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ANNUAL REPORT

of the

VERNON FOREST INSECT LABORATORY.

for the

Fiscal Year Ending March 31 - 1938

TABLE OF CONTENTS

Personnel

Ralph Hopping,	Entomologist in Charge
Geo. R. Hopping,	Assistant Entomologist
H. B. Leech,	Graduate Assistant
Kenneth Graham,	Graduate Assistant
Two Student Assistants (Seasonal)	
Miss Eleanor Eager,	Stenographer

INTRODUCTION

Herewith is presented the annual report of the Vernon Forest Insect Laboratory covering research, reconnaissance, investigations, and expenditures for the fiscal year ending March 31, 1938. Several new developments have taken place during the year such as the initiation of the forest insect survey, and the establishment of a permanent forest insect field station in Trinity Valley, twenty miles from Vernon. The final plan calls for a similar station to be established in conjunction with the Provincial Forestry Station at Cowichan Lake, Vancouver Island. This would greatly facilitate the forest insect survey work since all of the material from the coastal region could be reared at the Cowichan station and the material from eastern British Columbia and western Alberta can be handled at the Trinity Station. Eventually these stations will be furnished with electric power, water, and telephone.

Equipment at the Vernon laboratory is being steadily improved. Recently a constant temperature cabinet has been constructed and an up-to-date projection lantern has been acquired by Mr. Buckell which may also be available to the Forest Insect Division when occasion arises.

GENERAL FOREST INSECT CONDITIONS.

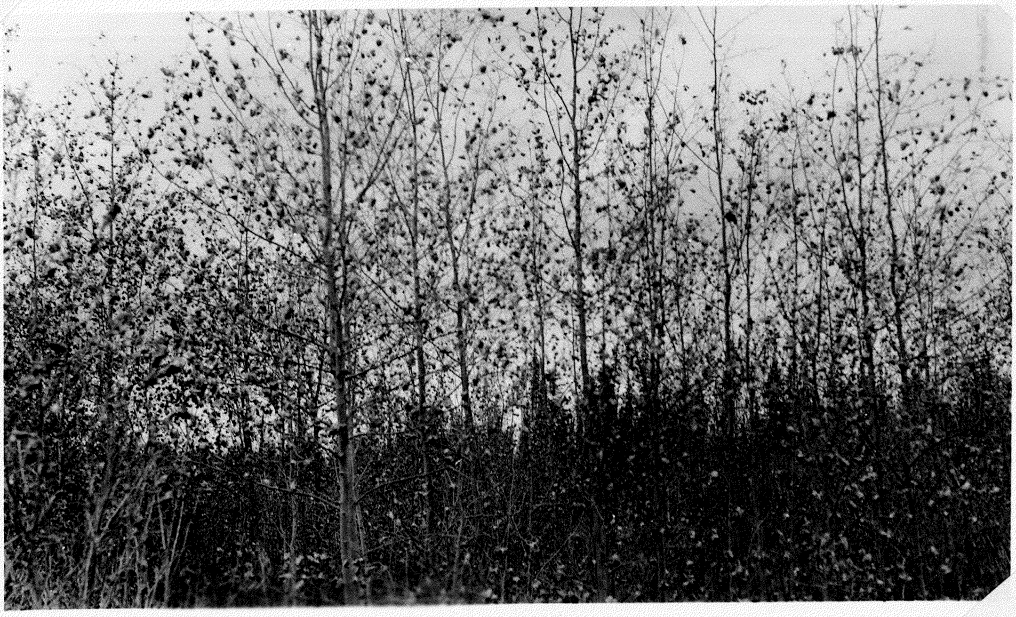
In the coastal region of the Province there have been no serious outbreaks of injurious forest insects for a number of years. In the interior and eastern parts, bark beetle populations have fallen to an endemic state. The most recent bark beetle outbreak has occurred in Kootenay National Park but during the past three years, this infestation also has rapidly declined owing to a combination of factors such as predators, parasites, and above normal precipitation for several years.

The forest insect survey uncovered four severe infestations of the western hemlock looper, Ellopia somniaria Hlst. in the Interior, one in the Arrowhead district, two in the Big Bend region, and one in Revelstoke Park. Returns from the survey indicated that the hemlock looper population was above normal throughout the entire eastern portion of the Province. This was borne out by observations of hemlock looper adults in many parts of the Kootenay and Rocky Mountain areas.

A severe infestation of the forest tent caterpillar Malacosoma pluviatis (Dyar) occurred in the Cariboo district; between Williams Lake and Quesnel, ? disstrs

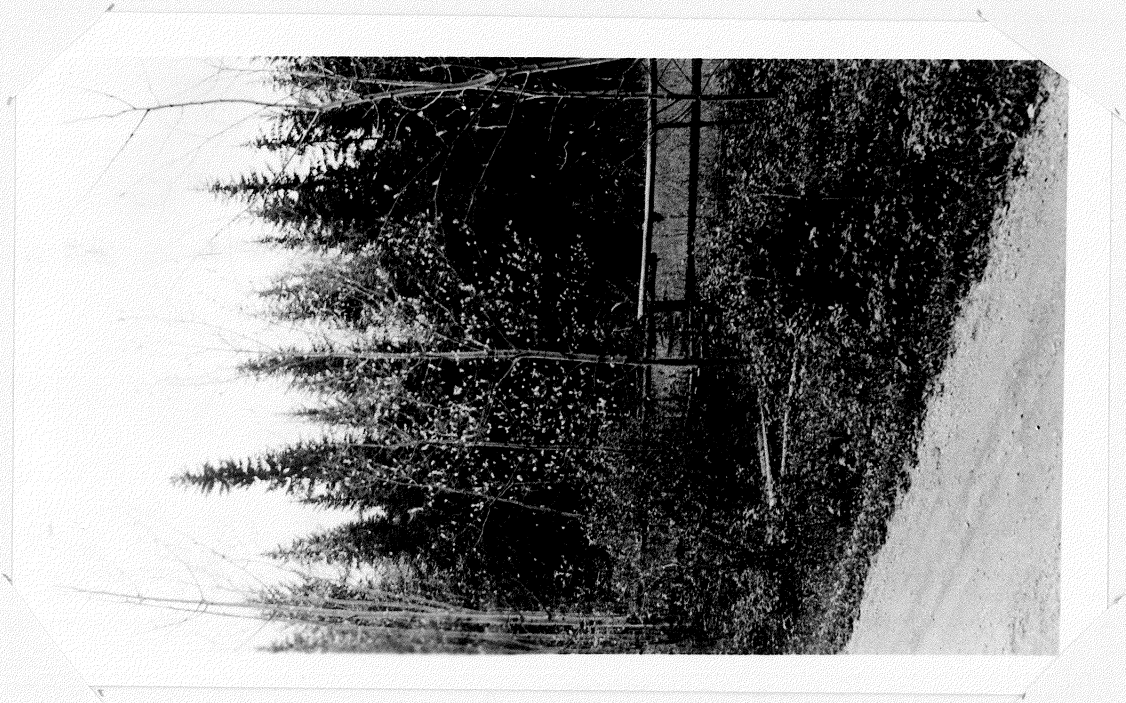
Defoliation of poplar caused by the tent caterpillar Malacosoma pluvialis (Dyar), Cariboo District of British Columbia, 1937.

Defoliation of poplar caused by the tent caterpillar Malacosoma pluvialis (Dyar), Cariboo District of British Columbia, 1937.



Poplars and shrubs defoliated by Malacosoma pluviatis (Dyar), Cariboo District of British Columbia, 1937.

Poplars and shrubs defoliated by Malacosoma pluviatis (Dyar), Cariboo District of British Columbia, 1937.



Quesnel and Prince George, and between Prince George and Vanderhoof. Trains on the P.G.E. Railway were held up by the caterpillars on the tracks and deciduous trees and shrubs were heavily defoliated. The accompanying photographs showing defoliation were taken by E.R. Buckell.

The larch sawfly (Lygaeonematus erichsonii Hartig.) in South eastern British Columbia, has declined to a point where it is difficult to find fresh egg scars. This sawfly is now known to occur as far west as Slocan Lake.

At Green Timbers Forestry Station near New Westminster, considerable damage to terminals of young spruce by Pissodes sitchensis Hopk. occurred on experimental areas.

Among the insects which have caused minor injury to forest and shade trees and forest products may be mentioned Cryptorrhynchus lapathi L. which heavily infested willows around Okanagan Landing and caused damage to a few ornamentals in the vicinity of Vancouver.

Anisandrus pyri Peck caused destruction of several ornamentals in the Vancouver area. In most cases the trees attacked had been weakened from some other cause such as winter injury.

The Douglas fir tussock moth, Hemerocampa pseudotsugata McD. was taken at the coast during 1937

for the first time. In the Salmon Arm district, it again caused injury to ornamental firs around a farm house.

A heavy flight of the pine butterfly, Neophasia menapia Feld. occurred on the Nanaimo River watershed during late August. No serious injury to trees could be found.

A curious instance occurred of termites spoiling a fresh paint job on a building at Green Timbers in August. The white surface proved such an attraction to termites, which happened to be in flight, that a large number were trapped in the white paint, and although the insects escaped, they left their wings behind. This so marred the appearance that it became necessary to scrape and repaint much of the building.

A localized outbreak of the alder sawfly, Hemichroa crocea Geoff. occurred on the Powell River townsite.

A number of cases of fleas in fuel sawdust were reported during the year and control recommendations were made.

Several cases were reported of injury to structural timbers, both at Powell River and Vancouver, by carpenter ants (Camponotus) and termites.

Several ornamental blue spruce trees in the Vernon district became heavily infested with the tussock moth,

Notolophus antiqua badia and control measures had to be taken.

In the north Okanagan Valley, the fall webworm defoliated many wild shrubs and deciduous trees as well as being very numerous in orchards.

TRINITY VALLEY FOREST INSECT EXPERIMENT STATION

On June 11th, 1929, the B. C. Provincial Forest Service set aside forty acres (the S.W. quarter of the N.E. quarter of Section 13, Township 2, Osoyoos Division of Yale District) to be used by the Dominion Entomological Branch for forest insect experimental purposes.

For several years a camp was maintained during field seasons and the caging of entire infested trees was carried on. However, it was not until 1937 that definite steps were taken to establish a permanent station there.

With the exception of a few species of conifers which occur only at high elevations, the area has nearly every conifer common to the Interior growing naturally there. These include Larix occidentalis Nutt., Picea engelmanni (Parry) Pinus contorta Dougl, Abies lasciocarpa Nutt., Pinus monticola Dougl., Thuja plicata Donn., Tsuga heterophylla (Raf.), Pseudotsuga taxifolia (Lambert) and Taxus brevifolia Nutt. Pinus ponderosa Dougl.

grows within a short distance of the area and some young ones have been transplanted to the forty. This diversity of species provides convenient food for rearing almost any defoliator which may be received from the area lying east of the Coast Range. Ample material is also provided for bark beetle studies.

Vance Creek, with a minimum flow of .7 cubic feet per second flows almost through the middle of the forty with a rapid drop and a thirty foot fall near the south line. This should provide suitable conditions for running a small pelton wheel and generator capable of lighting the station buildings. Conditions are also favorable for piping water to the buildings from Vance Creek.

Present facilities at the Station include:--

(1) A field laboratory 24' x 30' of four rooms (main laboratory, kitchen, sleeping room, and store room) with ample space for two additional rooms in the attic.

(2) A field insectary 15' x 30'. The wood work has been completed and materials are at hand to complete the screening, lining, construction of work tables and shelves.

Practically all of the larval material from the forest insect survey was reared at the station last season, but at that time the insectary was not built and facilities for rearing the material were of a makeshift nature.

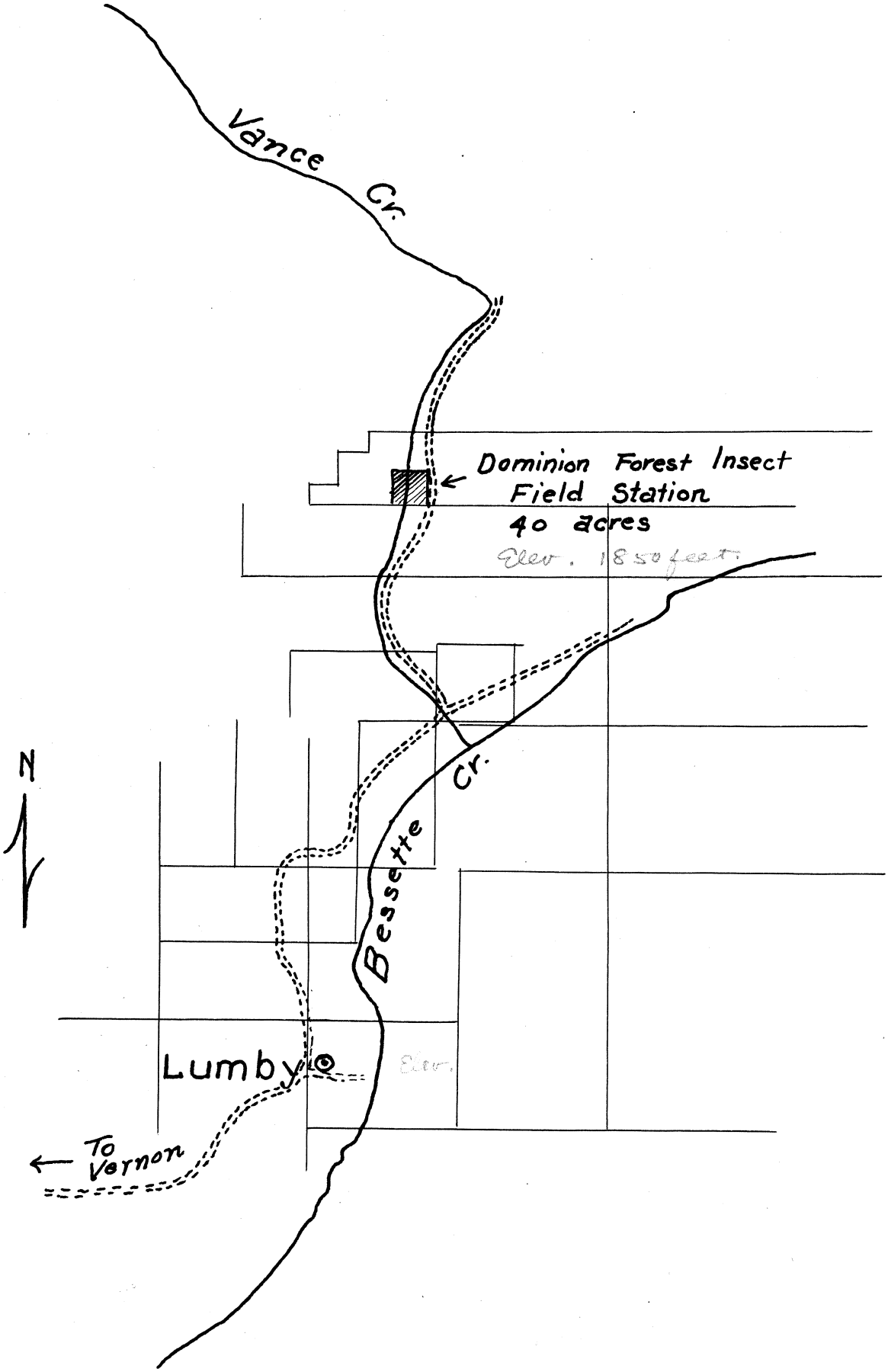
The Entomological Branch was fortunate in securing the assistance of the B. C. Forest Service in carrying out improvement work on the experimental area. A young men's forestry training camp with 15 men was located near the station and worked under the supervision of Branch officers.

Among the improvements were:--

1. Building a new, improved road in to the station from the main road.
2. Constructing a bridge across Vance Creek in order to make the area more accessible.
3. Clearing a fire guard forty feet wide, completely around the area.
4. Digging drainage canal through a swamp in connection with mosquito control.
5. Clearing and burning slash and debris on the area.

It is expected the camp will be augmented to 20 men during the summer of 1938 when further improvements are contemplated as follows:--

1. Installation of a septic tank.
2. Digging trench for pipe line for water supply.
3. Preparing a site for a small power shed.
4. Building a telephone line to connect the station with the Vernon-Shuswap line, .7 miles.
5. Continuation of clearing of debris from the area.

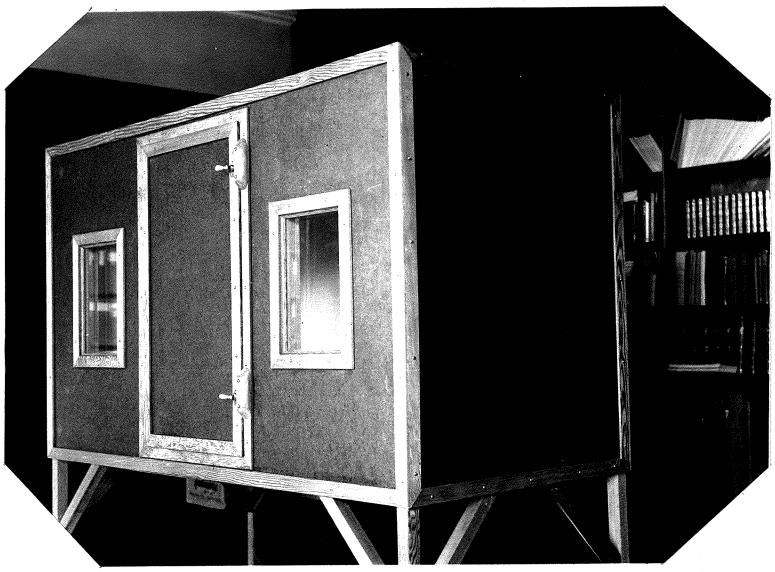

Vance Cr.
Dominion Forest Insect
Field Station
40 acres
Elev. 1850 feet
N
Bessette Cr.
Lumby
Elev.
To
Vernon

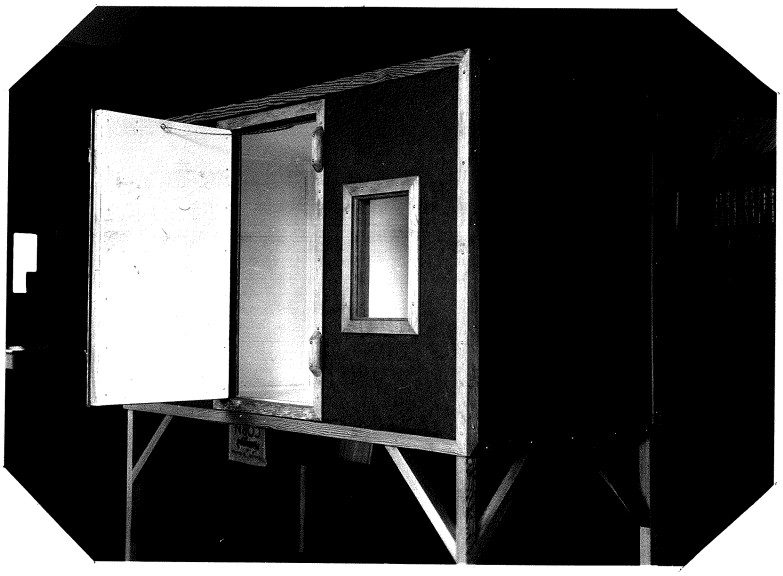
Constant temperature cabinet.

Vernon Forest Insect Laboratory.

Constant temperature cabinet.

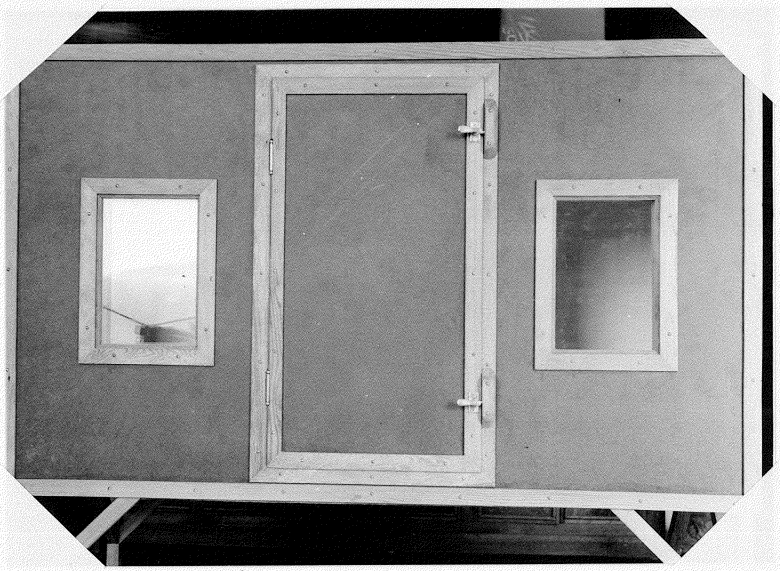
Vernon Forest Insect Laboratory.

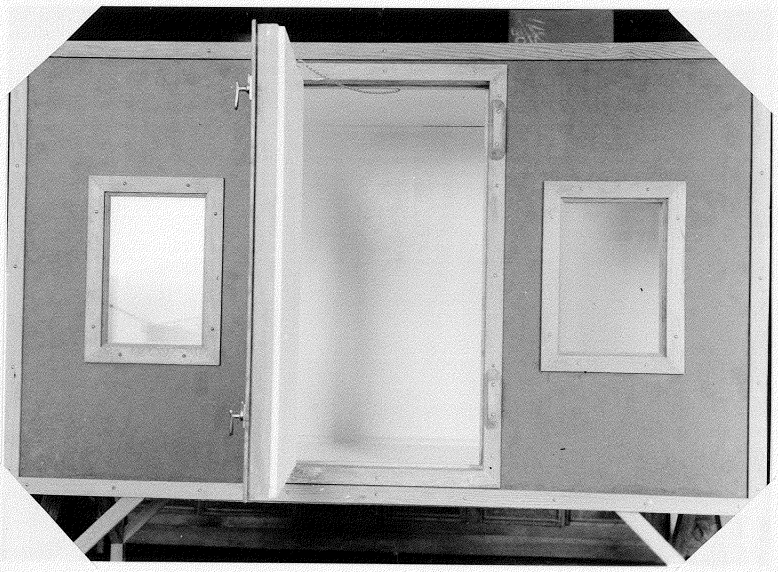




Constant temperature cabinet,
Vernon Forest Insect Laboratory.

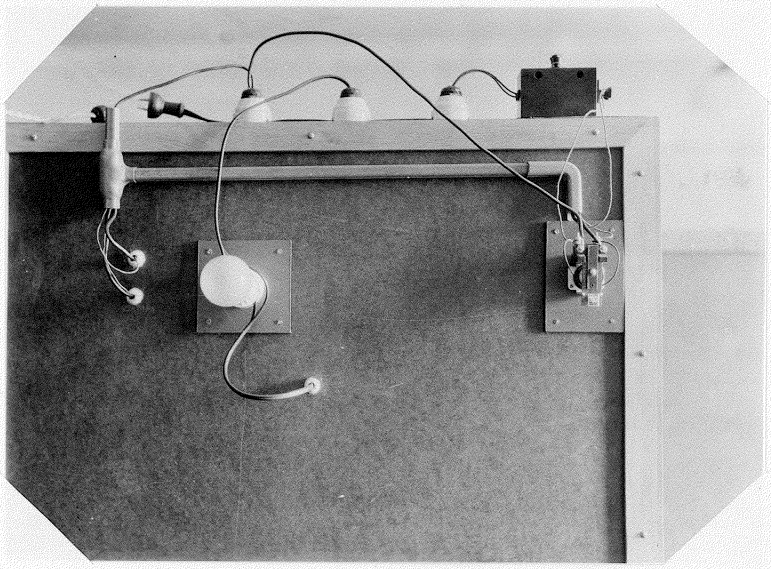
Constant temperature cabinet,
Vernon Forest Insect Laboratory.

