ARTHROPODS