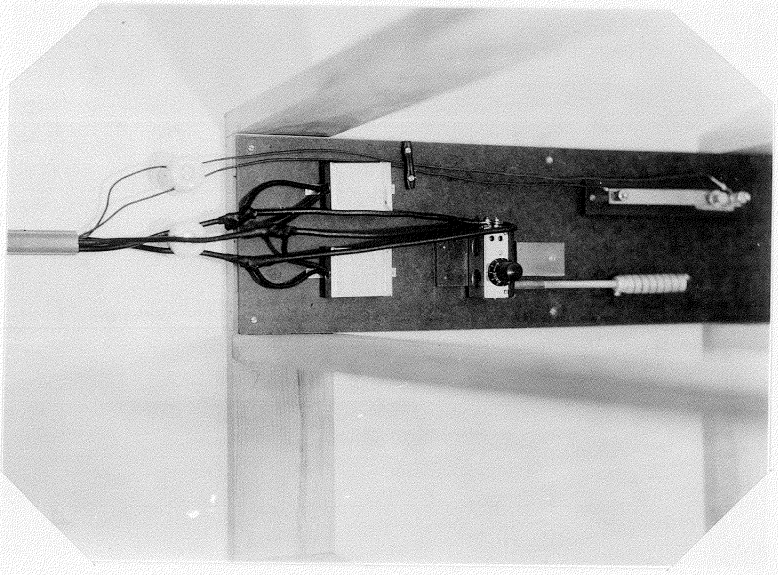




Detail of outside wiring. Constant temperature cabinet.

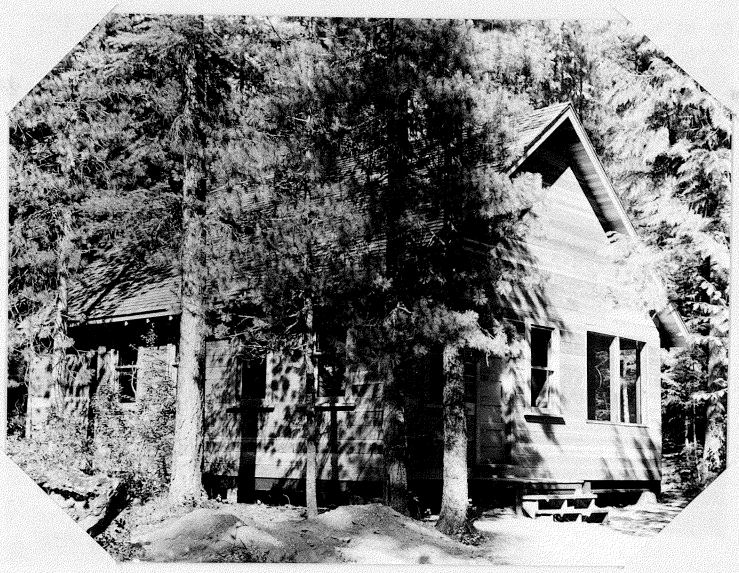
Detail of instrument wiring. Constant temperature cabinet.





Laboratory - Trinity Valley Forest Insect Field Station.

Insectary - Trinity Valley Forest Insect Field Station.



Rearing forest insect survey material prior to insectary facilities.

Rearing forest insect survey material prior to insectary facilities.

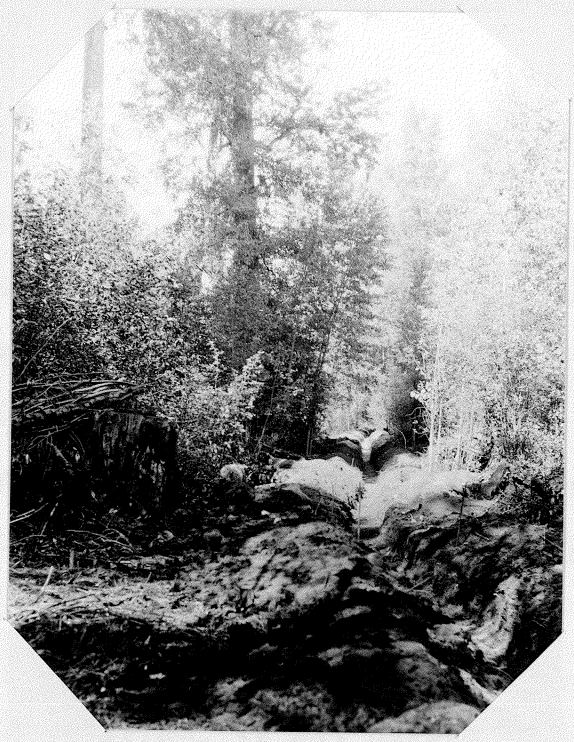
Population studies - western hemlock looper - Trinity Valley Forest Insect Field Station.

Mosquito Swamp - Trinity Valley Forest Insect Field Station.

Cleaning up debris on experimental area - Trinity Valley Forest Insect Field Station.

Drainage canal - Trinity Valley Forest Insect Field Station.

Drainage canal - Trinity Valley Forest Insect Field Station.



DETAILED PROJECT ANALYSIS

Bark Beetles.

The only active outbreak of bark beetles at the present time is in the vicinity of McLeod Meadow in Kootenay National Park (see map p. 36). In the early stages, the attack was mainly by Dendroctonus monticolae, but during the later stages most of the mortality has resulted from attack by Ips interpunctus.

By the time the National Parks authorities had noted this infestation, it had gained such proportions that they considered the cost of applied control to be prohibitive. However, they requested information on the trend of the outbreak and the sample plot method was used to determine this.

Seven sample plots have been examined each year since 1934 and the condition of every tree on each plot recorded (see map p.). The data in the following tables together with the analysis of the results clearly indicates that there has been a rapid decline in the infestation since 1934.

A. BARK BEETLE INVESTIGATIONS:

1. Project Number 17634

2. Title of Project:

Bark Beetle Sample Plot Studies.

3. Object of Project:

To establish sample plots at suitable locations throughout the lodgepole pine bark beetle outbreak at McLeod Meadows, Kootenay National Park, and to make examination of every tree on the plots each year and record its condition. At the same time much worth-while data could be secured relative to predators and parasites.

4. Nature and Importance of Work:

The aid of officers of the Entomological Branch was sought by the Parks Branch late in 1934 after the infestation had assumed huge proportions in the upper Kootenay Valley. Recommendations for control were sought as well as information on the probable course of the outbreak. The trees killed to date have created a serious fire hazard in that portion of the park besides presenting an unsightly scar to the view of tourists. This whole section of the park has been spoiled from a scenic standpoint, at least the dead, standing trees. Should fire occur in the area, the scar would remain fifteen or twenty years.

5. Location of Work:

McLeod Meadows and vicinity, sixteen miles from Radium Hot Springs, Kootenay National Park.

6. Officers in Charge and Complete Personnel:

Ralph Hopping,	Supervision of Work;
Geo. R. Hopping,	Direction of Work.
H. A. Richmond,	Execution of Work.
K. Graham,	Assistance in Work.
C. Morgan,	" " "

7. Co-operation With Other Departments:

Officers of the Parks Branch have aided in many ways in making these investigations, particularly by providing a cabin at McLeod Meadows and assisting with transportation when occasion presented.

8. Progress Report;

Seven sample plots, of one acre each, were established. Data taken each year since 1934 may be summarized as follows:--

Plot I: .2 miles south Meadow Creek Bridge.
No. of trees on plot - 191

	1934	1935	1936	1937
Trees dead	81	82	147	154
Trees green, unattacked.	31	36	32	34
" " attacked.	79	9	7	1
Trees turning.		64	5	1
	% change			
Trees dead		+1.22.	+44.22.	+4.54
" green, unattacked.		+13.88.	-11.11 .	+5.88
" " attacked.		-88.60.	-22.22.	-85.71
" turning			-92.12.	-80.00

Total mortality of Plot 1 to 1937 - 80.63%
Number of trees fallen by 1937----- 5

Plot II: .4 miles north of Meadow Creek Bridge.
No. of trees on Plot - 230

	1934	1935	1936	1937
Trees dead	79	80	88	99
Trees green, unattacked	141	142	135	129
" " attacked	9	3	3	0
" turning colour	1	5	4	2

% change

Trees dead	+1.2	+9.1	+11.1
" green, unattacked	+1.4	-4.9	-4.4
" " attacked	+66.6	-	+100.0
" turning colour	+80.0	+20.0	-50.0

Total mortality up to 1937 ------ 43.0%
Number of trees fallen by 1937--- 19

Plot III: .9 miles north of Meadow Creek Bridge.
No. of trees on Plot - 337

	1934	1935	1936	1937
Trees dead	79	80	85	97
Trees green, unattacked	251	248	244	228
" " attacked	6	4	4	8
" turning colour	1	5	4	0
Unacounted for				4

% change

Trees dead	+1.25	+5.9	+12.38
Trees green, unattacked	-1.20	-1.6	-6.50
" " attacked	-33.30	-	+50.00
" turning colour	+80.00	+20.0	-100.00

Total mortality to 1937 --------29.0%
Number of trees fallen by 1937 - 4

Plot IV: 4.0 miles north of Meadow Creek Bridge.

Only 3 infested trees were marked. The rest were green, unattacked in 1935. No newly attacked tree were apparent in 1936 and 1937.

Plot V: 5.1 miles north of Meadow Creek Bridge.

All trees were green, unattacked in 1935. No new attack in 1936. Three (3) trees were attacked in 1937, one by Ips and two by Dendroctonus.

Plot VI: 3.6 miles north of Meadow Creek Bridge.

Three trees showed fresh attack in 1934. Four more were attacked in 1936. One was attacked in 1937.

Plot VII: 1.5 miles south of Meadow Creek Bridge.

Number of trees on Plot - 123

	1934	1935	1936	1937
Trees dead	1	1	13	28
Trees green, unattacked	91	94	96	86
" " attacked	28	13	5	7
" turning colour	0	12	6	0
" unaccounted for	3	3	3	2

% Change

Trees dead	0	-92.3	-53.6
" green, unattacked	-53.6	-61.5	-10.4
" " attacked	-57.6	-59.2	-28.5
" turning colour	+100.0	-50.0	+100.0

Total mortality to 1937 -------22.7%
No trees had been found fallen by 1937.

All Plots

Total number of trees marked 881
" " " " killed up to 1937..... 376

Average Mortality 42.7%

Number of trees attacked in 1934 - 122
" " " " 1935 - 29 - Decline of 76.2%
" " " " 1936 - 19 - " " 34.5%
" " " " 1937 - 16 - " " 15.7%

A rapid subsidence of this infestation is clearly indicated by these figures and this fact has been communicated to the National Parks Branch. The plots upon which this is based represented every condition on the area from the portions of highest tree mortality at time of marking to the portions where practically all trees were still green.

Predators:

Woodpeckers have taken their usual toll of the bark beetles as evidenced by trees which have been completely stripped of bark.

Among insect predators, the most effective appears to be a Stratiomyid which has not as yet been determined. The larvae of this fly occur in huge numbers beneath the bark, and although they were not observed to feed on bark beetle larvae in the field, they readily attacked larvae of D. pseudotsugae in the laboratory. Unfortunately, they are rather heavily parasitized. Other important predators are Lonchaea sp. and Medeterus sp.

Parasites:

Only one parasitic species occurs in sufficient numbers to be a factor in the bark beetle decline. This is a Braconid, larvae of which are found in the larvae and pupal cells of the host. The larvae are white, lemon shaped affairs and the larval or pupal skin of the host can usually be found beside each parasite larva. Adults have been reared and will be submitted for identification.

LODGEPOLE PINE

BARK BEETLE INFESTATION

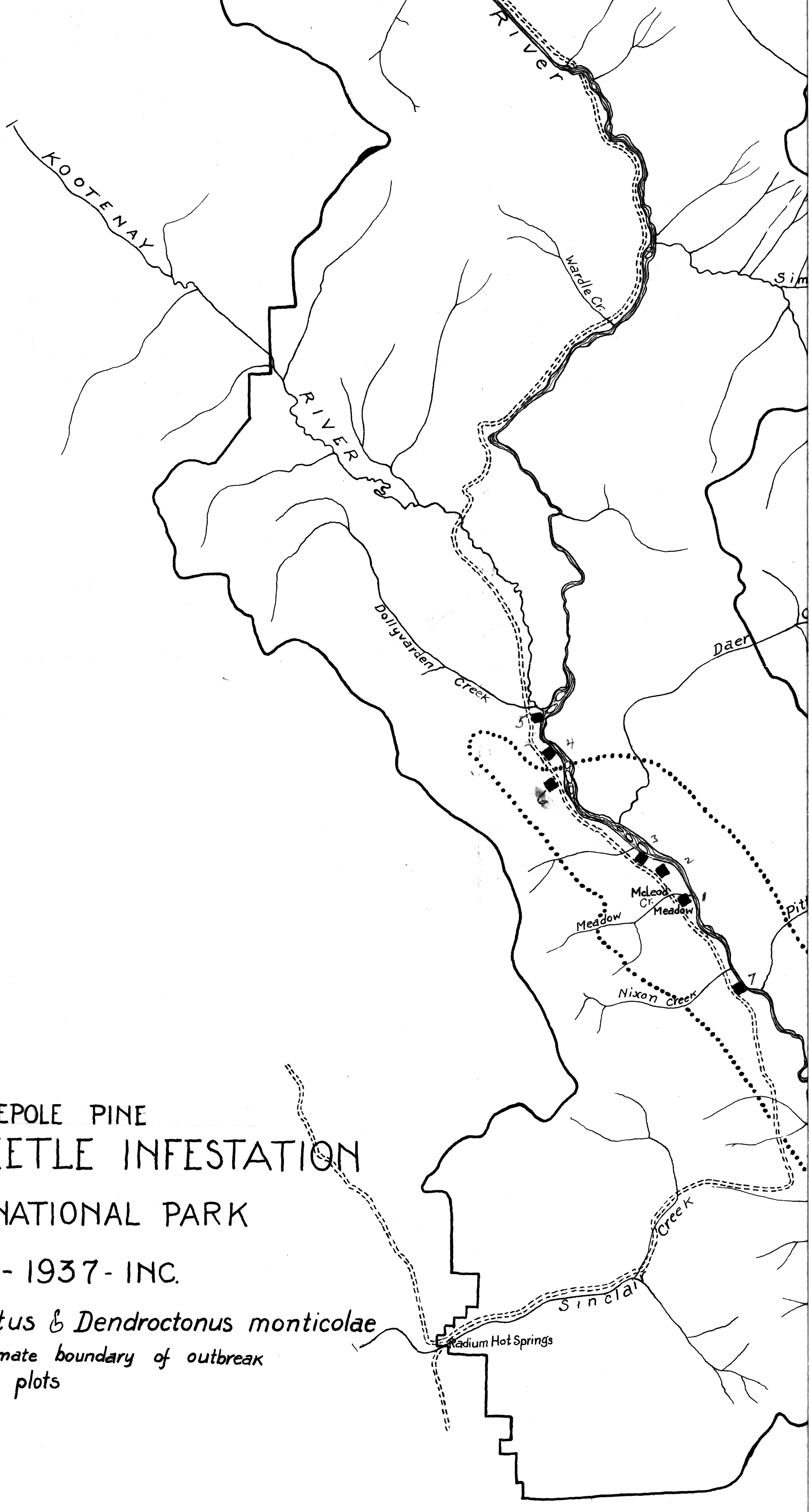
KOOTENAY NATIONAL PARK

1934 - 1937 - INC.

Ips interpunctus & Dendroctonus monticolae

..... *Approximate boundary of outbreak*

■ *Sample plots*



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INFESTATION

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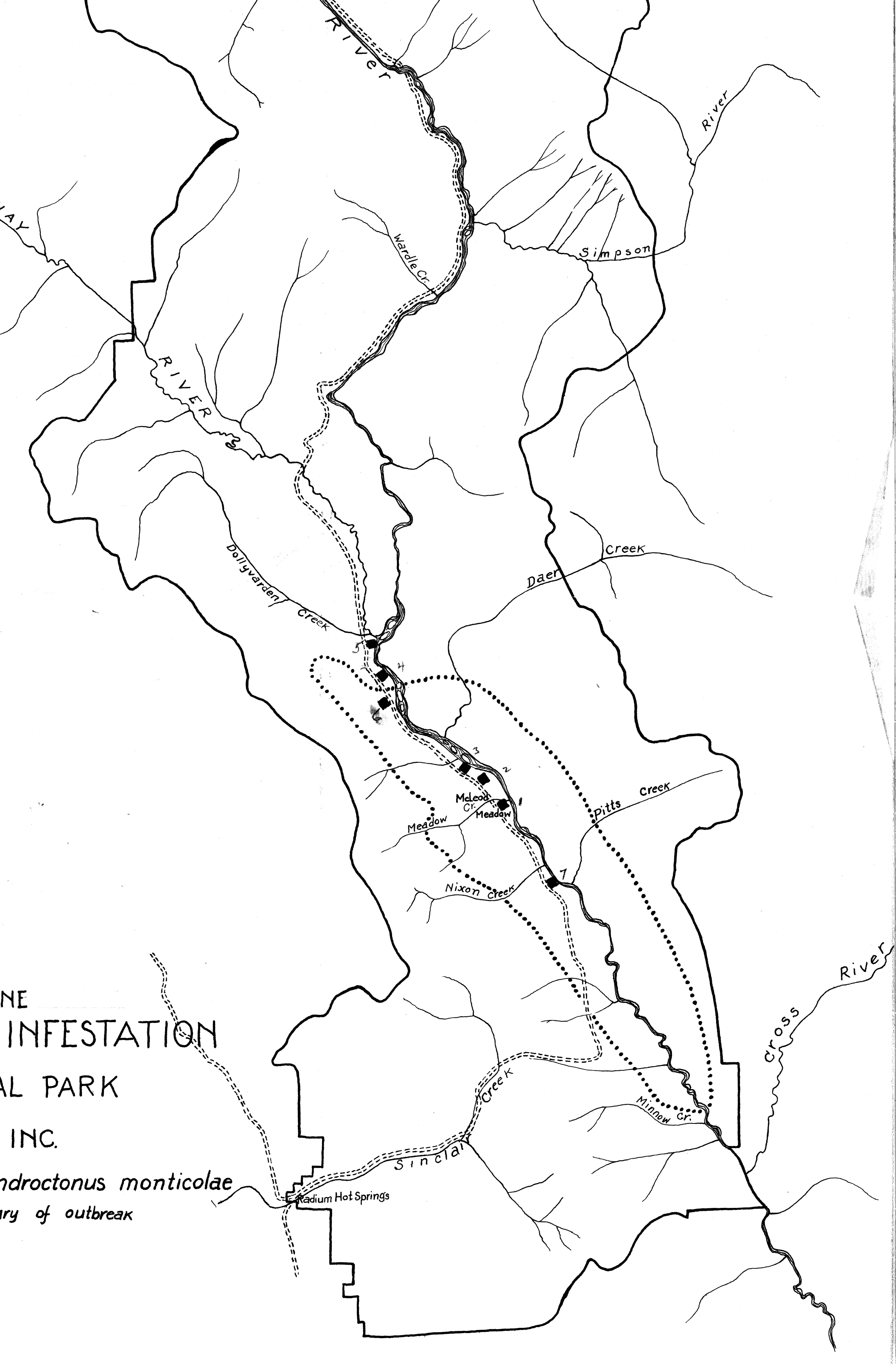
ndroctonus monticolae

ry of outbreak



Sept 22-28

Sample Plot 1.

Location: 0.2 miles south of Meadow Creek Bridge, marked by wto white corner stakes, the line joining them running S 30°E.

Tree Species: Lodgepole pine.

Tree Numbers: 1 to 192.

Plot Established 1935. Current examination Sept. 15, 1937.

Abbreviations used:

G - Tree green and alive.
D - Tree dead. Foliage brown or absent.
T - Tree infested and foliage turning colour.

Dm - Dendroctonus monticolae.

I - Ips

/30, /31, etc. Indicates year tree was infested.

Tree No.	D.B.H.	History of Bark beetle Activity				Hypomolyx activity
		1934	1935	1936	1937	
1	15	G	G	G	G	G Much. Encircles base.
2	16	G.Dm	G.Attack drowned out.	G	D	D Spot, east side.
3	8	D/34	D	D	D	D
4	14	G.Dm	T	D	D	D
5	4	d/31	D	D	D	D
6	16	D/31	D	D	D	D Down
7	12	D/31	D	D	D	D Spots on E.&W.
8	6	D/31	D	D	D	D (Down)
9	4	D/31	D	D	D	D (Down)
10	10	D/31	D	D	D	D
11	8	D/31	D	D	D	D None
12	12	D/30	D	D	D	D
13	12	G/Dm	T. Ips	D	D	D

Tree No.	D.B.H.	History of Bark beetle Activity 1934	1935	1936	1937	Hypomolyx activity
14	16	D/31	D	D	D	D
15	18	G Dm. & Ips	T	D	D	D
16	10	D/29	D	D	D	D
17	20	G Dm.	T	D	D	D
18	20	D)30	D	D	D	D
19	18	D/31	D	D	D	DSpot on W.
20	16	G/Dm.	T	D	D	D
21	14	G Dm. & Ips	T	D	D	D
22	14	G Dm.	T	D	D	D
23	10	G Dm.	T	D	D	D
24	16	G.	G	G	G	GSpruce
25	12	D/31	D	D	D	D
26	12	D/31	D	D	D	D
27	17	D/30	D	D	D	D
28	16	G Dm.	T	D	D	DSpot on E.
29	12	G Dm. & I.	T	D	D	D
30	12	G Dm. & I.	T	D	D	D
31	14	D/30	D	D	D	DNone
32	14	G Dm.	T	D	D	DSpot on W.
33	10	D/29	D	D	D	D
34	10	D/29	D	D	D	D
35	24	G Dm.	T	D	D	DSpots on E.&S.
36	10	G Dm.on 1 side.	G	T Ips	G	DNone
37	14	D/31	D	D	D	DNone
38	16	D/31	D	D	D	DNone
39	20	G Dm.	T	D	D	DSpots N,S, &W.
40	18	G Dm.	T	D	D	DEncircles base
41	10	D/33	D	D	D	DNone
42	14	D/29	D	D	D	D
43	6	D/30	D	D	D	D
44	12	D/30	D	D	D	DNone (Down)
45	16	G Dm.	T	D	D	DNone
46	22	G Dm.	T	D	D	DNone
47	8	D/29	D	D	D	DDown
48	14	Dm.& Ips	T	D	D	DNone
49	12	D/29	D	D	D	DSpots E. & E.
50	12	D/30	D	D	D	DNone
51	20	D/33	D	D	D	DLittle on S.
52	16	G Dm.	T	D	D	DNone
53	8	G.	G	G	G	G
54	10	G Dm.	T	D	D	DNone

Tree No.	D.B.H.	History of Bark beetle Activity 1934	1935	1936	1937	Hypomolyx activity
55	14	G Dm.	T	D	D	D None
56	12	G	G	G	G	G None
57	14	G	G Dm. & Ips	G Dm. & Ips	G	G None
58	14	G	G	T Ips	D	D None
59	12	G	G	G	G	D None
60	10	D/29	D	D	D	D
61	20	D/31	D	D	D	D
62	18	D/30	D	D	D	D Little on E.& W.
63	16	D/30	D	D	D	D Little on N.E.
64	12	D/29	D	D	D	D None
65	14	D/30	D	D	D	D 1 root on S.W.
66	14	G Dm.	T	D	D	D None
67	12	G Dm.	T	D	D	D None
68	10	G Dm.	T	D	D	D 1 root on E.
69	12	G Dm.	T	D	D	D None
70	10	D/30	D	D	D	D
71	8	D/30	D	D	D	D
72	12	D/29	D	D	D	D None
73	14	G Dm.	T	D	D	D
74	14	D/33	D	D	D	D None
75	10	G Dm.	G	G	?	D None
76	12	G Ips E.side	G	T Ips	D	D Much, 2/3 circum.
77	12	G	G	G	G	G
78	10	G	G	G	G	G None
79	14	G Dm. & Ips	T	D	D	D Much on all sides.
80	6	D/29	D	D	D	D
81	6	D/29	D	D	D	D
82	16	D/31	D	D	D	D
83	12	D/30	D	D	D	D
84	14	D/Dm.	D	D	D (Down)	D Little on S.E.
85	12	G Dm. & Ips	G Ips	T Ips	D	D Little on S.W.
86	18	G Dm. & Ips	T	D	D	D
87	6	G	G	G	G	G Little on N.E. Old Work.
88	14	G	G	G	G	G Little on N.E.&S.E.
89	12	G Dm. & Ips	G Ips on E. side.	G Ips on E. side.	G	G Little on N.
90	10	D/31	D	D	D	D
91	12	G	G	G	G	G Little on E.

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx activity
92	12	G Dm. & Ips	T	D	D	D Little on S.W.
93	6	D/29	D	D	D	D
94	14	G Dm. & Ips	T	D	D	D Spots on N.W.
95	6	G	G	G	G	G Spots on S.E. Old.
96	14	G Dm. & Ips	G	G	G	G Little on S.E.
97	14	D/30	D	D	D	D Little on S.E.&N.E.
98	16	G Dm. & Ips	T	D	D	D
99	16	D/30	D	D	D(Down)	D (Down)
100	20	D/31	D	D	D	D
101	12	G	T Dm. & Ips	D	D	D
102	12	G Dm.	T	D	D	D
103	12	D/30	D	D	D	D
104	12	G	G	G	G	G Little on E.
105	6	D/30	D	D	D	D (Down)
106	20	D/30	D	D	D	D None (Down)
107	14	G	G	G	D	D Little on E.
108	14	G	G	G	G	G None
109	6	G	G	G	G	G None
110	22	T Dm.	D	D	D	D None
111	8	G Ips /30	T	D	D	D None
112	12	G Dm. & Ips	T	D	D	D None
113	16	D/30	D	D	D	D
114	18	D/30	D	D	D	D
115	14	D/30	D	D	D	D
116	20	D/30	D	D	D	D
117	10	G	G	G	G	G
118	10	G	G	G	G	G None
119	12	G Dm.	T	D	D	D None
120	18	D/31	D	D	D	D
121	12	G Dm.	T	D	D	D None
122	8	D/30	D	D	D	D None
123	10	G Dm.	T	D	D	D 2 roots, N.E. side.
124	14	G Dm.	T	D	D	D None
125	10	G	G	G	G	G None
126	10	D	D	D	D	D None
127	22	D/31	D	D	D	D
128	18	G Dm.	T	D	D	D
129	8	G	G	G	G	G
130	8	G Dm.	T	D	D	D
131	12	G Dm.	T	D	D	D None

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx activity
132	12	G Dm. & Ips	T	D	D	DNone
133	14	G Dm.	T	D	D	D
134	10	G	G Dm. Ips	G Ips on N.E.	G (Drowned)	GSpot on S.W.
135	24	G Dm.	T	D	D	DLittle on W.
136	8	G Dm.	G	G Ips	G Ips on N.E.	DNone
137	14	D/33	D	D	D	DNone
138	10	D/30	D	D	D	DNone
140	10	G	G	G	G (Drowned)	GLittle on S.
141	10	D/30	D	D	D	DNone
142	10	D/29	D	D	D	DNone
143	10	D/29	D	D	D	DNone
144	12	G Dm. & Ips	T	D Ips on W. side	D	DNone
145	8	D/30	D	D	D	DNone
146	12	G Dm. & Ips	G., no activity	G Ips on W. side.	G (Drowned)	GNone
147	10	G Dm.	T	D	D	DNone
148	14	D/30	D	D	D	DLittle on E.
149	8	G	G Ips & Dm.	T. Ips active, Dm.dead	D	D
150	10	G Dm.	G	G	G	GLittle on S.E.
151	18	G Dm.	T	D	D	DMuch on all sides.
152	18	G Dm.	T	D	D	DSpots on S.W.
153	10	D/29	D	D	D(Down)	DNone
154	16	G Dm.	T	D	D	DNone
155	12	G Dm.	T	D	D	D
156	14	G Dm.	G	G Ips, young adults S. side	G (Drowned)	GMedium amount S.E. side. Old.
157	10	D/30	D	D	D	D
158	12	D/30	D	D	D	D
159	12	D/30	D	D	D	D
160	10	G	G	G	G	GNone
161	12	G	G	G	G	GNone
162	14	D/30	D	D	D	D
163	20	D/33	D	D	D	DNone

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx activity
164	12	D/30	D	D	D	D Much, ½ base of tree
165	14	D/30	D	D	D	D None
166	14	G Dm.	T	D	D	D Little on E.
167	8	G Dm.	T	D	D	D None
168	12	G Dm.	T	D	D	D
169	12	G Dm.	T	D	D	D None
170	12	G Dm.	T	D	D	D None
~~171~~	~~10~~	& Ips				
171	10	G Dm.	T	D	D	D None
172	8	G Dm.	T	D	D	D None
173	10	G Dm.	T	D	D	D None
174	12	G Dm.	T	D	D	D Little on S.W.
175	18	D/35	D	D	D	D Spot on N.E.
176	16	D/33	D	D	D	D
177	22	G Dm.	T	D	D	D Spot on E.
178	10	G Dm.	T	D	D	D None
179	12	G Dm. & Ips	G	G Former attack drowned out.	G	G Spots S.W.
180	14	D/32	D	D	D	D None
181	12	G Dm.	G	G half side dead.	D	D None
182	10	G Ips	T	D	D	D None
183	10	G	G	G	G (Drowned)	G None
184	6	G	G	G	G	G 1 root S. Old.
185	12	G	G	G. Ips E.side.	G (Drowned)	G Little on N.E.&S.W.
186	10	G Dm.	G Ips	D	D	D None
187	10	D)30	D d	D	D	D None
188	8	D/30	D	D	D (Down)	D (Cut Down)
189	20	G Dm.	G Ips E.side.	G.East side dead No new infestation	T	G Spots on E.
190	10	G Dm. & Ips	T	D	D	DLittle on E.
191	12	G	G	G	G	GLittle on N.E.
192	14	D/29	D	D	D (Down)	D (Down)

Sample Plot 2

Location: 0.4 miles north of Meadow Creek Bridge on east side road marked by two white corner stakes, the line joining them running N. 45° W

Tree Species: Lodgepole pine.

Tree Numbers: 193 to 425;

Plot Established 1935: **Current examinations:** September 15, 1937.

Abbreviations:

G - Tree green and alive.

D - Tree dead. Foliage brown or absent.

T - Tree Infested and foliage turning colour.

Dm.- Dendroctonus monticolae.

I - Ips

Tree No.	D.B.H.	History of Bark Beetle Activity				Hypomolyx Activity
		1934	1935	1936	1937	
193	12	G	G	G	G	G
194	10	G	G	G	G	G
195	6	G	G	G	D	D
196	12	G	G	G	G	G
197	6	G	G	G	G	G
198	10	G	G	G	D	D
199	8	G	G	G	G	G
200	4	G	G	G	G	G
201	8	G	G	G	D	D
202	8	G	G	G	D	D
203	6	D	D	D	D (Down)	D (Down)
204	10	G	G	G	D	D
205	12	G	G	G	G	G
206	10	G	G	G	G	G
207	8	G	G	G	G	G
208	8	G	G	G	G	G
209	12	G	G	G	G	G
210	10	G	G	G	G	G
211	12	G	G	G	G	G
212	14	G	G	G	G	G
213	10	D	D	D	D	D

Tree No.	D.B.H.	History of Bark Beetle Activity				Hypomolyx Activity
		1934	1935	1936	1937	
214	10	G	G	G	G	G
215	14	G	G	G	G	G
216	8	G	G	G	G	G
217	10	G	G	G	G	G
218	12	D	D	D	D	D
219	6	D	D	D	D	D
220	8	G	G	G	G	G
221	12	G	G	G	G	G
222	12	G	G	G	G	G
223	10	D	D	D	D	D (Down)
224	8	D	D	D	D	D
225	8	D	D	D	D	D
226	4	D	D	D	D	D
227	8	D	D	D	D	D
228	8	D	D	D	D	D
229	8	D	D	D	D	D
230	12	D	D	D	D	D
231	10	G	G	G	G	G
232	8	G	G	G	G	G
233	10	D	D	D	D	D
234	12	G Dm.	G	G. Infestation drowned.	G	G
235	16	G Dm.	T	D	D	D
236	8	D	D	D	D	D
237	16	G Dm. & Ips	T	D	D	D
238	12	G Dm. & Ips	T	D	D	D
239	14	G Dm.	G	G. W. side alive	G	G
240	16	G Dm. & Ips	G	G	G	G
241	10	D	D	D	D	D
242	16	T Dm.	D	D	D	D (snag)
243	12	G	G	G	G	G
244	8	D	D	D	D	D
245	8	D	D	D	D (Down)	D (Down)
246	12	G Dm. E. side	G	G. Infestation drowned.	G	G
247	10	G	G	G	G	G
248	8	D	D	D	D (Down)	D (Down)
249	10	D	D	D	D (Down)	D (Down)
250	16	G	G	G	G	G

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
251	14	D	D	D	D(Down)	D(Down)
252	12	D	D	D	D	D
253	12	G	G Dm. & Ips	G Infes-tation drowned.	G	G
254	10	G	G	G	G	G
255	4	G	G	G	G	G
256	8	G	G	G	G	G
257	8	G	G	G	G	G
258	10	G	G	G	G	G
259	12	G	G	G	G	G
260	8	G	G	G	G	G
261	10	G	G	G	G	G
262	6	G	G	I Ips	D	D
263	12	G	G	T Ips	D	D
264	10	G	G	G	G	G
265	10	D	D	D	D	D
266	10	G	G	G	G	G
267	10	D	D	D	D(Down)	D(Down)
268	14	G	G	G	G	G
269	12	G	G	G	G	G
270	8	G	G	G	G	G
271	18	G	G	G	G	G
272	10	G	G	G	G	G
273	10	G	G	G	G	G
274	10	G	G	G	G	G
275	6	G	G	G	T	D?
276	4	G	G	G	G (Sickly)	
277	10	G	G	G	G	G
278	10	G	G	G	G	G
279	10	D	D	D	D	D
280	10	D	D	D	D (Down)	D(Down)
281	5	D	D	D	D (Down)	D(Down)
282	8	D	D	D	D	D
283	8	G	G	G	G	G
284	8	G	G	G	G	G
285	12	G	G	G	G	G
286	6	D	D	D	D	D
287	10	G	G	G	G	G
288	12	G	G	G	G	G
289	6	G	G	G	G	G
290	8	D	D	D	D	D
291	10	G	G	G	G	G
292	12	G	G	G	G	G
293	10	G	G	G	G (Sickly)	G

Tree No.	D.B.H.	History of Bark Beetle Activity				Hypomolyx Activity
		1934	1935	1936	1937	
294	10	G	G	G	G	G
295	(Missing)					
296	(Missing)					
297	8	D	D	D	D	D
298	12	G	G	G	G	G
299	12	G	G	G	G	G
300	6	D	D	D	D (Down)	D (Down)
301	8	G	G	G	G	G
302	10	G	G	G	G	G
303	10	D	D	D	D (Down)	D (Down)
304	6	D	D	D	D (Down)	D (Down)
305	10	G	G	G	G	G
306	8	G	G	G	G	G
307	6	D	D	D	D	D
308	8	D	D	D	D	D
309	10	G	G	G	G	G
310	14	G	G	G	G	G
311	10	G	G	G	G	G
312	12	D	D	D	D	D (Down)
313	10	G	G	G	G	G
314	10	G	G	G	G	G
315	10	D	D	D	D	D
316	10	G	G	G	G	G
317	10	D	D	D	D	D
318	8	D	D	D	D (Down)	D (Down)
319	10	G	G	G	T	D
320	12	G	G	G	G	G
321	8	G	G	G	G	G
322	10	G	G	G	G	G
323	8	G	G	G	G	G
324	8	G	G	G	G (Sickly)	D
325	12	G	G	G	G	G
326	6	D	D	D	D	D
327	12	D	D	D	D	D
328	10	D	D	D	D	D
329	12	D	D	D	D	D
330	12	D	D	D	D	D
331	10	G	G	G	G	G
332	12	G	G	G	G	G
333	12	G	G	G	G	G
334	8	G	G	G	G	G
335	12	D	D	D	D	D
336	12	G	G	G	G	G
337	14	G	G	G	G	G
338	14	G	G	G	G	G
339	10	D	D	D	D (Down)	D (Down)
340	12	D	D	D	D	D
341	12	D	D	D	D	D

Tree No.	D.B.H.	History of Bark Beetle Activity				Hypomolyx Activity
		1934	1935	1936	1937	
342	12	D	D	D	D	D
343	10	D	D	D	D	D
344	12	D	D	D	D	D
345	14	G	G	G	G	G
346	14	G	G	G	G	G
347	6	G	G	G	G	G
348	6	D	D	D	D	D
349	8	G	G	G	G	G
350	10	G	G	G	G	G
351	10	G	G	T Ips	D	D
352	8	G	G	G	G	G
353	10	G	G	G	G	G
354	10	G	G	G	G	G
355	6	D	D	D	D	D
356	14	G	G	G Ips	G	G
357	10	G	G	G	G	G
358	12	G	G	G	G	G
359	12	G	G	G	G	G
360	6	G	G	G	G	G
361	12	G	G	G	G	G
362	10	G	G	G	G	G
363	10	G	T Ips	D	D	D
364	10	G	G	G Dm.	D	D
365	8	G	G	G	G	G
366	6	G	G	G	G	G
367	14	G	G	G	G	G
368	16	G	G	G	G	G
369	16	G	G	G	G	G
370	14	G	G	G	G	G
371	12	D	D	D	D	D
372	10	D	D	D	D	D
373	14	G	G	G	G	G
374	14	G	G	G	G	G
375	8	D	D	D	D	D (Down)
376	10	D	D	D	D	D
377	14	G	G	G	G	G
378	14	G	G	G	G	G
379	18	G	G	G	G	G
380	10	G	G	G	G	G
381	12	D	D	D	D (Down)	D (Down)
382	12	D	D	D	D	D
383	8	G	G	G	G	G
384	12	D	D	D	D	D
385	12	G	G	G	G	G
386	8	D	D	D	D	D
387	6	D	D	D	D	D
388	8	D	D	D	D	D
389	8	D	D	D	D (Down)	D (Down)
390	8	D	D	D	D	D

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
391	10	G	G	G	G	G
392	12	D	D	D	D	D
393	8	D	D	D	D	D
394	12	G Dm.	G	G Infestation drowned	G	G
395	8	G	G	G	G	G
396	12	G	G	G	G	G
397	14	G	G Dm.	G Infestation drowned	G	G
398	10	D	D	D	D	D
399	14	D	D	D	D	D
400	10	D	D	D	D	D (Down)
401	14	D	D	D	D	D
402	14	G	G	G	G	G
403	14	G	G	G	G	G
404	12	G	G	G	G	G
405	14	G	G	G	G	G
406	12	G	G	G Ips E. side.	G	G
407	10	G	G	G	G	G
408	10	D	D	D	D	D
409	10	D	D	D	D	D
410	12	G Dm. & Ips	G Ips W.side infested	D	D(Down)	D(Down)
411	12	G	G	D Ips numerous Dm.	D	?
412	6	D	D	D	D(Down)	D(Down)
413	12	D	D	D	D(Down)	D(Down)
414	16	D	D	D	D(Donw)	D(Down)
415	12	G	G	D Ips numerous	D	D
416	14	G	G	T Ips numerous	D	D
417	8	D	D	D	D	D(Down)
418	14	G	T Ips	D	D	D
419	16	G	G	G	D	D
420	10	D	D	D	D	D
421	Missing					
422	8	D	D	D	D	D
423	14	G	G	G	G	G
424	8	G	G	G	G	G
825	16	G	G	G	G	G

Sample Plot 3.

Location: 0.9 miles north of Meadow Creek Bridge on east side of road, marked by two white corner stakes.

Tree Species: Lodgepole pine.

Tree Numbers: 426 to 762.

Plot Established 1935. Current examination September 16, 1937.

Abbreviations used:

G - Tree green and alive.

D - Tree dead. Foliage brown or absent.

T - Tree infested and foliage turning colour.

Dm - Dendroctonus monticolae.

I - Ips

Tree No.	D.B.H.	History of Bark Beetle Activity				Hypomolyx Activity
		1934	1935	1936	1937	
426	14	G	G	G	G	G
427	12	G	G	G	G	G
428	12	G	G	G	G	G
429	12	G	G	G	G	G
430	8	G	G	G	G	G
431	10	D	D	D	D	D
432	10	D	D	D	D	D
433	8	G	G	G	G	G
434	6	D	D	D	D	D
435	6	G	G	G	G	G
436	10	G	G	G	G	G
437	20	G	G	G	G attacked.	G
438	14	G	G	G	G Attacked.	
439	12	G	G	G	G attacked.	G (att.)
440	18	G	G	G	G	G (att)
441	14	G	G	G	G	G
442	10	G	G	G	G sickly.	G
443	6	D	D	D	D	D
444	6	G	G	G	G	G
445	6	D	D	D	D	D (Down)
446	18	G	G	G	G	G

Tree No.	D.B.H.	History of Bark Beetle Activity				Hypomolyx Activity
		1934	1935	1936	1937	
447	12	G	G	G	G	G
448	10	D	D	D	D	D
449	10	D	D	D	D	D
450	10	D	D	D	D	D
451	10	G	G	G	G	G
452	12	G	G	G	G	G
453	10	G	G	G	G	G
454	10	G	G	G	G	G
455	10	D	D	D	D	D
456	12	D	D	D	D	D
457	6	D	D	D	D	D
458	10	G	G	G	G	G
459	8	G	G	G	G	G
460	12	G	G	G	G	G
461	4	D	D	D	D	D
462	8	G	G	G	G	G
463	6	D	D	D	D	D
464	12	G	G	G	G	G
465	8	G	G	G	G	G
466	8	D	D	D	D	D
467	4	D	D	D	D (Down)	D (Down)
468	6	D	D	D	D	D
469	8	G	G	G	G	G
470	12	G	G	G	G	G
471	12	G	G	G	G	G
472	8	G	G	G	G	G
473	12	G	G	G	G	G
474	8	G	G	G	G	G
475	12	G	G	G	G	G
476	10	G	G	G	G	G
477	6	D	D	D	D (Down)	D (Down)
478	8	D	D	D	D	D
479	10	G	G	G	G	G
					Sickly.	
480	4	D	D	D	D	D
481	8	G	G	G	G	G
482	8	G	G	G	G	G
483	8	G	G	G	G	G
484	4	D	D	D	D	D
485	8	G	G	G	G	G
486	8	G	G	G	G	G
487	14	D	D	D	D	D (Down)
488	14	G	G	G	G	G
489	8	G	G	G	G	G
490	10	G	G	G	G	G
491	10	G	G	G	G	G
492	10	G	G	G	G	G
493	8	G	G	G	G	G
494	10	G	G	G	G	G

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
495	10	D	D	D	D	D
496	10	G	G	G	G	G
497	8	D	D	D	D	D
498	16	G Dm.	G	G Infestation drowned	G	G
499	16	G	G	G	G	G
500	10	G	G	G	G	G
501	6	D	D	D	D	D
502	10	G	G	G	G	G
503	12	G	G	G	G	G
504	10	G	G	G	G	G
505	8	G	G	G	G Sickly	G
506	10	G	G	G	G	G
507	6	D	D	D	D	D
508	12	G	G	G	G	G
509	12	G	G	G	G	G
510	8	G	G	G	G	G
511	10	G	G Dm.	G Ips attack only on N.E.side	G attacked	G
512	10	G	G	G	G	G
513	10	G	G	G	G	G
514	12	G	G	G	G	G
515	12	G	G	G	?	G
516	8	D	D	D	D	D
517	14	G	G	G	G	G
518	14	G	G	G	G	G
519	14	G	G	G	G attacked.	G (Aff.)
520	10	G	G	G	G	G
521	12	G	G	G	G	G
522	12	G	G	G	G	G
523	14	G	G Dm.	T Ips,Dm. larvae dead.Ips active	D D	D D
524	10	G	G Dm.	T Ips active. Dm. larvae		
525	12	G	G Dm.	T dpadactive Dm.larvae dead.	D	D

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
526	8	D	D	D	D	D
527	10	G	G	G	G	G
528	12	G Dm.	G	G Attack drowned.	G	G
529	12	G Dm.	T	D	D	D
530	14	G	G	G	G	G
531	12	G	G	G	G	G
532	10	G	G	G	G	G
533	12	G	G	G	G	G
534	12	G	G	G	G	G
535	10	G	G	G	G	G
536	6	G	G	G	G	G
537	8	G	G	G	G	G
538	14	G	G	G	D	D
539	12	G	G	G Dm.&Ips attacking	D	D
540	10	G	G	G Ips&Dm. Ips Y.A. present.	D	D
541	12	G	G	T Ips&Dm. Ips Y.A. present.	D	D
542	12	G	G	G	G	G
543	12	G	G	G	G	G
544	8	G	G	G	G	G
545	12	G	G	G	D	D
546	8	D	D	D	D	D
547	12	G	G	G	G	G
548	10	G	G	G	G	G (Att.)
549	16	G	G	G	G	G
550	16	G	G	G	G	G (Att.)
551	10	G	G	G	G	G (Att.)
552	12	G	G	G	G	G (Att.)
553	6	G	G	G	G	G
554	8	G	G	G	G	G
555	10	D	D	D	D	D
556	8	D	D	D	D	D
557	8	D	D	D	D	D
558	6	D	D	D	D	D
559	12	G	G	G	G	G
560	6	D	D	D	D	D
561	6	D	D	D	D	D (Down)
562	14	G	G	G	G	G
563	8	G	G	G	G	G
564	12	G	G	G	G attacked	D
565	8	G	G	G	G attacked	G
566	14	G	G	G	G	G
567	8	G	G	G	G	G

Tree No.	D.B.H.	History of Bark Beetle Activity				Hypomolyx Activity
		1934	1935	1936	1937	
568	16	G	G	G	G	G
569	8	G	G	G	G	G
570	8	G	G	G	G	G
571	10	G	G	G	G	G
572	8	D	D	D	D	D (Down)
573	12	G	G	G	G	G
574	8	G	G	G	G	G
575	10	G	G	G	G	G
576	12	G	G	G	G	G
577	10	G	G	G	G	G
578	12	G	G	G	G	G
579	8	G	G	G	G	G
580	8	D	D	D	D	D
581	10	G	G	G	G	G
582	10	D	D	D	D	D
583	10	G	G	G	G	G
584	12	G	G	G	G	G
585	12	G	G	G	G	G
586	12	G	G	G	G	G
587	14	G	G	G	G	G
588	12	G	G	G	G	G
589	4	D	D	D	D	D
590	14	G	G	G	G	G
591	10	G	G	G	G	G
592	8	G	G	G	G	G
593	12	G	G	G	G	G
594	6	G	G	G	G	G
					attacked.	
595	8	G	G	G	G	G
596	8	G	G	G	G	G
597	10	G	G	G	G	G
598	8	G	G	G	G	G
599	8	G	G	G	G	G
600	10	G	G	G	G	G
601	12	G	G	G	?	G
602	8	G	G	G	G	G
603	10	G	G	G	G	G
604	6	D	D	D	D	D
605	10	G	G	G	G	G
606	10	D	D	D	D	D
607	12	D	D	D	D	D
608	10	D	D	D	D	D
609	10	D	D	D	D	D
610	14	D	D	D	D	D
611	6	D	D	D	D	D
612	12	G Dm.& Ips.	T Dm.& Ips	D	D	D
613	8	G	G	G	G	G
614	8	G	G	G	G	G

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
615	6	G	G	G	G	G
616	4	D	D	D	D	D
617	4	G	T Ips	D	D	D
618	6	D	D	D	D	D
619	8	G	G	G	G	G
620	10	G	G	G	G	G
621	8	D	D	D	D	D
622	8	G	G	G	G	G
623	6	G	G	G	G	G
624	8	D	D	D	D	D
625	10	T Ips	D	D	D	D
626	10	G	G	G	G	G
627	8	D	D	D	D	D
628	10	G	G	G	G	G
629	10	G	G	G	G	G
630	12	G	G	G	G	G
631	12	G	G	G	G	G
632	8	D	D	D	D	D
633	8	G	G	G	G	G
634	8	G	G	G	G	G
635	12	G	G	G	G	G
636	14	D	D	D	D	D
637	12	G	G	G	G	G
638	8	G	G	G	G	G
639	14	G	G	G	G	G
640	10	G	G	G	G	G
641	8	G	G	G	G	G
642	8	D	D	D	D	D
643	8	D	D	D	D	D
644	14	G	G	G	G	G
645	10	D	D	D	D	D
646	14	G	G	G	G	G
647	12	G	G	G	G	G
648	12	G	G	G	G	G
649	4	G	G	G	G	G
650	8	D	D	D	D	D
651	12	G	G	G	G	G
652	14	G	G	G	G	G
653	14	G	G	G	G	G
654	18	G	G	G	?	G
655	12	G	G	G	?	G (AH.)
656	6	D	D	D	D	D
657	10	G	G	G	G	G
658	10	G	G	G	G	G
659	10	G	G	G	G	G
660	10	G	G	G	G	G
661	10	G	G	G	G	G
662	4	G	G	G	G	G
663	12	G	G	G	G	G

Tree No.	D.B.H.	History of Bark Beetle Activity				Hypomolyx Activity
		1934	1935	1936	1937	
664	8	D	D	D	D	D
665	12	G	G	G	G	G
666	8	G	G	G	G	G
					sickly.	
667	16	G	G	G	G	G
668	10	G	G	G	G	G
669	10	G	G	G	G	G
670	10	G	G	G	G	G
671	8	G	G	G	G	G
672	8	D	D	D	D	D
673	12	G	G	G	G	?
674	8	G	G	G	G	G
675	8	G	G	G	G	G
676	8	G	G	G	G	G
677	10	G	G	G	G	G
678	10	G	G	G	G	G
679	6	D	D	D	D	D
680	10	G	G	G	G	G
681	8	D	D	D	D	D
682	6	D	D	D	D	D
683	12	G	G	G	G	G
684	14	G	G	G	G	G
685	8	G	G	G	G	G
686	12	G	G	G	G	G
687	14	G	G	G	G	G (Ath.)
688	10	D	D	D	D	D
689	12	G	G	G	G	G
690	10	G	G	G	D	G
691	10	G	G	G	G	G
692	10	D	D	D	D	D
693	4	G	G	G	G	G
694	12	G	G	G	G	G
695	10	G	G	G	G	G
696	8	D	D	D	D	D
697	6	D	D	D	D	D
698	12	G	G	G	G	G
699	14	G	G	G	G	G
700	12	G	G	G	G	G
701	10	D	D	D	D	D
702	12	G	G	G	G	G
703	12	G	G	G	G	G
704	14	G	G	G	G	G
705	12	G	G	G	G	G
706	12	G	G	G	G	G
707	10	D	D	D	D	D
708	12	G	G	G	G	G
709	12	G	G	G	G	G (Ath.)
710	10	G	G	G	D	D
711	12	G	G	G	G	G
712	10	G	G	G	G	G

Tree No.	D.B.H.	History of Bark Beetle Activity				Hypomolyx Activity
		1934	1935	1936	1937	
713	10	G	G	G	G	G
714	10	D	D	D	D (Down)	D (Down)
715	6	D	D	D	D (Down)	D (Down)
716	12	D	D	D	D	D
717	12	G	G	G	G	G
718	8	G	G	G	G sickly	G
719	10	G	G	G	G	G
720	12	G	G	G	G	G (Att.)
721	12	G	G	G	G	G
722	10	G	G	G	G	G
723	12	G	G	G	G	G
724	10	G	G	G	G	G
725	12	G	G	G	G	G
726	10	G	G	G	G	G
727	16	G	G	G	G	G
728	12	G	G	G	G sickly	G (Att.)
729	16	G	G	G	G	G (Att)
730	12	G	G	G	D	D
731	10	G	G	G	G	G
732	12	G	G	G	G	G (Att.)
733	12	G	G	G	G	G
734	10	D	D	D	D	D
735	10	G	G	G Ips active on S. side.	D	D
736	8	G Ips	T Ips	D	D	D
737	8	G	G	G	G sickly	G
738	4	G	G	G	G	G
739	6	D	D	D	D	D
740	8	G	G	G	G	G
741	12	G	G	G	G	G
742	12	G	G	G	G	G
743	8	D	D	D	D	D
744	8	D	D	D	D	D
745	12	G	G	G	G	G
746	12	G Dm. & Ips	T	D	D	D
747	12	D	D	D	D	D
748	8	D	D	D	D	D
749	12	G	G	G	G	G
750	12	G	G	G	G	G
751	12	G	G	G	G	G
752	12	G	G	G	G	G
753	10	G	G	G	G	G
754	12	G	G	G	G	G
755	6	D	D	D	D	D

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
756	12	G	G	G	G	G
757	10	G	G	G	G	G
758	14	G	G	G	G	G
759	12	G	G	G	G	G
760	10	G	G	G	G	G
761	8	G	G	G	G	G
762	6	D	D	D	D	D

Sample Plot 4.

Location: 4.0 miles north of Meadow Creek Bridge on east side of road.

This plot is located in an area near the northern extremity of the main McLeod Meadows infestation. Practically all trees on it were green. When established in 1935 only those trees infested were numbered, there being but three such trees. No new trees had been attacked in 1936. These trees attacked in 1935 were: -

Nos. 764, 765, 766.

No new attacks on standing trees in 1938 but there were 13 green windthrown trees which were heavily infested with bark beetles since they fell. Windthrown trees just outside the plot.

Sample Plot 5.

Location: 5.1 miles north of Meadow Creek Bridge on east side of road.

Like Plot 4, this plot is beyond the main McLeod Meadow infestation. Practically all trees on it were green when established in 1935. Only infested trees were tagged and when examined in 1936 no new infestation had occurred. Trees attacked in 1935 were numbered as follows:

Nos. 768, 769, 770, 771, 772.

No new attacks on standing trees in 1938.

Sample Plot 6.

Location: 3.6 miles north of Meadow Creek. Bridge on west side of road. South line runs N 80° W. S.E. corner is "Mt. Selkirk" sign.

Abbreviations Used: Same as Plot 1.

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
774	12	G Dm.	T	D		D
775	12	G Dm.	T	D		D
776	10	G Ips	T	D		D
902	12	G	G	T Dm. Ips		D
903	12	G	G	G Dm. Ips.		G
904	12	G	G	T Dm. & Ips		D
905	6	G	G	T Dm. & Ips		D

Sample Plot 7.

Location: 1.5 miles south of Meadow Creek Bridge. S.E. corner opposite "Mile 75." In stand of timber similar to Plots 1 and 2 and was established as a check against Plots 1 and 2. Established in 1935 when trees killed prior to that year were blazed but not tagged. Trees attacked since 1934 were tagged as were those which were still green. The tabulation therefore shows only green trees and those actively infested. Old dead trees were not recorded.

Tree Numbers: 778 to 901.

Abbreviations Used:

G - Tree green and alive.

T - Tree infested and beginning to discolour.

D - Tree dead. Foliage brown or absent.

Dm - Dendroctonus monticolae.

I - Ips

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
778	12	G Dm.	G	G Dm. drowned	G drowned	G
779	8	G	G	G	G	G
780	12	G Dm.	T Ips	D	D	D
781	12	G Dm.	G	T Ips active	D	D

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
782	8	G Dm.	G	T Ips active	D	D
783	12	G Dm.	G	T Ips active	G attacked	G
784	10	G	G	G	G	G
785	14	G	G	G	G	G
786	14	G	G	G	G	G
787	14	G Dm.	G Ips E. side.	G	G	G
788	12	G	G	G	G	G
789	6	-	-	-	G	G
790	12	G	G	G	G	G
791	8	G	G	G	D	D (cut)
792	10	G Dm.	G	G drowned	D	D
793	8	G Dm.	G Ips	G attack E.side only. Dm. drowned.	G attacked.	G
794	10	G Dm. & Ips	T Ips	D	D	D
795	8	G	G Ips	T	D	D
796	12	G Dm.	G Dm.	G Dm. drowned	G	G
797	6	G Dm.	G	G	D ?	G
798	8	G Dm.	G	G	G	G
799	10	G	G	G	G	G
800	8	G Dm.	G	G attack drowned	G	G
801	14	G Dm.	G	G E.side dead. Larvae dead.	G attacked	G
802	12	G	G	G	G	G
803	Missing					
804	10	G	G	G	G	G
805	10	G	G	G	G	G
806	12	G	G	G	G	G
807	12	G	G	G	G	G
808	10	G	G	G	G	G
809	10	G	G	G	G	G
810	12	G	G	G	G	G
811	14	G Dm. & Ips	T Ips active Dm.dead.	D	D	D
812	10	G	G Ips	G Ips dead.	G	G
813	16	G Dm. E. side	T Ips W.side.	D	D	D

Tree	D.B.H.	History of Bark Beetle Activity				Hypomolyx Activity
		1934	1935	1936	1937	
814	10	G	G	G	G	G
815	10	G	G	G	G	G
816	16	G	G dm. & Ips	D	D	D
817	8	G	G	G	G	G
818	10	G	G	G	G	G
819	12	G	G	G	G	G
820	8	G	G	G	G	G
821	10	G	G	G	G	G
822	10	G	G	G	D	D
823	10	G	G Ips & Dm.	G Y.A. of Ips present. Dm. dead.	G attacked	G
825	8	G	G	G	G	G
824	10	G	G Dm.	G Dm. drowned	G	G
826	10	G	G	G	G	G
827	10	G	G	G	G	G
828	8	G	G	G	G	G
829	8	G	G	G	G	G
830	10	G	G	G	G	G
831	10	G	G	G	G	G
832	10	G	G	G	G	G
833	8	G	G	G	G	G
834	10	G	G	G	G	G
835	10	G	G	G	G	G
836	10	G	G	G	G	G
837	12	G Dm. & Ips	T Ips active. Dm.dead.	D Ips Y.A.	D	D
838	12	G Dm.	G	G. Dm. drowned.	G	G
839	12	Missing				
840	12	G Dm.	G Ips	T Ips active	D	D
841	12	G Dm. E.side	G Ips	T Ips active, Dm.galleries.	D	D
842	6	G	G	G	D	D
843	8	G	G	G	G	G
844	10	G	G Dm.	G Dm. drowned	G	G
845	10	G	G	G	G	G
846	10	G	G Dm. & Ips	G Ips pupae E.side.	G	D
847	10	G Dm & Ips	G	G	G	G

Tree No.	D.B.H.	History of Bark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
848	8	G Dm. & Ips	T	D	D	D
849	10	G	G	G	G	G
850	10	G	G	G	G (marked same as 832)	G
851	10	G Dm.	G	G Dm. drowned	G	G
852	10	G	G	G	G	G
853	8	G	G	G	G	G
854	10	G	G	G	G	G
855	8	G	G	G	G	G
856	12	G	G	G	G	G
857	8	G	G	G	G	G
858	10	G Dm. & Ips	T	D	D	D
859	14	G Dm.	T	D Ips Y.A. Dm. dead.	D	D
860	10	G	G	G	G	D
861	14	G Dm.& Ips on E.side.	T Dm. dead. Ips.Y.A.	D	D	D
862	10	G	T Ips	D	D	D
863	12	G	G	G	G	G
864	10	G	G	G	G	G
865	8	G	G	G	G	G
866	8	G	G	G	G	G
867	10	G	G	G	G	G
868	12	G	G	G	D	D
869	12	G	G	G	G	G
870	14	G	G	G	D	D
871	10	G Dm. & Ips	T	D	D	D
872	10	G	G	G	G	G
873	10	G	G	G	G	G
874	10	G	G	G	G	G
875	12	G	G	G	G	G
876	12	G	G	G	G	G
877	12	G	G	G	G	G
878	16	G	G	G	G	G
879	10	G	G	G	G	G
880	10	G	G	G	G attacked one side.	D
881	14	G	G	G	G	G
882	14	G	G	G	G	G
883	16	G	G	G	G	G
884	14	G	G	G	G	G
885	10	G	G	G	G	G

Tree No.	D.B.H.	History of Dark Beetle Activity 1934	1935	1936	1937	Hypomolyx Activity
886	14	G	T Dm. & Ips	D Ips Y. A. numerous	D	D
887	10	G	G	G	G	G
888	10	G	G	G	D	D
889	12	G	G	G	G	G
890	12	G Dm.& Ips on E.Side.	G Dm. dead.Ips active	G West side still green.	G (attacked.	G
891	14	G	G	G	G	G
892	12	G	G	G	G	G
893	10	G	G	G	G	G
894	12	G	G	G	D ?	G
895	6	G	G	G	G	G
896	10	G Dm.& Ips on E.side.	G	G E.side dead, W. side green	G attacked	G
897	12	G	G	G	G	G
898	10	G	G	G	G	G
899	12	G	G	G	G	G
900	14	D	D	D	D	D
901	14	G	G	G	G	G

PROJECT ANALYSIS

B. EUROPEAN LARCH SAWFLY (Lygaeonematus erichsoni Hartig.)

1. Project No. 17556*

2. Title of Project:

A study of the Bionomics and Control of the European Larch Sawfly in British Columbia.

3. Object of Project:

An investigation to determine the various factors influencing the spread of the European larch sawfly in southeastern British Columbia and an attempt at control by the introduction of the parasite, Mesoleius tenthredinis Morley, a Tachinid (Zenillia sp.) from Japan, and possibly, parasites from other countries.

4. Nature and Importance of Project:

British Columbia has many good, but localized, stands of western larch, and the annual value of larch products approximates three-quarters of a million dollars. When first discovered in 1933, the sawfly was present in epidemic numbers on a small area in Southeastern British Columbia. By establishing suitable parasites, it was hoped that the injury by the sawfly might be minimized which probably would mean the saving of the entire larch stands of the Province.

* These project numbers correspond with card index numbers and are taken from the series allotted to this laboratory by Ottawa.

5. Location of Work:

From the Fernie district westward to Slocan Lake. Most of the field work was done in the vicinity of Fernie, B.C.

6. Officers in Charge and Complete Personnel:

Ralph Hopping, Supervision of Project.

Geo. R. Hopping, Direction of Work.

H. B. Leech, Execution of Work.

7. Co-operation With Other Organizations:

The B. C. Forest Service has provided field laboratory accomodations near Fernie and has co-operated in the matter of transportation when opportunity presented.

8. Progress Report:

The seasonal development of the sawfly was followed for several years, both in the field and under caged conditions. This may be summarized as follows:

Emergence of adults - During the latter part of May.

Egg laying - Throughout late May, into June and July.

Incubation - 10 to 12 days.

Larval feeding - Continued throughout June, July, and August, varying with elevation and local factors

Cocoons are spun in the soil or duff or beneath logs, stones, or other objects affording cover, during August and September.

Generations - One per season.

Parthenogenesis - Usual method of reproduction

Diapause - Percentage carrying over to next season ranged from .64 to 22.2 according to site.

Distribution 1934 - Northern end of Columbia Lake to International Boundary and Corbin to Rosen Lake.

1935 - Range extended westward to Kitchener.

1936 - Westward to Kootenay Lake.

1937 - " " Slocan Lake.

Larch practically ceases north of Columbia Lake and east of Corbin so the direction of spread has necessarily been westward.

Method of Spread: 1..Slowly, by flight.

2. In long jumps by females carried in automobiles (conjecture borne out by evidence).

Along with the seasonal development the various factors that influence the trend of the outbreak were studied. These may be summarized as follows:--

Parasites (native)

Collopisthia nematicida Pack-Hymenoptera-Chalcididae

1934 -	17.1%	parasitism - Basis	942	cocoons
1935 -	10.0%	"	7058	"
1936 -	6.7%	"	6766	"

Bessa selecta Mg. - Diptera - Tachinidae

1934 -	5.09%	parasitism - Basis	924	larvae
1935 -	37.5%	"	148	"

1936 - Figures not available - parasitism heavy.

While admittedly the figure for 1935 is not based on a sufficient number of larvae, the collection was a random selection and indicates a marked increase in parasitism by this fly.

Parasites (introduced)

Mesoleius tentbredinis Morley - Hymenoptera - Ichneumonidae

Liberations - material from eastern Canada.

1934 - 673 liberated at Lizard Creek, Fernie
1935 - 289 " " Rosen Lake, B.C.
1935 - 1863 " " Hosmer, B.C.
1936 - 159 " " Kitchener, B.C.

1683?

Recoveries:

1935 - 187 - 2.6% parasitism - Basis 7058 cocoons.
1936 - 1344 - 20.0% " - " 6766 "

Liberations - Material from local collections.

1936 - 93 liberated at Lizard Creek.
- 229 " " Rosen Lake.
- 105 " " Lumberton, B.C.
- 229 " " Kitchener, B.C.

Total liberations - 3640 adults.

Zenillia sp. - Diptera - Tachinidae.

Liberations - Material from Japan via Belleville.

1935 - 116 liberated at Rosen Lake.
1935 - 756 " " Hosmer.

The original shipment from Belleville contained 1265 flies but the mortality in transit was heavy. No recoveries of this fly have been made.

Predators

Only a single bird, the Western Robin, was observed to feed upon the sawfly larvae. There was considerable

evidence that mice and moles consume the contents of the cocoons but definite figures are lacking, and difficult to obtain. The method used of judging by the type of opening in the cocoon is inaccurate. Yellow jackets (Vespa sp.) preyed on the larvae to a limited extent.

Fungi (native)

Isaria sp.

1934 - 9.0% mortality - Basis 942 cocoons
1935 - 37.9% " " 7058 "
1936 - 60.4% " " 6766 "

The above mortality was under cage conditions but observation in the field indicated that similar mortality was occurring there. Because of the continuous nature of the fungus accurate mortality figures are difficult to obtain in the field for the entire season.

Total Mortality (cocoon stage)

Year	Percentage Mortality	Basis	% Emergence of sawflies	Diapause	Unaccounted for %
1934	17.1	942	65.7	-	17.2
1935	50.5	7058	34.3	10.2	5.0
1936	87.1	6766	5.9	4.2	2.8

In the spring of 1937, cocoons were so scarce that it was useless to try to collect them. The larches came into leaf beautifully and it was extermely difficult to find a terminal showing egg scars.

The above data provides the explanation for the subsidence of the sawfly epidemic in British Columbia.

However, there is one important factor which has been obscured, but which probably is responsible for much of the mortality in the cocoons collected in 1936. Beginning on October 30th and continuing for three days in 1935, a -17°F frost was experienced at Fernie. There was no snow on the ground at the time and many native trees, especially cedars and pines, were seriously injured. Cultivated fruit trees were killed in many orchards and gardens. This undoubtedly caused a considerable mortality in the larvae within the cocoons, but this mortality was obscured in the collections made the following spring owing to Isaria taking possession and hence the mortality was attributed to this rather than the frost.

The immediate and successful establishment of Mesoleius is not in conformity with experience in introducing parasites nor does it conform to mathematical probabilities, which leads to the suspicion that Mesoleius may already have been present on the area, although no recoveries of it were made in cocoon collections made the year previous to, and the year of first liberations.

The work in 1937 was confined to scouting which established the presence of the sawfly as far west as Slocan Lake.

9. Cost of Operation (incl. officers' salaries)

1934	-	$512.53
1935	-	837.62
1936	-	649.85
1937	-	32.40
Total	-	$2,032.40

10. Plans for Future Work:

The work for 1938 will be confined to scouting to ascertain if further westward spread has taken place. This should not cost more than $50.00. However, if further outbreaks occur, the work of parasite dissemination will be continued as well as the study of the various control factors.

C. AMBROSIA BEETLES:

1. Project No. 17405:

2. Title of Project:

The Study of the Biologies of the Economically Important Ambrosia Beetles of the British Columbia Coast With a View to Economic Saving.

3. Object of Project:

Determination of the seasonal development of the ambrosia beetles Platypus wilsoni Sw., Gnathotrichus sulcatus Lec., G. retusus Lec., and Trypodendron cavifrons Mannh. with a view to the avoidance of attack on green logs in the woods and the establishment of a quick method for destroying the insects in export lumber.

4. Nature and Importance of Project:

The project was first undertaken because of the rejection of lumber cargoes at ports of destination (principally Australia) on account of ambrosia insects or evidences of such. Subsequently Australian authorities have insisted on a signed declaration by B. C. exporters, signifying that each cargo is free from ambrosia insects. In cases where ambrosia insects were found in cargoes the entire shipload was fumigated and the cost (sometimes 65 cents per thousand) charged to the shipper. It, therefore, became desirable to find some efficient but reasonable way to kill all insects in export lumber and to suggest changes in logging practices whereby ambrosia beetles might be prevented from attacking the green logs.

5. Location of Work:

Steelhead, near Mission, B.C.; Green Timbers near New Westminster; Whonnock, B.C.; and at the Forest Products Laboratory, Vancouver, B.C.

6. Officers in Charge and Complete Personnel:

Ralph Hopping,	Supervision of Project
Geo. R. Hopping,	Direction of Work.
W. G. Mathers,	Direction and Execution of Work.
H. B. Leech,	Execution of Work (in part)
K. Graham	Execution of Work (in part)

7. Co-operation with Other Departmental Units and Other Organizations:

All kiln treatments and chemical treatments of lumber were carried out in co-operation with the Dominion Forest Product Laboratory at Vancouver.

8. Progress Report:

Some of the facts of seasonal development which have been determined for the above ambrosia beetles are as follows:-

1. Time of flight and attack.
2. Sex which does excavating.
3. Rate of excavation.
4. Host trees.
5. Character of galleries.
6. Oviposition habits.
7. Incubation period.
8. Larval habits.
9. Pupation habits.
10. Length of cycle.
11. No. of broods per year.

In 1933, an effective method was tested for killing

all ambrosia insects in green export lumber. Samples and suitable checks were subjected to temperatures varying from 120°F. to 160°F., relative humidity 80%. It was found that all ambrosia insects were killed in 1.5 hours at 160°F and 150°F., 2.5 hours at 140°F. and 9 hours at 120°F. For the use of manufacturers, results were published in Circular 38, Dept. of Interior, "The Effect of Kiln Temperatures and Air Seasoning on Ambrosia Insects (pinworms) - by Geo. R. Hopping, Dominion Entomological Branch, and J. H. Jenkins, Dominion Forest Products Laboratories.

An attempt to find a chemical dip, which would kill ambrosia insects in lumber within a reasonable time was unsuccessful.

The third phase of the study consisted of testing various chemical sprays on logs in the woods with a view to repelling attack, and the establishment of the definite period of attack in order to avoid such by proper regulation of cutting and handling of logs.

With regard to repellents, certain creosote-kerosene combinations have indicated almost complete protection to green logs during the season 1937.

A table was prepared in order to show when logs could safely be left in the woods for a time and during what periods the logs should be removed as soon as cut. This was published in the trade journal, "B. C. Timberman" for the use of operators. It indicates that logs are safe from attack from

October 1st to April 30th, but during the remainder of the year, logs should be removed to the booming ground or mill pond as soon as possible after falling. This applies particularly to hemlock and Douglas fir.

Other factors which have been investigated as possible factors in attack have been moisture content and acidity of the log. In the repellent studies, the moisture content and sap acidity were established and correlated with the degree of attack. Results indicate that a moisture content of not less than 90% is necessary for ambrosia beetle attack. No definite relationship was indicated between ambrosia beetle attack and sap acidity. Data also indicate that unless the moisture content becomes less than 90%, the length of time a log has been cut (up to at least one year) makes little difference to susceptibility to attack.

9. Cost of Operation:

1932.	Kiln temperature tests.....	$220.36
1933.	Chemical dips.....	399.68
	Log preference and life history studies.....	771.07
1934.	Log preference, life history studies, moisture and acidity tests.....	847.41
1935.	Repellent studies.....	225.00
1936.	" "	250.00
1937.	(Not yet compiled)	
	Total	$2,713.52

10. Plans for Future Work:

It will be advisable to car y out repellent studies for one more season, testing more thoroughly the creosote-kerosene sprays. The cost of this work for 1938 should not exceed $200.00.

D. THE WESTERN HEMLOCK LOOPER (Ellopia somniaria Hulst.)

1. Project No. 17633.

2. Title of Project:

Ellopia somniaria Hulst., A Reconnaissance of 1937 Outbreaks and a Preliminary Investigation of Parasites.

3. Object of Project:

To establish the areas of defoliation, estimate tree mortality, and to study parasitism and moth emergence as a possible index of development in 1938; also to collect pupae for parasite storage experiments at the Belleville Parasite Laboratory.

4. Nature and Importance of Work:

The western hemlock looper, in the past, has caused greater timber losses in the forests of British Columbia than any other defoliator with the possible exception of the Douglas fir tussock moth. The present outbreaks, which first came to notice early in August, 1937 (through the forest insect survey), are probably the most extensive which have occurred in the Province. Many timber limits are involved upon which the yearly levies have been paid for some time and the wholesale destruction of the timber would mean a great loss to these licensees. Several of the larger companies are already in communication with us and we are keeping them informed of the developments in case salvage operations become imperative. In order to do this, it will be necessary to make a rather thorough study of the factors

influencing the trend of the outbreak. Under the conditions obtaining on the areas, airplane dusting does not seem advisable.

5. Location of Work:

Big Bend Area West of Golden; Trout Lake in the Arrowhead district; Trinity Valley Field Station for rearing work and population studies.

6. Officers in Charge and Complete Personnel:

Ralph Hopping,	Supervision of Project.
Geo. R. Hopping,	Direction of Work.
K. Graham,	Execution of Work.
H. B. Leech,	" " "
Cecil Morgan,	" " "

7. Co-operation with Other Organizations:

The B. C. Forest Service reported outbreaks and furnished transportation to officers when opportunity permitted.

8. Progress Report:

The Trout Lake infestation was the first one to be reported in August, 1937. This area is approximately twenty miles long and one to three miles wide. An officer visited the area shortly after the report was received and found the caterpillars commencing to pupate. Subsequently, 20,000 pupae were collected, 17,000 of which were sent to the Belleville Parasite Laboratory for storage experiments. At the Trinity Field Station, 3,000 were retained in order to get some idea of parasite emergence.

Parasitism:

Moth emergence

Males.....15.8%	Basis 3,018	pupae
Females..... 6.1%	"	" "
Parasites... 4.9%	"	" "

The reason for the low percentage of females becomes clear when it is known that this collection of pupae was made at the beginning of pupation. The pupation peak of the males occurs prior to that of females and an early collection would mean a preponderance of males.

The rather low parasitism (although approximate) coupled with the great numbers of moths in flight in September indicates continued severe defoliation in 1938. Last summer's feeding will result in a tree mortality of 85 to 90% over limited areas, but over the entire area of noticeable defoliation the mortality will be 5 to 10%.

Other areas of infestation occurred on the Big Bend Highway about 40 and 60 miles respectively from Golden, and another area in Revelstoke Park. The limits of one of the Big Bend areas was determined as being approximately 14 miles long and 2 to 3 miles wide. The same observations (as above) on tree mortality apply to the Big Bend areas.

With the material collected at Trout Lake, a long time experiment on the yearly fluctuation of population (excluding parasites) has been commenced at the Trinity Field Station. Biotic potential will be traced through a long period and correlated with outbreaks in an attempt to establish factors responsible for the comparatively sudden rise in population

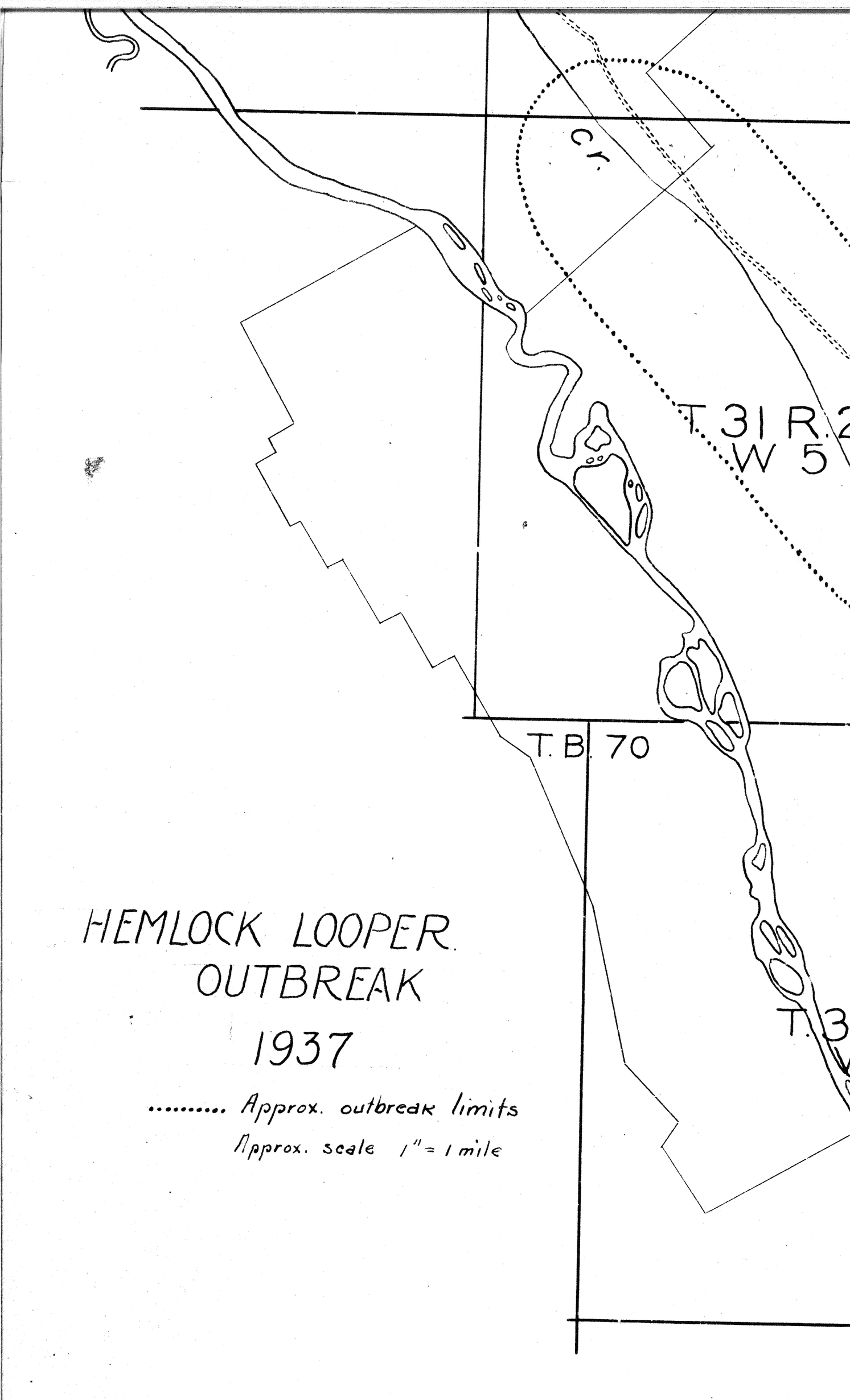
from time to time. A similar experiment is being conducted using the Douglas fir tussock moth.

9. Cost of Operation:

The cost in 1937 amounted to $73.85 including officers' salaries. This does not include the population studies being initiated at Trinity Field Station but covers only examination of outbreaks and cocoon collection.

10. Future Work:

It will be necessary to make a much more thorough study of parasitism and other factors influencing the outbreaks in 1938. Egg parasitism has not been determined and more accurate data is needed on larvae and pupal parasite emergence. The cost will approximate $500.00 including officer's salaries.



HEMLOCK LOOPER OUTBREAK 1937

..... Approx. outbreak limits

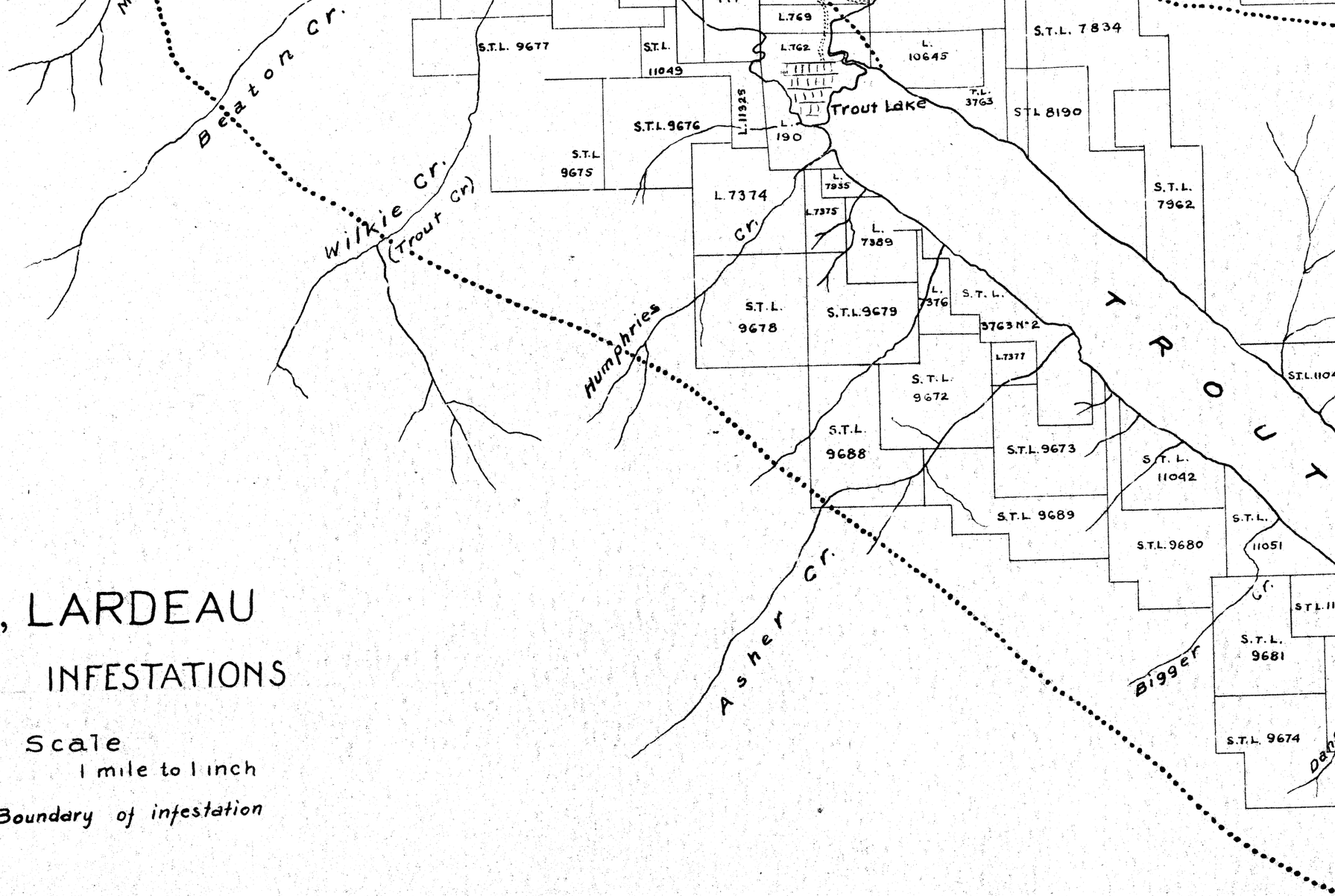
Approx. scale 1" = 1 mile

TROUT LAKE, LARDEAU

HEMLOCK LOOPER INFESTATIONS

1937 Scale
1 mile to 1 inch

..... Boundary of infestation



E. FOREST INSECT SURVEY:

1. Project Number 17635.

2. Title of Project:

A Survey of Insects Occurring on Spruce in British Columbia and Western Alberta.

3. Object of Project:

Primarily, to determine whether the European spruce sawfly is present in western Canada spruce stands, to increase our knowledge of injurious forest insects in this region, and to detect infestations of defoliating insects.

4. Nature and Importance of Project:

The European spruce sawfly is the most destructive forest insect ever imported into Canada. Apparently, the only feasible method of combatting this insect is by the proper importation and dissemination of parasites from Europe. In order to accomplish this end most successfully, it is necessary to know the detailed distribution of the sawfly in order to distribute parasites most effectively; hence the forest insect survey.

5. Location of Work:

Throughout the forested areas of British Columbia and western Alberta. Rearing of material is carried out at Trinity Field Station and at the Vernon laboratory.

6. Officers in Charge and Complete Personnel:

Those responsible for carrying out the forest insect survey in British Columbia are as follows:--

Ralph Hopping, Dominion Entomological Branch
Geo. R. Hopping, " " "
H. B. Leech, " " "
E. C. Manning, Chief Forester, Victoria, B. C.
Major F. J. Jennings, Supt. Banff National Park
Capt. E. N. Russell, Supt. Yoho, Revelstoke, Glacier, and Kootenay National Parks.
A. C. Wright, Supt. Jasper National Park.
H. Knight, Supt. Waterton Lakes National Park.

Those making collections were rangers and wardens of The B. C. Forest Service and National Parks respectively, as well as foremen of the Young Mens Forestry Training Camps.

7. Co-operation With Other Organizations (covered above)

8. Progress Report:

The survey was commenced in 1937 when certain available men in various organizations connected with forest administration were asked to make collections of insects from spruce in the vicinity of their stations during June, July, August, and September. These collections are made by placing a ground sheet or canvas beneath the spruce tree and shaking the tree vigorously or jarring it by hitting the stem with an axe. Trees up to fifteen feet in height are used. All insects which fall upon the canvas are placed alive in a heavy cardboard box, spruce foliage is provided for food, and the box is sealed with tape and mailed to the Vernon Laboratory from the nearest post office. These boxes are collapsible, and bear the printed address of the Vernon Laboratory. They are mailed to each collector at the beginning of each of the four months mentioned above. Printed instructions are included with each box and a negative report

form in case no insects are discovered. Each co-operator receives a written acknowledgement with a general statement as to the contents of the box sent in.

1937

No. of boxes sent	401
No. of boxes returned . .	189
Negative reports.	138
% making returns.	82.0%

Insects Recovered

Much of the material has not yet emerged and a detailed statement is not called for here.

Arachnida (in spite of instructions not to include)	88	
Coleoptera	223	
Collembola	several	
Corrodentia.	90	
Dermaptera	1	
Diplopoda	12	
Diptera.	98	
Hemiptera	166	
Homoptera.	106	
Hymenoptera.	182	
Lepidoptera.	403	
Neuroptera	26	
Orthoptera	3	
Plecoptera	10	
Thysanura	6	
Trichoptera.	7	
Fungi.	5	samples

Total number of insects recovered..... 1,333
Number of insects potentially injurious.. 612

No specimens of the European spruce sawfly in any stage were recovered in the shipments. The survey brought to attention three outbreaks of the western hemlock looper which have become serious problems. The three defoliators most commonly received were the western hemlock looper,

Ellopia somniaria Hulst., the black-headed bud-moth, Perone variana Fern, and the larvae of the sawfly, Pikonema dimmoc. (Cresson).

9. Cost of Operation:

The cost of this work to the Entomological Branch was small, amounting to the cost of the boxes (figures for which are not available) and the postage on boxes and letters which did not exceed $25.00. The expense of officers attending rangers' meetings in order to explain the survey plan, might be added, the amount being $64.20.

10. Plans for Future Work:

Plans for the extension of the present survey during 1938 have been bairly well formulated. There is definite assurance that the number of boxes sent out during 1938 will approximate 1,200 and the returns should be in the neighborhood of 1,000. In 1939 the survey will probably reach the maximum number of collections practicable for British Columbia.

SUMMARY REPORT OF THE 1937 FOREST INSECT SURVEY IN BRITISH COLUMBIA

The forest insect survey in British Columbia was commenced in 1937 for the purpose of determining whether the European spruce sawfly was present in our western spruce stands and also to gain a fuller knowledge of our forest defoliators. The survey also serves to bring to light outbreaks at an earlier stage of development than in the past. The methods employed in making the survey are similar to those employed in eastern Canada.

Certain available men in various organizations connected with the forests and timber industry are asked to make collections of insects during June, July, August, and September, from spruce trees in the vicinity of their stations. These collections are made by placing a ground sheet or canvas beneath the spruce tree and shaking the tree vigorously or hitting it with an axe. All insects which fall upon the canvas are placed alive in a heavy card board box, spruce foliage is provided for food, and the box is sealed with tape and mailed to the Vernon Laboratory from the nearest post office. These boxes are specially made, collapsible, and bear the address of the Vernon Forest Insect Laboratory. They are mailed to each collector at the beginning

of each of the four months mentioned above. Printed instructions are included with each box and also a negative report form in case no insects are discovered. Each co-operator receives a written acknowledgement with a general statement as to the contents of the box sent in.

At rangers' meetings and other meetings connected with the timber industry which are held regularly in various parts of the province the officers of the Entomological Branch explain the need for the forest insect survey and the methods proposed to carry it out. At the same time a summary report is presented of the previous years results.

Those largely responsible for the organization and carrying out of the survey in the west are as follows:-

Ralph Hopping,	Dominion Entomological Branch, Vernon, B.C.
Geo. R. Hopping,	Dominion Entomological Branch, Vernon, B. C.
H. B. Leech,	Dominion Entomological Branch, Vernon, B. C.
E. C. Manning,	Chief Forester, B. C. Forest Service.
Major P. J. Jennings,	Supt. Banff National Park.
Capt. E. N. Russell,	Supt. Yoho, Revelstoke, Glacier, and Kootenay National Parks.
A. C. Wright,	Supt. Jasper National Park.
H. Knight,	Supt. Waterton Lakes National Park.

In this initial year of the survey co-operation in the matter of making collections was confined to the B. C.

Forest Service, and the National Parks Branch. Other organizations will be included as the survey is expanded.

The following summary of results obtained in 1937 is necessarily general because much of the material has not reached the adult stage and identification if uncertain and often impossible.

B. C. FOREST SERVICE

District	Month	Boxes sent	Boxes returned	Negative Reports
Kamloops	June	13	6	5
	July	15	11	3
	August	15	12	1
	September	15	11	2
Vancouver	June	18	1	6
	July	18	9	9
	August	14	4	6
	September	12	4	6
Prince Rupert	June	8	1	3
	July	9	4	4
	August	9	4	4
	September	8	4	4
Prince George	June	7	3	2
	July	7	2	5
	August	7	4	3
	September	7	2	4
Nelson	June	12	5	2
	July	12	9	3
	August	12	9	3
	September	12	4	6
	Totals	228	109	81

NATIONAL PARKS

Region	Month	Boxes sent	Boxes returned	Negative reports
Banff	July	11	2	9
	August	12	3	6
	September	7	-	-
Yoho	July	5	5	-
	August	5	4	1
	September	5	2	1
Glacier	July	3	1	2
	August	3	1	2
	September	3	1	2
Mt. Revelstoke	July	2	2	-
	August	2	2	-
	September	2	2	-
Kootenay	July	3	-	3
	August	3	3	-
	September	3	1	2
Waterton Lakes	July	5	-	5
	August	7	1	1
	September	2	-	2
Jasper	July	11	10	1
	August	13	13	-
	September	15	10	5
	Totals	122	63	42

YOUNG MENS FORESTRY TRAINING PROJECT.

These camps were established by the B. C. Forest Service in co-operation with the Federal Government to make forest improvements and train young men in elemental f orestry.

No. of boxes sent 51
No. of boxes returned ...17
Negative returns 15

GRAND TOTAL

No. of boxes sent 401
No. of boxes returned.. 189
Negative reports 138

Percentage of co-operators making returns - 82%.

INSECTS RECOVERED

(and Other Arthropods)

ARACHNIDA

Acarina (mites)			4
Araneida (spiders)	egg cases		4
	adults & immatures		80

Coleoptera

Alleculidae	adult		1
Anobiidae	"		1
Buprestidae	"		1
Cantharidae	"		4
Carabidae	"		1
Cerambycidae	larvae		2
"	adults		8
Chrysomelidae	larvae		3
"	adults		8
Coccinellidae	larvae		18
"	pupae		2
"	adults		24
Curculionidae	larvae	(a few	
	pupae	(Pissodes	
	adults		37
Elateridae	adults		41
Helodidae	"		3
Lampyridae	"		2
Lathridiidae	"		9
Leiodidae	"		1
Melandryidae	"		15
Melyridae	"		12
Scarabaeidae	"		2
Scolytidae	larvae		3
	adult		1
Staphylinidae	"		6
Tenebrionidae	"		18

Collembola			Several
Corrodentia (Psocidae)			90
Dermaptera (Forficula)			1
Diplopoda			12
Diptera	Asilidae	adults	2
	Bibionidae	"	13
	Culicidae	"	5
	Syrphidae	larvae	57
		pupae	6
		adults	2
	Tipulidae	"	2
	Trupaneidae	"	1
	Trypetidae	"	1
	Unidentified Diptera	pupa	1
		adults	8
Hemiptera	Anthocoridae	adults	1
	Aradidae	"	3
	Coreidae	"	1
	Lygaeidae	"	16
	Miridae	"	91
	Nabidae	nymph	1
		adults	7
	Neididae	"	4
	Pentatomidae	empty eggs	20
		nymphs	5
		adults	4
	Unidentified Hemiptera,	nymphs	2
		adults	11
Homoptera	Aleyrodidae	immature	3
		adults	5
	Aphididae		
	Dilachnus sp.	adults	41
	Mindarus sp.	"	many
	Unidentified aphis,	adults	12
	Cercopidae	nymph	1
		adults	22
	Cicadellidae	nymph	1
		adults	3
	Coccidae	nymphs	Several
		adults	4
	Fulgoridae	"	11
	Phylloxeridae (Adelges spp.)	galls	46
		adults	many
	Unidentified Homoptera,	"	3

Hymenoptera

Sawflies

Abia	larva	1
	adult	1
Lygaeonematus	egg scars, cocoons (Larix)	13
Neodiprion	larvae	108
	cocoons	14
	adults	1
Pachynematus	larvae	3
Pamphiliidae	"	6
Siricidae	adults	6

Parasitic Hymenoptera

Chalcididae	adults	2
Ichneumonidae l	"	3
Unidentified	cocoons	4
	adults	6

Social Hymenoptera

Ants (miscellaneous)..	adults	14

Lepidoptera

Cacoecia	larvae	4
	pupae	1
	adults	2
Ellopia	larvae	41
	pupae	17
	adults	14
Geometridae (undetermined spp.)	larvae	176
	pupae	4
	adults	2
Hemerocampa	adults	2
Malacosoma	cocoon	1
	adult	1
Nepytia	larvae	13
	pupae	2
Peronea	larvae	33
	pupae	3
	adults	9
Unidentified Lepidoptera,	larvae	52
	pupae	16
	adults	5

Neuroptera

Chrysopidae	larvae	6
	pupae	2
	adults	1
Hemerobiidae	larvae	1
	adults	6
Polystoechotidae	"	2

	Raphidiidae	larva	1
		adults	3
	Unidentified Neuroptera,	larva	1
		adults	3
Orthoptera		adults	3
Plecoptera		adults	10
Thysanura		adults	6
Trichoptera		adults	7
Fungi (on foliage)		samples	5

CONCISE TOTALS

*	Arachnidae	egg cases	4
		other stages .	84
	Coleoptera	larvae	26
		pupae	2
		adults	195
	Collembola		Several
	Corrodentia (Psocidae)		90
	Dermaptera		1
*	Diplopoda		12
	Diptera	larvae	57
		pupae	7
		adults	34
	Hemiptera	eggs	20
		nymphs	8
		adults	138
*	Homoptera	immature	5
		adults	101
		galls	46
	Hymenoptera	larvae	118
		cocoons	31
*	(ants = 14)	adults	33
	Lepidoptera	larvae	319
		pupae	49
		adults	35

Neuroptera	larvae	9
	pupae	2
	adults	15
Orthoptera		3
Plecoptera		10
Thysanura		6
Trichoptera		7
¥ Fungi (on foliage)	samples	5

* Actual totals should be much higher, especially under Mindarus sp., since these were often recorded as "many" or "numerous."

* Directions were given not to include spiders, centipedes, ants.

¥ Fungi on leaves of Picea, Populus and Salix.

COMPLETE TOTALS (All stages included)

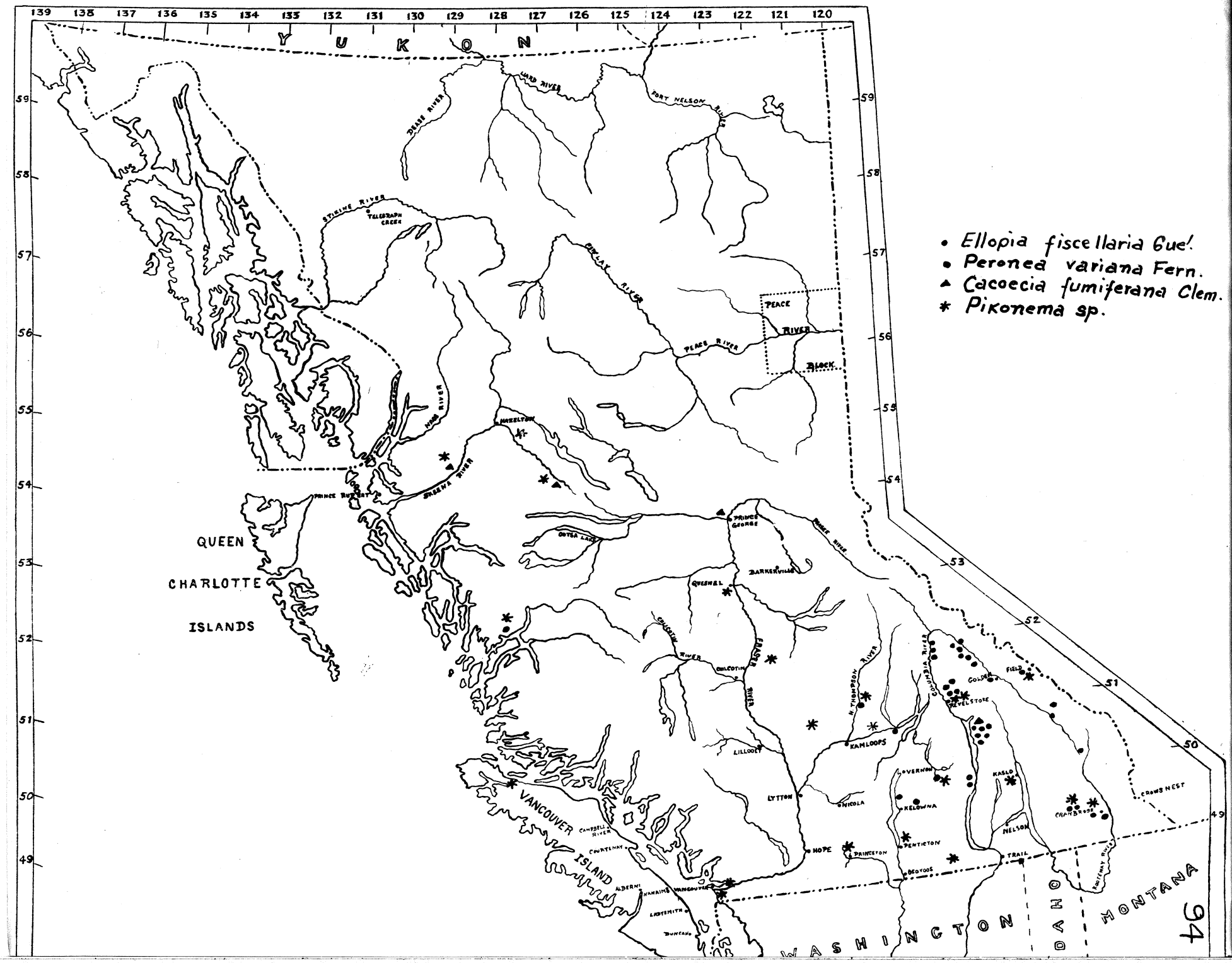
Arachnida	88
Coleoptera	223
Collembola	Several
Corrodentia (Psocidae)	90
Dermaptera	1
Diplopoda	12
Diptera	98
Hemiptera	166
Homoptera (less galls)	106
Hymenoptera	182
Lepidoptera	403
Neuroptera	26
Orthoptera	3
Plecoptera	10
Thysanura	6
Trichoptera	7
Fungi (on foliage)	5 samples.

No specimens of the European spruce sawfly in any stage were received in the shipments. The survey brought to notice three outbreaks of the western hemlock looper which

subsequently increased to serious proportions. The three defoliators most commonly received were the western hemlock looper, Ellopia somniaria Hulst., the black headed bud-moth Peronea variana Fernald and the larvae of the sawfly Pikonema dimmockii (Cresson).

FUTURE SURVEY PLANS

Plans for the extension of the present survey work during 1938 have been fairly well formulated. There is definite assurance that the number of boxes sent out during 1938 will approximate 1,200 and the returns should be in the neighborhood of 1,000. In 1939 the survey will probably reach the maximum number of collections practicable for British Columbia.


• Ellopia fiscellaria Gue.
• Perenea variana Fern.
▲ Cacoecia fumiferana Clem.
* Pikonema sp.
YUKON
QUEEN CHARLOTTE ISLANDS
VANCOUVER ISLAND
PEACE RIVER
PEACE RIVER BLOCK
PRINCE GEORGE
QUESNEL
BARKERVILLE
KAMLOOPS
LILLOOET
LYTTON
HOPE
PRINCETON
KELOWNA
PENTICTON
KASLO
NELSON
TRAIL
CRANBROOK
FIELD
GOLDEN
REVELSTOKE
CROWS NEST
WASHINGTON
IDAHO
MONTANA
94

F. TRINITY VALLEY FIELD STATION:

In planning the survey, it became evident that accommodations must be provided where food was readily available for rearing larvae. For some years the B. C. Forest Service has reserved a 40-acre tract of timber in Trinity Valley, twenty miles from Vernon, for the use of the Dominion Entomological Branch. This tract is particularly well suited for development as a permanent forest insect field station because the stand is of all classes, and nearly every conifer common to the Interior of the Province is represented on the plot. A good stream flows through the centre of the plot, the minimum flow being nearly 1 cubic foot per second.

During 1937, two buildings were erected, a main building (laboratory) and an insectary, although the latter was not completed early enough to be of any use during that season. The main building consists of a laboratory, sleeping room, kitchen, store room and closets. There is ample space for two more rooms up-stairs. When completed, the insectary will consist of two compartments, one screened with 40 mesh wire and the other with ordinary screening. Eventually, electric light, water, and telephone facilities will be installed.

Larvae and other insects, received from the insect survey shipments, which require feeding and care during the spring and summer, will be handled at this field laboratory. At the same time, investigational work will be carried on to determine and evaluate various factors influencing the rise of destructive forest insect populations.

A similar station is planned for the coastal region. This will undoubtedly be situated at the Cowi chan Forestry Station and, when established, can take care of the forest insect survey material for that region as well as carry on investigations of problems peculiar to the coastal belt.

In addition to major projects, the Vernon Forest Insec Laboratory is called upon to investigate and make control recommendations for many injurious insects of minor importance. These are generally brought to attention by nurserymen, Householders, lumber manufacturers and dealers in forest products.

Some of these insects about which information has been supplied during 1937, together with control measures, may be listed as follows:--

Hissodes sitchensis Hopk. - B. C. Forest Nursery at Green Timbers, New Westminster, B. C.

Camponotus sp. destroying timbers in private dwellings - Vancouver and Powell River.

Termites - destroying timbers in a University of B. C. Building; also spoiling a new paint job by sticking to the paint in great numbers.

Trachykele blondeli Mars. - Inquiry on distribution.

Fleas in fuel sawdust - Several requests for control measures from Vancouver residents.

Anisandrus pyri Peck- Attacking ornamental Acacia tree and walnut in Vancouver, B.C.

Cryptorrhynchus lapathi L. - Attacking ornamental wi
both at Vancouver and Vernon, B. C.

Notolophus antiqua - attacking ornamental spruce at V

Hemerocampa pseudotsugata McD.- attacking ornamental
Douglas fir, Salmon Arm, B. C.

Hemichroa crocea Geoff. - attacking ornamental alders
at Powell River, B. C.

Adelges cooleyi Gil. on Sitka spruce.

Saperda sp. in Aspen logs - Pacific Lumber Inspection
Bureau.

A great many odd rearings of forest and shade tree insects were carried out at the Trinity Valley Field Station and three shipments of bark beetle parasites, Coeloides sp., were made to the Belleville Laboratory for trans-shipment to Holland.

Phenological notes were commenced more or less as a trial to determine the most suitable species to establish as permanent phenological indices.

ANNUAL REPORT

Of the

VANCOUVER SUB-LABORATORY

-1937-

INTRODUCTION

The coast district of British Columbia was in 1937 again free of any major outbreak of forest insects. However several minor outbreaks occurred, including a serious infestation of the sitka spruce weevil, Pissodes sitchensis Hopk., in the plantations of the Provincial Forest Service adjoining the Green Timbers Forestry Experiment Station 6 miles south of New Westminster, B.C., and an outbreak of the alder sawfly, Hemichroa crocea Geoff., at Powell River, B.C. Moreover, heavy flights of the pine butterfly, Neophasia menapia Feld., occurred on two rather inaccessible areas on Vancouver Island, but no noticeable defoliation was reported.

Ambrosia beetles attacking freshly cut logs continue to be an important problem in this district and the main project of this laboratory during the past year was the continuation of the investigation of repellents as a possible means of preventing attacks. This project has been carried on during the past three summers and of the

various solutions experimented with the creosote-kerosene mixtures have shown the most promise. A preliminary study of the sitka spruce weevil infestation at the Green Timbers Forestry Experiment Station was also undertaken in addition to the investigation of various minor problems, the inspection of reported insect damage to shade and forest trees and to forest products, and the issuing of entomological advice in connection with such damage and in reply to a considerable number of inquiries received regarding various miscellaneous insect pests. The outgoing mail from this laboratory during 1937 amounted to 181 letters and 18 packages, handled without any stenographic assistance.

The laboratory was visited by Dr. Arthur Gibson, Dominion Entomologist, on September 7th, by Mr. Ralph Hopping, Forest Entomologist in charge in British Columbia, on October 12th and by Mr. G.R. Hopping, Assistant Forest Entomologist, in August. These visits were for the purposes of inspecting the activities of the laboratory and of conferring with the writer on the work in this district. Both Mr. Ralph Hopping and Mr. G.R. Hopping also visited the laboratory at the time of the annual meeting of the Entomological Society of British Columbia, which was held in Vancouver on February 27th. This meeting was also attended by the writer.

In the latter part of August the writer was very fortunate to have the privilege of visiting the laboratories of the United States Bureau of Entomology, located at Puyallup, Wash., and Portland, Ore. Investigations of truck crop and garden insects are conducted at Puyallup and a half day was spent there looking over the equipment of the laboratory and conferring with Messrs. Wm. Baker and C.W. Getzendaner, members of the staff. Enroute from Puyallup to Portland, a stop was made at the Pack Demonstration Forest of the University of Washington. This forest is located at La Grande, Wash., and is the site of a new forest insect field insectary under the supervision of the laboratory at Portland. The latter is the headquarters of the Bureau's forest insect work in the Pacific Northwest and as its problems are very similar to those of this laboratory, an extremely profitable day and a half was spent there. In addition to discussing in the laboratory various phases of the entomological work with Mr. F.P. Keen, entomologist in charge, and with Mr. R.L. Furniss, assistant entomologist, a trip into the field was made with Mr. Furniss in order to look over a logging operation salvaging fire-killed timber and to observe the work of wood borers, particularly the Cerambycid, Criocephalus productus, in the fire-killed timber, an important problem of the Portland Laboratory.

The writer also spent from November 7th to 30th on detail work at the Vernon Laboratory.

The weather in the coast district of the province during the year was characterized by a prolonged cold spell extending through January and most of February followed by a very backward spring and a comparatively cool summer. A mild fall was also experienced with the first frost not being recorded until the middle of November.

Inspections.

In addition to various inspections of insect damage to local shade trees and forest products, particular attention was paid to the construction of a new road through the centre of Stanley Park and the disposal of the resulting slash. (See Figures 1-6).

Moreover, an examination was made on July 7th of the alder sawfly outbreak at Powell River, B.C., and at the same time a reported insect outbreak in white pine in that district was investigated. The latter, however, proved to be white pine blister rust work in young second growth coming in on logged over areas. A number of the trees had been killed while others showed only dead branches. Some of the infected trees showed pitch moth attack while a Pityophthorus sp. was recovered from the trunk of one of the dying trees.

An inspection trip was also made to Vancouver Island

in the latter part of September. A portion of the Nanaimo River watershed on which a heavy flight of the pine butterfly had recently occurred was visited, but no defoliation of the timber was found. A visit was also made to the Provincial Forestry Experiment Station at Cowichan Lake where the occasional dying Douglas fir on the experimental plots continue to be a problem. Such trees show Pseudohylesinus and Scolytus attack on the trunks and in some cases the work of what is apparently Pissodes fasciatus Lec. is to be found at the root collars. However, the primary organism attacking the trees is undoubtedly the root fungus Armillaria sp. While on the Island the opportunity was also taken to confer with officers of the Provincial Forest Service at Victoria, B.C., on our work and to visit the laboratory of Mr. W. Downes.

Co-operation.

Very satisfactory co-operation has been maintained between this laboratory and the University of British Columbia, the Provincial Forest Service and the Dominion Forest Products Laboratory. Grateful acknowledgment is made to the University for the continued use of Room D in the Agriculture Building as an office and laboratory and to its Department of Forestry for permission to use its forest for our work. During the absence of the Professor of Entomology during the summer months the

writer has been only too pleased to handle the various inquiries received by the University regarding miscellaneous household and garden insects. Particular thanks are also due the Forest Products Laboratory for providing space for our portable rearing cages and for the splendid co-operation regarding entomological problems in connection with forest products. In reference to the latter, at the request of the British Columbia Lumber and Shingle Manufacturers' Association considerable time was spent during the year by Mr. R. Perry of the Forest Products Laboratory and by the writer on the preparation of a joint paper on termites and their control. The purpose of such a paper is for the use of the Association in the furthering of the export market for British Columbia timber. However, the completion of the paper has been held in abeyance for the receipt of additional data from the West Indies.

At the request of Mr. W. Downes of the Victoria Laboratory and acting on his instructions, the writer was pleased to liberate 6,500 parasitized earwigs for him on August 6th in the vicinity of Vancouver.

Personnel.

Except for the assistance of Mr. K. Graham for the brief period from May 10th to 15th, the work of this laboratory during the year was carried on entirely by W. G. Mathers, the writer.

Projects for 1938.

The major projects to be undertaken in 1938 by this laboratory are the continuation of the investigation of ambrosia beetles attacking green logs and a detailed study of the sitka spruce weevil outbreak on the Provincial Forest Service plantations at the Green Timbers Forestry Station. In order to carry out these projects as planned, in addition to the other duties of the laboratoty, it is essential that a seasonal assistant be assigned to this laboratory in 1938. Such an assistant would be located at the Green Timbers Station for most of the season for the purpose of conducting the field studies of the spruce weevil. At the same time he could make a study, particularly as to parasites, of the willow borer, Cryptorhynchus lapathi, which is active in the native willow about the station.

The ambrosia beetle investigation in 1938 will include:

1. Further experiments with repellents as a means of preventing attack, with special attention being paid to creosote-kerosene mixtures, and with the application of at least one set of the solutions sufficiently early in the season to record their effectiveness against the heavy spring flight of Trypodendron.

2. The separation of the flight periods of Gnathotrichus sulcatus and G. retusus, both of which were found in the latter part of 1937 to have attacked the repellent logs. Previous to that time observations and collections had indicated that only G. sulcatus was present.

3. The preparation of a complete report for publication covering all phases of our ambrosia beetle investigation to date. Sugjects to be dealt with in the report should include, description of the insects, their life histories and habits, our experiments with kiln temperatures, air seasoning, chemical dips, repellents and time of felling in relation to attack and concluding with recommendations for minimizing and controlling damage by these insects. In view of inquiries received, such a report would be very much appreciated by the lumber industry.

The study of the sitka spruce weevil, Pissodes stichensis, to be complete would need to be conducted at the Green Timbers Forestry Station where an excellent opportunity is available for a thorough investigation of this pest, including its life history and habits, the relation of such factors as exposure, age of trees, composition of the stand, etc., to attack, and its control factors. Moreover, the plantations provide an ideal location for both temporary and permanent sample plots. The damage already caused by this weevil in the plantations

indicate the necessity of alterations in the planting plans now being followed in this district and in this connection our studies should definitely indicate what changes should be made and to what extent. The full co-operation of the Provincial Forest Service in these studies has already been assured.

The needs for a permanent field station in the coast district have increased greatly since 1932, when plans for it were first submitted, and the establishment of such a station should be proceeded with as soon as possible. The most satisfactory site for the station is at the Provincial Forestry Experiment Station located at Cowichan Lake on Vancouver Island. Not only could many of the insect problems relative to mature timber and logging operations be carried on there, but special attention could be given to insects affecting reproduction. Moreover the station would provide an excellent place for the handling of all the forest insect survey material originating in the coast district. A drawback to the location of the station at Cowichan Lake is the distance from our coast headquarters here at this laboratory. However, to overcome this, it is suggested that this laboratory be moved to Victoria where a field crop and fruit insect laboratory of the Branch is already established. In Victoria we would also be in closer contact with the

headquarters of the Provincial Forest Service and the larger sized logging operations would be more accessible. There would also be distinct advantages in having this laboratory in close proximity to the laboratory already in Victoria.

FOREST INSECT CONDITIONS DURING 1937

Defoliators

This year the forest insect survey was extended to British Columbia with the Vernon Laboratory the centre of activity. Here the survey was confined to spruce and was of preliminary nature, particularly in the coast district where no personal contacts were made and from which reports were only received from officers of the Provincial Forest Service. However, the limited number of returns received from the coast district yielded some interesting material and although much of it has not yet been identified, data already obtained on the more important species are incorporated in the following summary.

No reports of the occurrence of any of the following three forest defoliators were received this year nor were their presence noticed:

Black Headed Budworm - Peronea variana Fern.
Hemlock sawfly - Neodiprion tsugae Mid.
Douglas fir webworm - Halisidota argentata Pack.

Western Hemlock Looper - Ellopia somniaria Hulst.

Although several serious outbreaks of this species were found this year in the interior of the province, the only record of its presence in the coast district was one larva contained in the Survey Box 3803 received in the latter part of August from the forest rangera at Ocean Falls, B.C.

Spruce Budworm - Cacoecia fumiferana Clem.

As during the past several years, a few spruce budworm larvae were recovered from trees in the Botanical Garden of the University. The hosts included, Engelmann spruce, sitka spruce and western hemlock. In addition, one dead larva which was presumed to be this species, was found in the Survey Box 3519 received in July from the forest ranger at Terrace, B.C., while an empty pupal case which may have been of this species was included in Box 3799 received in August from the ranger at Hazelton, B.C. These records, should they be correct, are of considerable interest for we have no previous record of the occurrence of the spruce budworm in the Skeena river district.

Green Hemlock Looper - Nepytia phantasmaria Stkr.

13 caterpillars and 2 pupae of what were apparently this species were submitted in the Survey Box 3841 in the latter part of August by Mr. D.M. MacKenzie in charge of the forestry training camp at the Green Timbers Forestry Station near New Westminster, B.C.

Pine Butterfly - Neophasia menapia Feld.

A very heavy flight of this butterfly occurred this fall on portions of the Nanaimo river watershed, but no defoliation was observed. A similar flight of the same species was also reported in September on the Nimpkish river watershed located in the northern portion of Vancouver Island.

Douglas Fir Tussock Moth - Hemerocampa pseudotsugata McD.

Specimens of this tussock moth which was reported to be defoliating several Douglas firs near Mill Bay on Vancouver Island, were recieved this past summer by Mr. W. Downes of Victoria, B.C. and Mr. Ralph Hopping at Vernon. This is our first record of the occurrence of this defoliator in the coast district.

Satin Moth - Stilpontia salicis L.

Several poplars on the campus of the University were this year again lightly infested by this species. However, Mr. R. Glendenning reported in June (Canadian Insect Pest Review, 15:134) that he found a moderate infestation of the satin moth on roadside willows on Sumas Prairie, B.C. and Mr. W. Downes reported in July (Can. Insect Pest Review, 15:191) sporadic defoliation by the same species on Lombardy poplars at Victoria, B.C. and on aspens in the surrounding country.

Tent Caterpillars - Malacosoma sp.

Although Mr. Downes has reported a decline in the tent caterpillar infestation in the Victoria district, it was abundant in the orchard of the University of British Columbia and Mr. Glendenning reported that severe outbreaks of the forest tent caterpillar were active this year over small areas in the Mission and Sumas districts, B.C., but that otherwise the species was not abundant nor generally distributed. (Can. Insect Pest Review, 15:134).

Alder Sawfly - Hemichroa crocea Geoff.

An outbreak of the alder sawfly occurred this year in second growth alder at Powell River, B.C. The infestation extended over several hundred acres with heavy defoliation of trees located along the upper border of the townsite and on the edge of the golf course.

Bark Beetles.

No outbreaks of bark beetles were reported during the year in the coast district. Moreover, the outbreak reported in 1936 in Abies grandis at Duncan, B.C. has subsided, no fresh 'red tops' being evident in September of this year. However, several instances were encountered during the year where secondary bark beetles were active in dying trees weakened by other causes.

Wood Borers

Ambrosia Beetles attacking Conifers.

Ambrosia beetle attacks on green logs continued to be an important problem in this district. Several requests for information were received during the year and our investigation of these insects is being continued.

Western Cedar Borer - Trachykele blondeli Mars.

In October a request was received for information on the distribution of this species and Prof. G.J. Spencer received a report in April that an entire shipment of 500 cedar poles from Vancouver Island to the British Columbia Electric Power and Gas Company in Vancouver had been condemned due to the workings of this borer.

Aspen Borer - Saperda calcarata Say.

In March a report was received that several logs in a shipment of aspen logs at New Westminster from the Salmon Arm district, B.C., for export to Japan showed insect damage. A 3-foot section of the infested material was submitted to this laboratory and the damage appeared to be the work of Saperda calcarata. Although the section was caged no adults have been recovered to date.

Termites - Zootermopsis angusticollis Hagen.

The foundation timber of the agricultural vocational building, built in 1920 on the campus of the University, was found in July to be so heavily infested with this

termite and dry rot that considerable replacement work was necessary. The infested material had been in direct contact with the ground. Moreover in September a portion of temporary wooden curbing which had been in position for 12 years on the campus was replaced due to damage by the same species of termite.

Termites were in flight this year from the middle of August to well into September, the flight period being prolonged by unsettled weather. On the evening of August 28th the fresh white coat of paint which had been applied that day to a new building at the Green Timbers Forestry Station proved such an attraction to termites in flight that many of them became trapped by their wings in the paint. Although the insects escaped, their wings which remained so marred the appearance of the paint that it was necessary to scrape and repaint both ends of the building.

Carpenter Ants - Camponotus herculeanus L.

On June 15th carpenter ants were found infesting the studding of two inside walls of a sun room on the first floor of a dwelling in Vancouver. The ants passage extended along the sills from an outside corner on the opposite side of the house. On October 26th damage to the fir flooring of a room of another house in Vancouver was found to be the work of the same insect. In this case the damage was so severe that the replacement of the flooring

was advisable. Moreover, in July the heartwood of a large western red cedar in the grounds of a private residence in West Vancouver was also found to be infested with carpenter ants.

Miscellaneous Wood Borers.

A large oak beam, 12" x 16" x 11', in the warehouse of a local importer of hardwoods was found on July 16th to be heavily infested with live grubs which have since been tentatively identified as Platysystrophus (Eupsalis) minutus Drury. The beam was of swamp oak from Indiana.

Samples of maple 'bends' received on March 12th from a local builder of small boats were found to be infested with Habrobregma sp. and in September grubs of an undetermined Lucanid were recovered from sills on which lumber had been stacked in a local storage shed. Moreover, on September 11th insect damage by an undetermined species was found in hickory imported by a local firm.

Miscellaneous Insects.

Anisandrus pyri Peck.

Several reports of damage by this species were received during the year. In May specimens were received from Squamish, B.C. where several apple trees had been killed and from Gibson Landing, B.C. where the insects had killed a young maple. Then in August a sample of a young walnut tree which had been killed by the same species was received from Aldergrove, B.C. and in September a

dying acacia tree in Vancouver was also found to have been attacked by it. Two trees of this latter host at the Green Timbers Forest Experiment Station were also attacked and killed in the spring by the same species.

Pissodes sitchensis Hopk.

A serious outbreak of this weevil occurred this year on plantations at the Green Timbers Forestry Station, six miles south of New Westminster, B.C. Sitka spruce of from 7 to 9 years of age were attacked and the infestation extended over about 140 acres with over 50 per cent of the spruce on parts of the area infested. (See Figure 15).

Cryptorhynchus lapathi Linn.

This snout beetle was found this year to be particularly active in native willows on the plantations at the Green Timbers Forestry Station (See Figure 16). Many of the willows were being killed and a similar infestation on Sumas Prairie, B.C. was reported in July by Mr. R. Glendenning. (Can. Insect Pest Review, 15:138).

Coptodisca arbutiella Busck.

The several madrona, Arbutus menziesii, on the campus of the University were again fairly heavily infested with this leaf miner and also by a second species which has been identified by Dr. J. McDunnough as Marmara arbutiella Busck and which had not previously been represented in the National Collection at Ottawa, (See Figures 13 and 14).

Oonerostoma piniariella Zeller.

This small needle mining lepidoptera was again active

on the western white pine in the Botanical Garden of the University. This species which was first taken by the writer in 1935 was recovered in British Columbia in 1922 by Mr. J. S. Boyce of the United States Forest Service from white pine near Abbotsford, B.C.

Laspeyresia sp.

Shipments of sitka spruce cones from the Queen Charlotte Islands, which past through Vancouver in January were found to be fairly heavily infested with a microlepidoptera of the genus Laspeyresia.

Aphids on Conifers.

Attack by Adelges cooleyi Gill. on second growth Douglas fir was fairly general this year throughout the coast district. Infested material was submitted to this laboratory for identification from Forest Service officers at Victoria, B. C. and Thurston Bay, B.C. Galls of A. coloradensis occurred this year on the sitka spruce in the Botanical Garden of the University and were also found on several sitka spruce at the Green Timbers Forestry Station.

Fleas in Sawdust.

Six reports of fleas occurring in fuel sawdust stored in the basements of private dwellings in Vancouver were received by this laboratory this year, the first report being on June 30th. On September 7th a local dealer informed the writer that complaints about fleas in sawdust in sawdust/had been exceptionally numerous this fall.

MAJOR PROJECT

Investigation of Ambrosia Beetles

The ambrosia beetle attacks on green logs continues to be a serious problem with the timber industry in the coast district of the province. In January the British Columbia Lumber and Shingle Manufacturers Association issued two trade extension circulars to its members in reference to these insects. The first, No. 59 and dated January 8th, contained a warning from their Timber Commissioner in the United Kingdom that the question of wormholes in lumber is viewed as an extremely serious matter in the Old Country and quoted a letter of complaint which had been received by the Commissioner from a large importer of hemlock. This letter stated in part, "we regret to say that in several parcels received lately, there is some pinhole worm to be found. This absolutely will not be accepted on the market, and we shall be very glad if you will kindly take necessary steps to bring this home to exporters."

The second circular, No. 68 and dated January 29th, contained a report, several pages in length, from their Trade Commissioner in Australia, regarding shipments of fir logs from British Columbia reported to be infested with ambrosia beetles. The report was dated December 18, 1936 and the Commissioner stated that during his visits

to various mills during the previous three weeks he had received numerous complaints about the prevalence of pin worm or ambrosia beetle in the logs, and moreover, that the quantities infested with this insect seemed to be increasing instead of decreasing. Furthermore, the report stated that "inspectors of the Federal Quarantine Department and Department of Agriculture are constantly at the ship's side during the discharge of cargo, where they designate what logs are to be sprayed or treated in some manner to kill the bugs". The usual procedure, according to the Commissioner, is to spray the infested logs with kerosene and as a result of watching several spraying operations and checking the results a few days later and in some cases, weeks later, he found that "the bugs are still alive, and in most cases, very active and on the increase" and rightly concludes that "the spraying of logs with a thin coating of kerosene or gasolene is farcial as far as the results are concerned". Another important observation contained in the report is that "infected logs, regardless of amount discharged, become more infested during the trip from Vancouver to Australia" as a result the commissioner concluded that "a considerable increase of bugs, and possibly incubation, takes place during this period". However, in the writer's opinion any increase in the infestation during transit

would undoubtedly be the result of parent beetles re-emerging and re-attacking the logs. In concluding the report the Commissioner stated that he sincerely hoped that the problem would be brought before the various log shippers in British Columbia and that steps would be taken to eliminate the shipment of such infested logs as much as possible.

Following the issuing of this second circular a representative of a Vancouver company exporting logs called at the laboratory for information on ambrosia beetles attacking Douglas fir logs being sent to Australia. Then on May 27th a report was received from a second exporting company of recent heavy ambrosia beetle attacks on the company's logs at Crofton on Vancouver Island. The logs had been cut at Cowichan Lake and were for export to Australia. Moreover, the supervisor of scalers of the Provincial Forest Service also called at the laboratory in October for information concerning ambrosia beetle damage to green logs, and as a result of the information we were able to give him on the subject, the supervisor was convinced that the problem was much more serious for the lumberman than he had believed.

This year, our investigation of ambrosia beetles was again confined mainly to the study of repellents as a means of preventing attack on green logs. However, a few

notes were made on the life histories and habits and additional data secured on the moisture content of the sapwood of logs in relation to attack.

Notes On Life Histories and Habits.

The first attacks this year by Trypodendron were observed on April 29th on logs of both hemlock and Douglas fir on Timber Berth 'X'. The attacked logs had been cut in the early winter and at the time of the examination the beetles had already penetrated from one to two inches from the outer surface of the bark.

Attacks this year by Gnathotrichus were not recorded until May 14th at which time several were found to be just entering logs of the Repellent Studies on Timber Berth 'X'. The number of such attacks on each log ranged from nil up to nine. Practically all of the attacks recorded this year on the repellent logs were by Gnathotrichus. Comparatively heavy flights occurred in the latter parts of May, June and July and from the middle to the end of August. Moreover, fresh Gnathotrichus attacks occurred as late as the first part of November, with several live adults being taken on the surface of the logs on October 21st and one on November 4th. A noticeable tendency was observed during the early part of the season for the attacking Gnathotrichus to concentrate on single logs during a set interval. This is shown in the summary of attacks

on the repellent logs, Table I (see page 125), by the number of attacks recorded on May 28th on log No. 24, on June 3rd on Log No. 21 and on June 24th on Log No. 3.

Previous to this fall, observations and collections had led us to believe that G. sulcatus was the only species of Gnathotrichus attacking hemlock logs under study. However, the writer has recently determined that attacks by G. retusus had also occurred on the logs of the Repellent Studies. Hence the flight data previously recorded by G. sulcatus will have to be revised and with this in view, a special effort will be made in 1938 to separate the flight data for the two species.

No attacks by either Platypus wilsoni or Xyleborinus tsugae were recorded this year.

Repellent Studies.

The investigation of repellents for ambrosia beetles attacking green hemlock logs was continued this year at the logging operation on Timber Berth 'X' located several miles north of Whonnock, B.C., and approximately 43 miles from the laboratory. As the site used for last year's experiments was to be logged this year, a new site about 1/3 mile away was selected for this year's experiments. The necessary hemlock trees for the investigation were again very generously donated by the operator, Mr. P. Bain of Whonnock, B.C.

A series of 25 ten-foot logs were used, the first 13

logs being from two trees felled on March 10th and the balance from two trees felled on May 13th and 14th. These logs were rolled into parellel positions on an old skid road and were protected by partial shade. (See Fig. 7 and 8). The bark remained for the most part intact and the tops of the logs were all in the same direction, approximately east. The measurements of the logs were as follows:

Details of Logs of Repellent Studies - 1937.

Log No.	Length	Diameter inside Bark. Butt	Top
1.	10'	16.0"	14.5"
2.	10	14.5	14.0
3.	10	14.0	13.5
4.	10	13.5	12.5
5.	10	12.5	11.5
6.	10	11.5	10.5
7.	10	10.5	9.0
8.	10'	18.5"	14.5"
9.	10	14.5	13.5
10.	10	13.5	13.0
11.	10	13.0	12.5
12.	10	12.5	11.5
13.	10	11.5	10.5
14.	10'	12.0"	11.5"
15.	10	11.5	11.0
16.	10	11.0	10.5
17.	10	10.5	10.0
18.	10	10.0	9.0
19.	10	9.0	8.5
20.	10'	10.0"	9.0"
21.	10	11.0	10.0
22.	10	11.5	11.0
23.	10	12.0	11.5
24.	10	12.5	12.0
25	10	13.0	12.5

These logs were in consecutive order as follows:

1st tree: Butt log No. 1, top log No. 7.
2nd tree: " " No. 8, " " No. 13.
3rd tree: " " No.14, " " No. 19.
4th tree: Top log No. 20, butt log No. 25.

The solutions selected for trial this year and the logs treated with each were as follows:

(a) 1:8 lime-sulphur solution to which Lethalate Wetting Fluid was added at the rate of approximately ½ pint per 100 gallons.
Applied to Logs No. 2 and 18.

(b) Dry Bordeaux Mixture in water at the rate of 12.5 pounds per 50 gallons plus the Wetting Fluid.
Applied to Logs No. 3 and 17.

(c) Microsul Fluid at the rate of 1 gallon to 100 gallons of water.
Applied to Logs No. 5 and 15.

(d) Microsul and Colloidal L.A. solution, containing Microsul at the rate of approximately 5 gallons per 100 gallons of water and Colloidal L.A. at the rate of 6¼ pounds per 100 gallons, plus the Wetting Fluid.
Applied to Log No. 11.

(e) Same as (d) except Microsul at the rate of only 1 gallon per 100 gallons of water.
Applied to Log No. 24.

(f) 1 part of Creosote (dark) to 3 parts of Kerosene.
Applied to Log No. 6.

(g) 1 part of Creosote (dark) to 6 parts of Kerosene.
Applied to Log No. 14.

(h) Sulphite waste liquor to which the Wetting Fluid was added.
Applied to Logs No. 8 and 21.

(i) Bouisol diluted in water at the rate of approximately 2½ quarts to 100 gallons, plus the Wetting Fluid.
Applied to Logs No. 9 and 22.

(j) Quassia solution at the rate of 25 pounds of Quassia chips to 100 gallons of water, plus the Wetting Fluid. Solution made by soaking chips in water for 24 hours and then boiling for 2 hours.
Applied to Logs No. 12 and 25.

The untreated logs, Nos. 1, 4, 7, 10, 13, 16, 19, 20 and 23 were reserved as checks.

Details concerning the chemicals used in the various solutions are as follows:

Lime-sulphur concentrate, Pest X brand: 30-32° Baume at 60° F. Total sulphur in soluble sulphides 24.47%.

Dry Bordeaux Mixture: a product of the Canada Paint Co. Active substances; copper hydroxide 20% to 25% Total copper (as metallic copper) not less than 13%.

Microsul Fluid: a 40% micronized sulphur compound made by the Lunevale Products Ltd. of England. Recommended dilution for preblossom spray, 1 gal. to 100 gallons. No spreader required.

Colloidal L.A.: a lead arsenate solution produced by the Lunevale Products Ltd. Analysis: 50% Lead arsenate, 15% Arsenic oxide and 30% Lead oxide.

Sulphite Waste Liquor: received fresh in May from the Powell River Pulp and Paper Co., Powell River, B. C.

Bousol: a colloidal copper compound produced in England and distributed locally by Buckerfield's Ltd.

Lethalate Wetting Fluid: a combined spreader and sticker made by the Lunevale Products Ltd. ½ pt. to 100 gals. of spray recommended.

As in the previous two years a small bucket pump sprayer was used for applying the sprays and approximately one gallon of solution was applied per log. All the solutions with the exception of the Quassia which was not available at the time, were applied to one set of logs, Nos. 1-11, on May 14th. The Quassia was to be applied at the first opportunity and at the same time a second set of logs was to be treated with all the solutions. However,

owing to unfavourable weather this could not be undertaken until May 21st and then after only four of the solutions had been applied, the spray pump broke and it was necessary to postpone the balance of the treatments until May 23rd.

Observations for attacks were made at intervals throughout the season, the presence of frass being used as an indication of attack, and as each new attack was observed it was marked with a red pencil and recorded. A summary of the attacks found on the logs after the application of the sprays is given in Table I.

In addition to the attacks tabulated, the following attacks were recorded previous to the application of the sprays, on May 14th: Log No. 1, 2 attacks; Log No. 2, 5 attacks: Log No. 3, 1 attack; Log No. 4, 1 attack; Log No. 7, 4 attacks; Log No. 8, 9 attacks; Log No. 9, 3 attacks; Log No. 10, 1 attack and Log No. 11, 3 attacks and on May 21st: Log No. 12, 2 attacks. In view of these attacks and the fact that Gnathotrichus adults were actually in flight on the days the sprays were being applied, it is quite probable that a portion of the attacks recorded on the first succeeding examinations might actually have been started in the bark before the application of the solutions. The difficulty of locating in the narrow crevices of the bark the first fine reddish frass ejected by the beetles is quite apparent. However, irrespective of this

TABLE I

SHOWING AMBROSIA BEETLE ATTACKS ON LOGS OF REPELLENT STUDIES, 1937.

Log No.	May 21	May 28	June 3	June 14	June 24	June 2	July 9	July 16	July 23	Aug. 4	Aug. 13	Aug. 20	Sept. 2	Sept. 14	Sept. 24	Oct. 6	Oct. 21	Nov. 4	TOTAL
1 Check	4	1	-	4	10	20	2	5	15	25	3	18	15	11	1	2	2	-	138
2 Lime-sulphur 1:8	3	-	1	-	4	1	3	4	2	17	10	5	7	1	-	-	-	-	58
3 Bordeaux mixture	1	1	2	9	44	21	8	6	8	7	4	17	9	3	3	0	-	-	143
4 Check	4	5	2	8	8	8	6	3	3	28	3	42	15	10	2	1	3	0	151
5 Microsul	5	-	-	-	4	8	3	7	2	19	4	32	25	9	4	1	-	-	123
6 Creosote-kerosene 1:3	-	-	-	-	-	-	-	-	2	-	-	1	-	-	-	4	7	1	15
7 Check	1	-	-	-	1	-	1	-	-	3	3	14	17	10	8	2	2	-	62
8 Sulphite waste liquor	7	4	2	-	-	1	-	-	-	1	-	1	12	14	15	4	-	4	65
9 Bouisol	8	1	1	2	9	7	1	7	12	8	3	12	4	3	1	-	-	-	79
10 Check	-	3	-	1	1	2	-	1	11	9	3	15	5	3	2	-	3	1	60
11 Microsul-Coll. L.A.	6	4	2	1	2	3	4	2	7	8	2	5	5	3	2	1	3	6	66
12 Quassia soln.	-	12	3	1	-	4	-	9	14	11	7	20	12	6	1	1	-	-	101
13 Check	-	6	2	6	3	7	2	5	3	7	4	14	8	2	2	-	1	-	72
14 Creosote-kerosene 1:6	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	2
15 Microsul	-	5	3	2	1	8	2	10	12	6	1	6	4	9	4	3	1	1	78
16 Check	-	2	4	3	2	9	8	10	5	11	2	8	6	2	4	-	2	-	78
17 Bordeaux mixture	-	-	1	2	4	4	9	4	5	16	6	16	21	26	5	5	2	1	127
18 Lime sulphur 1:8	-	1	5	2	1	9	2	3	-	4	1	11	6	12	14	7	1	2	81
19 Check	-	-	1	-	3	22	8	5	12	16	4	14	17	5	1	1	-	-	109
20 Check	-	17	9	3	1	12	1	1	16	11	3	11	14	4	2	-	1	1	107
21 Sulphite waste liquor	-	6	23	1	1	7	1	4	6	6	3	29	23	5	4	1	1	-	121
22 Bouisol	-	12	7	1	11	20	10	3	7	11	2	8	7	6	1	3	-	1	110
23 Check	-	16	6	6	10	18	5	12	11	20	1	17	16	5	2	2	1	-	148
24 Microsol-coll. L.A.	-	26	11	8	2	25	5	4	8	5	2	19	14	6	6	3	-	2	146
25 Quassia soln.	-	16	3	3	-	20	5	6	7	13	1	17	11	18	8	5	2	1	136
TOTALS	39	138	88	63	122	236	86	111	168	263	72	352	273	173	92	46	35	21	2376

possibility, it is evident from the summary of attacks that the majority of the solutions, as used, are of little value as repellents for ambrosia beetles attacking green logs.

In reviewing the results of the repellent experiments of the past three years, the most promising solutions used have been the creosote-kerosene mixtures. In 1935, when a light creosote was used with kerosene in the proportions of 1 to 3 on a log at the Green Timbers where the ambrosia beetle popluation was light, one attack occurred within 14 days, but a second single attack was not recorded until 51 days later. In 1936, when the experiments were first conducted on Timber Berth 'X' where a much heavier ambrosia beetle population was present, no attacks were recorded on a log sprayed with 1 part of light creosote and 3 parts of kerosene until 37 days after the date of application. This year a dark or heavy creosote was used in the experiments. On the first log treated with 1 part of this creosote and 3 parts of kerosene no attack occurred within 70 days, while on the second log, treated with a mixture of 1 part of the creosote to 6 parts of kerosene, an attack was not recorded until 75 days after the application.

Plans are being made to continue the Repellent studies another year with particular attention being given to creosote-kerosene mixtures and it is hoped that circumstances will permit the application of the solutions in

April to logs cut in the fall of 1937 so that data may be secured on their effectiveness against Trypodendron attack, in addition to attacks by Gnathotrichus.

Moisture Content Determinations.

In order to supplement the data secured inour previous studies of the relation of the moisture content of the sapwood to attack by ambrosia beetles, determinations were made this year of the moisture content of the sapwood of the logs used in the Repellent Studies. These determinations were made from two sets of samples, the first set being taken on September 24th from the upper half of the logs midway along the south sides, while the second set were cut on October 6th from the same relative position on the north side of the logs. The moisture content of the samples to a depth of one inch and expressed in percentage of dry weight are given in Table II.

These determinations further substantiate the conclusion previously reached in these studies, namely that sapwood moisture content of not less than 90 per cent is necessary for ambrosia beetle attack. Incidently it is interesting to note the much higher moisture content of the top logs in comparison with the butt logs of the same trees.

TABLE II.

Repellent Studies - 1937.

Determinations of the Moisture Content of the Sapwood.

Log No.	Moisture Contents to Depth of 1" Sept. 24	Oct. 6	Average
1.	120%	112%	116.0%
2.	161%	163%	162.0%
3.	191%	126%	163.5%
4.	193%	146%	169.5%
5.	185%	189%	187.0%
6.	211%	200%	205.5%
7.	208%	204%	206.0%
8.	99%	102%	100.5%
9.	120%	125%	122.5%
10.	141%	137%	139.0%
11.	131%	147%	139.0%
12.	154%	151%	152.5%
13.	177%	189%	183.0%
14.	119%	116%	117.5%
15.	102%	114%	108.0%
16.	105%	99%	102.0%
17.	126%	184%	155.0%
18.	137%	136%	136.5%
19.	143%	144%	143.5%
20.	174%	173%	173.5%
21.	178%	157%	167.5%
22.	151%	149%	150.0%
23.	117%	158%	137.5%
24.	123%	106%	114.5%
25.	118%	146%	132.0%

MINOR PROJECTS

Sitka Spruce Weevil - Pissodes sitchensis Hopk.

A preliminary study was commenced this year of the outbreak of the sitka spruce weevil at the Green Timbers Forestry Station. The infestation was first reported on June 28th and was found to extend throughout the sitka spruce plantings of the plantations on logged over land adjoining the nursery. These plantings consisted of about 14 acres of pure sitka spruce and approximately 126 acres of spruce and Douglas fir. The trees varied from 7 to 9 years of age, the oldest having been set out in 1930 as 1-1 stock. Over 50 per cent of the spruce on portions of the area proved to be infested. (See Figure 15).

On June 28th the infested leaders were just beginning to droop and the insects were present as from ½ to ¾ grown larvae. On the same date a series of 18 infested leaders were collected and placed in a portable cage (a) under field conditions at this laboratory. On July 22nd an additional 18 infested leaders were similarly caged (Cage B) while on August 4th, 25 more of the damaged tops were removed and placed in a cage (c) under somewhat more shady conditions.

The emergence of Pissodes adults from Cage A commenced on August 3rd and continued until August 23rd while in Cage B the emergences extended from August 3rd to September 7th, but in both of these cages the peak of the emergences

took place about the middle of August. However, Pissodes adults were not recovered from the material in Cage C until August 18th, but in this cage the emergence continued throughout September. A summary of the total emergences from the three cages is given in the following table.

TABLE III.

Emergences from Caged Sitka Spruce Leaders - 1937

Cage No.	Date Caged	No. of Leaders	Emergences Parasites	Emergences Pissodes	Average No. Pissodes per Leader.
A.	June 28	18	nil	104	5.8
B.	July 22	18	11	492	27.3
C.	Aug. 4	25	4	496	19.8

The low emergence from the material caged on June 28th is accounted for by the fact that many of the Pissodes larvae which were only partly developed at that time, were unable to complete their development on the limited amount of feeding material available for them in the cage. The reduced emergence from Cage C in comparison with that from Cage B indicated that some emergence had already occurred in the field previous to August 4th. Furthermore, the emergence in the field was apparently completed by September 10th for no Pissodes were recovered from a series of 6 infested leaders caged on that date. The comparative few parasites, consisting of several unidentified species of Hymenoptera, were for the most part recovered before the

peak of the Pissodes emergence had been reached.

On August 5th two infested leaders taken in the field on the preceding day were dissected. The first was heavily infested and several Pissodes adults had already emerged. However, 22 Pissodes pupae and 8 adults were still present in addition to 4 larvae which were believed to be parasitic. Unfortunately, attempts to rear the latter were unsuccessful. The second leader with 8 inches of new 1937 terminal growth, showed only light attack and from it only 12 Pissodes pupae, 2 Pissodes adults and 1 parasitic larvae were obtained.

Examinations at the end of the season of infested leaders in the field and of the caged material showed that this years attack had killed back the leaders for distances up to 3 feet and included in practically all cases both the 1937 and 1936 growth, while in the more severe cases the killing extended back into the 1935 growth. Moreover, field observations showed that partly shaded or overtopped trees are much less lightly to be attacked than those with exposed tops.

No evidence of Pissodes attack on the spruce in plantations at Campbell River, B. C., was found by Mr. McKinnon of the Research Division of the Provincial Forest Service, in the course of his examination of the plantations in the latter part of July.

Platystrophus (Eupsalis) in Oak Timber.

A large oak beam, 12" x 16" x 11', in the warehouse of a local importer of hardwoods was found on July 16th to be infested with live borers. The species of insect was unknown so in order to permit us to investigate the damage and at the same time avoid the danger of the insects spreading to other lumber in the warehouse, the beam was delivered to the Forest Products Laboratory at the University. The timber was of swamp oak cut in Indiana and weighed over 900 pounds.

The insect damage was confined to both ends of the beam, a five-foot section in the centre being uninfested. Two sections of from 18 to 24 inches in length and showing the workings of the borers, were cut from each end. One of these sections was caged for the recovery of adults, another was split up in order to obtain specimens of the grubs and the remaining two sections were set aside for experimental treatment in the dry kiln. The workings of the insects consisted of long winding galleries, varying from ½ to 2½ mm. in diameter and extending throughout the sections. Several of the galleries were packed with frass. The timber was quite moist and on splitting gave off a distinct odour of fermentation.

No adults have been recovered to date, but grubs obtained by splitting have been identified tentatively as of Platystrophus (Eupsalis) minutus Drury, a species native to Indiana.

The experimental treatment in the dry kiln was for the purpose of determining if insects in such size timber could be controlled by kiln treatment. At the same time officers of the Forestry Products Laboratory, who conducted the experiment, were interested in the effect of such treatment on the timber. Of the two sections of the beam set aside for this purpose, one was used as a check while the other, before being placed in the kiln, had three thermometers inserted in it. One of the thermometers was set to a depth of 2½ inches near the end of the block, another to the same depth at the centre of the top side and the third next to the latter but to a depth of 5 inches, half the thickness of the block. The treatment commenced on the morning of August 4th and the schedule was as follows:--

0	to 27	hour	- Kiln temperature	125°,	humidity	100%	
27	to 46.5	"	- "	"	138°,	" approx.	35%
46.5	to 53.5	"	- "	"	138°,	" "	85%

The abrupt change in the humidity at the end of 27 hours was the result of the source of steam being changed from the main boiler to an electric heater with an insufficient capacity to maintain the higher humidity. The main boiler was again used during the latter part of the run. A summary of the temperature records of the block follows:--

Hours from start of run	Temperature Readings °F. End 2½" depth	Centre 2½" depth	Centre 5" depth.
6	90°	89°	77°
12	99	98	92
18	111	105	100
24	120	116	113
27	122	119	116
30	122	119	118
46.5	122	123	122
48.5	122	123	123
50.5	125	125	125
53.5	129°	126°	126°

The foregoing treatment was apparently successful in controlling the insects in that all grubs found in an examination of the block following the treatment, were dead. However, the schedule as followed can not be recommended as it resulted in considerable checking of the timber. In reference to the above temperatures, it is interesting to note that in a leaflet recently issued by the Forest Products Laboratory at Princes Risborough, England, on the kiln sterilization of Lyctus-infested timber the lethal period at 120° and 80 per cent humidity is given as 6 hours and at 125° and 80 per cent humidity as 2 hours, whereas, the centre of our block was exposed to these temperatures for at least 7 and 3 hours, respectively.

Relation of Enicmus minutus L. to Oak Lumber.

On examining in August of last year Lyctus damage in a shipment of white oak lumber stacked in a local warehouse, a number of very small beetles were recovered from between the oak planks. The status of these beetles was not known but specimens sent to Mr. Ralph Hopping were identified by him as Enicmus minutus. L.

On June 15th of this year a series of the same species taken on oak lumber in the same warehouse were submitted to this laboratory for identification. The warehouse was visited by the writer on June 18th when additional specimens were to be observed on the lumber. The adults, it was learnt, had invariably appeared within about one month after shipments of oak had been received and moreover, they had not so far been taken on any other species of lumber in the warehouse. However, on September 11th the writer recovered the same species in a pile of imported hickory stock in another warehouse in the city. But the presence of a certain amount of waning with the bark still intact on the lumber where the beetles were most numerous indicated that the species bred in the bark. In support of this possibility, adults were recovered from samples of bark placed in a rearing jar in the laboratory.

This species, however, is apparently of no economic importance. Mr. Hopping has informed the writer that it

has been found breeding in mould and it is undoubtedly native to British Columbia. Moreover, the comparatively moist condition of the bark strips on the lumber when it arrives a t the warehouse is inducive to the development of mould and it is such mould that in all probability attracts the insects to the bark.

Alder Sawfly - Hemichroa crocea Geoff.

On July 8th a series of 25 heavily parasitized mature alder sawfly larvae which had been collected the previous day at the infestation at Powell River, B.C., were placed in a rearing jar in the laboratory. By July 12th all of the specimens but one, had entered sand provided for them in the bottom of the jar and had apparently pupated. Several of the cases were partly exposed on the surface of the sand. The recovery of adults from this material was as follows:--

July 23 - 1 Bessa selecta (Diptera parasite)
" 26 - 4 " "
Aug. 14 - 1 Hemichroa crocea, female.
" 16 - 1 " "
1 undetermined Hymenoptera parasite.
Sept. 1 - 1 " " " , dead.

Total - 9 specimens.

On September 23rd 3 empty puparia and 21 sawfly pupal cases were recovered from the sand. On opening the pupal cases in December, 1 was found to contain an empty puparium while 4 otherscontained sawfly larvae, 3 of which showed signs of life. The balance of the cases

contained dried up specimens or were empty.

The alder sawfly infestation at Powell River, B.C., was examined on July 7th at which time feeding by the larvae of the first generation was practically completed and many eggs and a few small larvae of the second generation were already present. The eggs are inserted in slits made in the sides of the mid-rib of the leaves and on July 7th counts were made in the field of the number of eggs which had been depostied on ten different leaves. On four of the leaves on which the eggs had been inserted in a row on only one side of the mid-rib the counts were: 15, 16, 23 and 33, while for the remaining leaves on which the eggs had been inserted in two rows, one on each side of the mid-rib, the counts were: 23, 33, 40, 46, 50 and 74.

Miscellaneous Rearings.

Cacoecia fumiferana Clem. (Spruce Budworm).

This year twelve spruce budworm larvae were recovered from trees in the Botanical Garden of the University and reared in the laboratory. Seven of the specimens were taken on the Engelmann spruce on June 19th and their lengths were as follows: 7 mm., 7 mm., 9 mm., 12 mm., 18 mm., 20 mm. and 22 mm. By June 22nd one of the larger specimens had pupated and the other two larger ones were entering the prepupal stage. One of the latter had pupated by the following day while the other had formed its pupal

case by June 25th. By July 2nd, the moths, two males and one female, had emerged from these cases, the pupal periods being not less than 10, 9 and 7 days respectively. Eggs in the female totaled 190. Of the four smaller sized larvae, one died within a couple of days, but of the remaining three, one pupated by June 26th, another by July 5th and the third by July 10th. The emergences from these were as follows; a male moth from the first on July 5th with a pupal period of 9 days, and female moths from the other two on July 12th and 17th, respectively. The pupal periods of both females was 7 days in duration and the egg counts were only 133 and 158. A considerable amount of fat globules was present in the abdomen of each of these two specimens.

On June 19th four spruce budworm larvae were also taken on the sitka spruce. One of these specimens was already in the prepupal stage while the other three were 7 mm., 10 mm. and 17 mm. in length, respectively. The first pupated by June 21st and emerged on June 28th, 7 days later, as a female moth, the egg count of which was 143. Of the other three specimens, one, which pupated by June 28th died in its pupal case, while the remaining two pupated on July 3rd and July 8th, and emerged as male moths on July 12th and July 15th, repsectively.

Only one specimen was taken on the western hemlock. This larva was recovered on June 19th, at which time it

was 18 mm. in length. Before commencing to pupate on June 28th the specimen attained a length of 25 mm. The pupal cases was completed by June 29th and the moth, a female emerged July 8th, 9 days later. However, only 117 eggs were found in the abdomen of this moth.

Stilpontia salicis L. (Satin Moth).

Three satin moth caterpillars brought into the laboratory on June 18th were placed in a container for rearing. On July 8th a female moth was recovered from one specimen which pupated on July 3rd, a pupal period of 5 days. A second specimen pupated by July 8th and from it a female moth emerged only 4 days later. The pupa of the third specimen was completed on July 10th and the moth, a male, emerged from it on July 10th and the moth, a male, emerged from it on July 19th, a pupal period of 9 days.

Zeiraphera ratzeburgiana Sax. (Deter. McDunnough).

On May 26th, three larvae of this species were found feeding on the new needles of the sitka spruce in the Botanical Garden of the University. These specimens, which were only about 9 mm. in length, were transferred to the laboratory for rearing and by June 2nd all three had pupated, the pupal cases being between needles held together by light webbing. One moth emerged on June 15th while the other two were recovered on the following day.

Coptodisca arbutiella Busck. (Madrona Shield Bearer)

Coptodisca arbutiella Buxck. (Madrona Shield Bearer).

A series of madrona leaves showing the presence of the larvae of this species were collected in the field on April 28th and placed in a rearing jar in the laboratory. Several pupal cases were formed by May 3rd and on May 20th a total of 30 of the cases were transferred to a separate vial. The emergence extended from May 28th to June 9th but a total of only 14 moths and 4 adults of the Chalcid Mirax sp. were recovered. The majority of the parasites recovered in the rearings of C. arbutiella in 1936 were also of this species, the determinations being confirmed by Mr. G. S. Walley who considers the species as being near to Mirax ectodemiae Roh. However, our specimens are from a different host and from a widely separated locality. (Sample of injured leaves shown in Figure 13).

Marmara arbutiella Busck. (Deter. McDunnough).

Although the work of this Lepidopterous leaf miner has been observed in association with that of Coptodisca arbutiella for several years, adults were not recovered until this year. A series of madrona leaves showing its work was taken in the field on April 28th and placed in a rearing jar in the laboratory. By May 3rd several specimens were found to have formed cocoons next to the midrib of the leaves. These cocoons were flattened, oval to round in shape, white in colour and with small crystal-like globules on their upper surfaces. The mature pupae

within the cocoons were brown in colour. No moths were present on May 20th, but on May 25th, 9 were recovered and by May 31st a total of 17 moths had emerged from the material. One moth was recovered from a leaf which was placed in a separate rearing tin on April 30th at which time the larva was still projecting its mine. By May 3rd this larva had extended its mine from the right centre of the leaf to the upper right margin and from there had encircled the upper half of the leaf back to the left centre next to the mid-rib. By May 6th the larva had cut its way out of the leaf and formed its cocoon at a point at the junction of the side and bottom of the tin. The moth emerged on May 29th, 25 days later. (Work of this species shown on Figure 14).

Epinota terracoctana Wls. (Deter. McDunnough).

This species which feeds on the foliage of madrona was referred to under "Miscellaneous Rearings" in the Annual Report of this laboratory for 1936 as Epinotia sp. The specific name was received from Dr. J. McDunnough in July of this year. Only three adults were recovered in 1936. This year a special effort was made to obtain additional specimens and although evidence of its work was not uncommon, only one larvae was taken. This specimen was recovered on April 28th and the moth emerged on June 10th.

Polita lutra Gn. (lubens Grt,) var. glaucopis Hampson.

This species, which was identified by Dr. McDunnough, was reared from a series of eggs found on June 9, 1936 on a needle of the Pinus contorta growing in the University's Botanical Garden. The eggs hatched on June 15th and the larvae, which were naked, were first kept on pine twigs in the laboratory until July 16th when they were then transferred to a caged potted lodgepole pine transplanted under field conditions. The larvae fed on into September with pupation taking place by September 24th. The naked pupal cases were formed on the surface of soil covered with forest floor debris. The specimens were overwintered under field conditions and three moths emerged on May 31st and June 2nd of this year.

Cryptorhynchus lapathi L. (Willow Borer).

On June 28th samples of native willow infested with this species were collected at the Green Timbers Forestry Station and placed in a portable cage under field conditions at this laboratory. Only larvae were present at that time. The emergence of adults commenced on August 3rd with the peak being reached on August 19th. Although a total of 53 Cryptorhynchus adults emerged from the caged material, no parasites were recovered. (See Figure 16).

Cone and Seed Insects:

On January 7th about a dozen infested sitka spruce cones were received from Mr. H. F. Olds, chief of the

Vancouver Plant Inspection office. The cones had been taken prior to fumigation, from a shipment received from the Queen Charlotte Islands. The cones were placed in a rearing jar in the laboratory and between January 27th and February 1st, 5 moths were recovered from them. Specimens of the moths forwarded to Ottawa were identified by Dr. McDunnough as "a species of Laspeyresia, apparently very close to bracteatana Fernald", and subsequently verified by Dr. Heinrich of Washington, D.C., as "a possibly dark form of L. rana". A series of 12 undetermined Chalcids were also recovered from the same cones between January 27th and February 22nd. Moreover, on February 23rd a series of 6 dilapidated adults of a species of Megastigmus (Chalcid) were received from Mr. T. Wells of the Green Timbers Forestry Station. The adults had been found dead in a jar containing Douglas fir seed which had been collected near Langley Prairie, B. C. in 1935. Several of the seeds showed characteristic exit holes while in one seed a dead partly emerged adult was found.

IDENTIFICATION OF MISCELLANEOUS INSECTS.

During the year the following determinations of miscellaneous insects not mentioned elsewhere in this report were received:

Coleoptera:

Lyctus brunneus Stephens - The determination by the writer

has recently been confirmed by Mr. Ralph Hopping. The species was reared from a small sample of Australian gum-wood received in September, 1936, from a local importer of hardwoods. 15 adults were recovered, one of which emerged in November of last year and was referred to as Lyctus sp. under "Miscellaneous Rearings" in the 1936 Annual Report of this laboratory.

Minthea stichothrix Reit. The damage to a wooden stool submitted by the owner in 1934 for identification proved to be the work of this species. The stool had been made from a single block of Native African wood and had been in Vancouver for about six months before the damage was noticed. The species was referred to in the Annual Report for 1934 as a Lyctus, but the writer recently identified it as a Minthea and Mr. Ralph Hopping in verifying this determination concluded that it is undoubtedly M. stichothrix Reit.

Hymenoptera:

Meteorus sp. - Determined by Mr. G. S. Walley. Eleven adults of this species were reared from a colony of Halisidota argentata larvae received in March, 1936, from Mr. W. Downes, Victoria, B.C. (See "Douglas Fir Webworm" - Annual Report for 1936). Mr. Walley considered this species as very close to M. hyphantriae but probably a distinct species.

Meteorus hypophloei Cush. - Determined by G. S. Walley. Several adults of this species were recovered in 1936 from

a caged section of Douglas fir infested with Pseudohylesin from Cowichan Lake, B. C. Mr. Walley considered it a most interesting species and according to him it was described in 1931 from Metaline Falls, Wash. and its biology was published in 1933 by DeLeon who proved it to be a parasite of Hypophloeus larvae which later were associated with Dendroctonus monticolae. Our specimens constitute the first Canadian Record.

Spathius sp. - Determined by G. S. Walley. Four adults of this species were recovered from the same log as M. hypophloei. Several species of this genus are parasites of bark beetles.

Pachyceras ? n. sp. - Determined by A. B. Gahan of the United States National Museum, who considered it is very close to P. xylophagorum Ratz. and may be merely a variety. A series of 19 adults were recovered in 1936 from the same log as M. hypoploei and Spathius sp.

Dinotus n. sp. - Determination obtained from the U. S. National Museum. Several adults were taken in 1936 in a cage containing a 3-foot section of sitka spruce infested with Hylurgops rugipennis.

Diptera:

The following Diptera were identified by Dr. O. Peck:

Bessa selecta Meig. - A parasite of the alder sawfly, Hemichroa crocea Geoff., three adults being reared from larvae infesting alder on the campus of the University.

(See under "Alder Sawfly" in the Annual Report of this laboratory for 1936).

Uramyia halisidotae Towns. - A parasite of the Douglas fir webworm, Halisidota argentata Pack., two adults being reared from caterpillars received in 1936 from Victoria, B. C. (See under "Douglas Fir Webworm" in the 1936 Annual Report.).

Lonchaea sp. - Recovered from several puparia taken on July 14, 1936 from the galleries of Dendroctonus obesus in sitka spruce.

1941

Figures 1 and 2.

Showing progress in construction of the new road through Stanley Park in 1937. Figure 1 taken in April and Figure 2 showing same portion of road taken in December.

Photos by W.G.M.

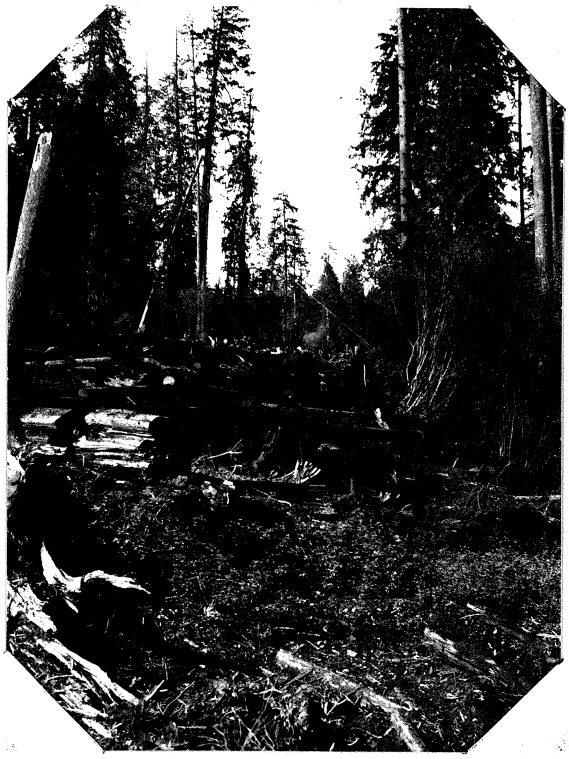


Figure 1.

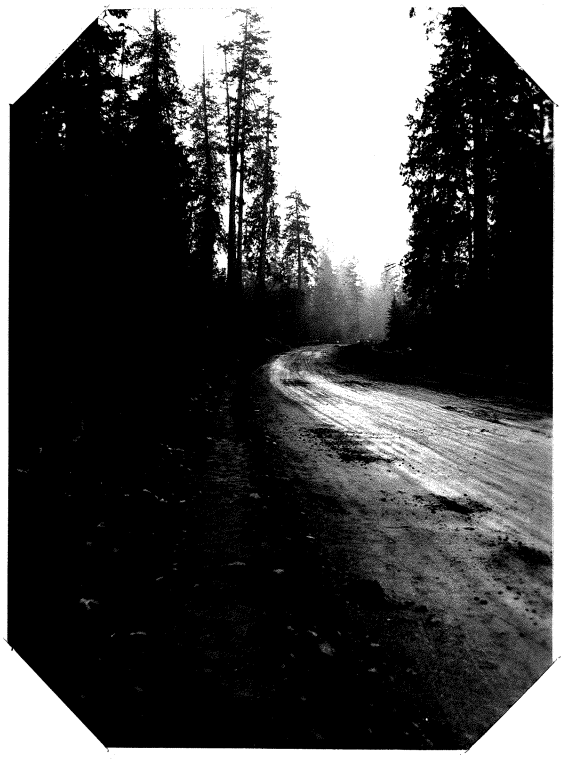


Figure 2.

e91

Figures 3, 4, 5 and 6.

Showing additional views of the construction of the new road through Stanley Park in 1937. Figures 3 and 5 taken in April while Figures 4 and 6 show the same portions of the road in December.

Photos by W.G.M.

Figure 3.

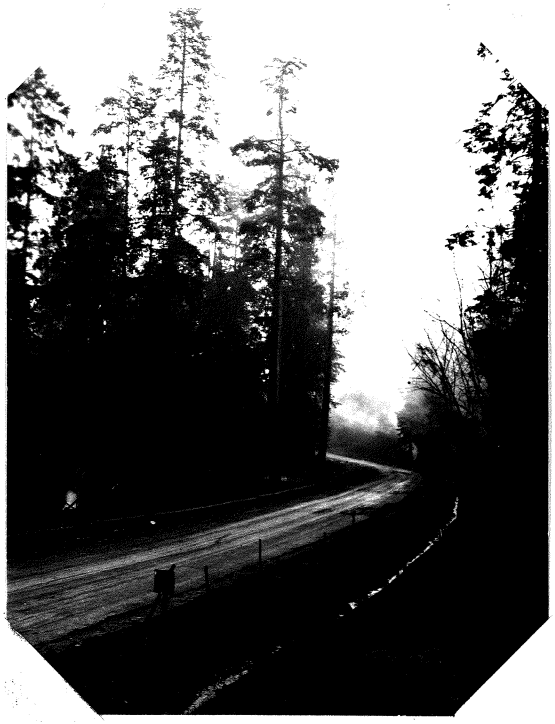


Figure 4.

Figure 5.

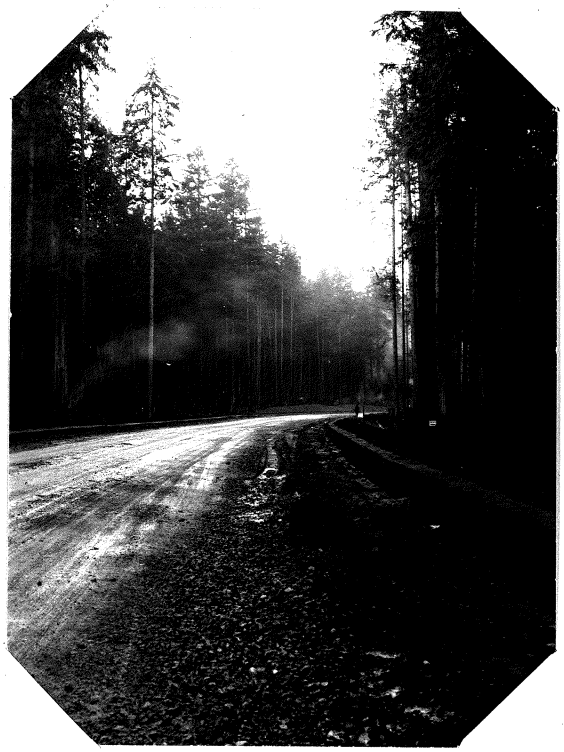


Figure 6.

Figure 7.

Showing logs used in the Repellent Studies on Timber Berth 'X' in 1937. Logs No. 14 to No. 25 in the foreground with the latter in the immediate foreground.

Photo by W.G.M.

Figure 8.

Showing a closer view of the logs in the background of Figure 7. Log No. 13 in the immediate foreground.

Photo by W.G.M.

Figure 7.

Figure 8.

Figure 9.

Showing gallery of the ambrosia beetle, Gnathotrichus sulcatus Lec. in western hemlock.
X .25
Photo by A.A.D. & W.G.M.

Figure 10.

Showing main burrows and larval "cradles" of the ambrosia beetle, Trypodendron cavifrons Mannh. in western hemlock.

Photo by W.G.M.

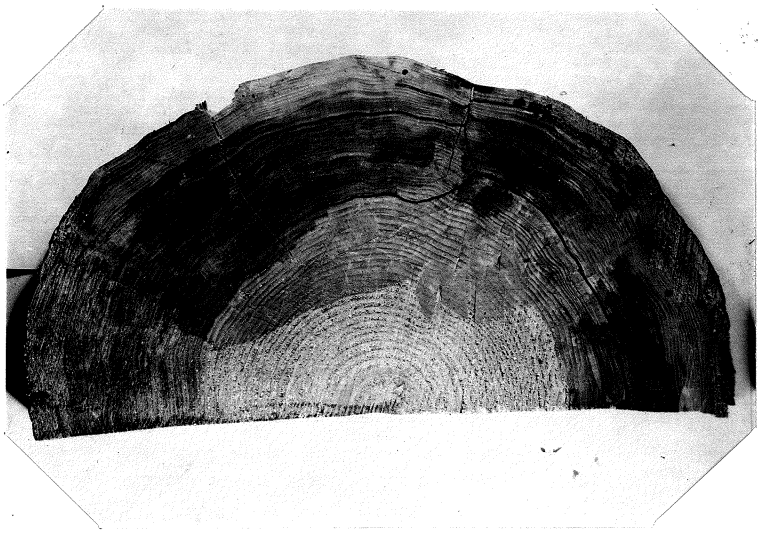


Figure 9.

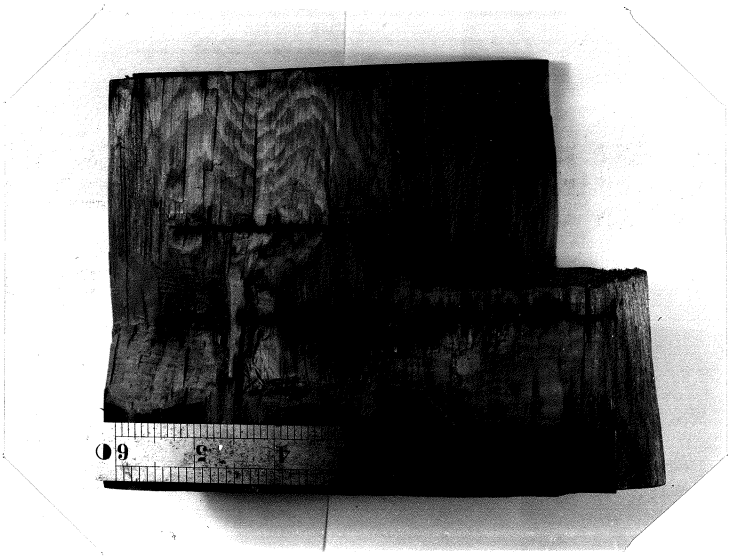


Figure 10.

Figures 11 and 12.

Showing galeries of the ambrosia beetle, Platypus wilsoni Sw. in western hemlock. X .25

Photos by A.A.D. & W.G.M.

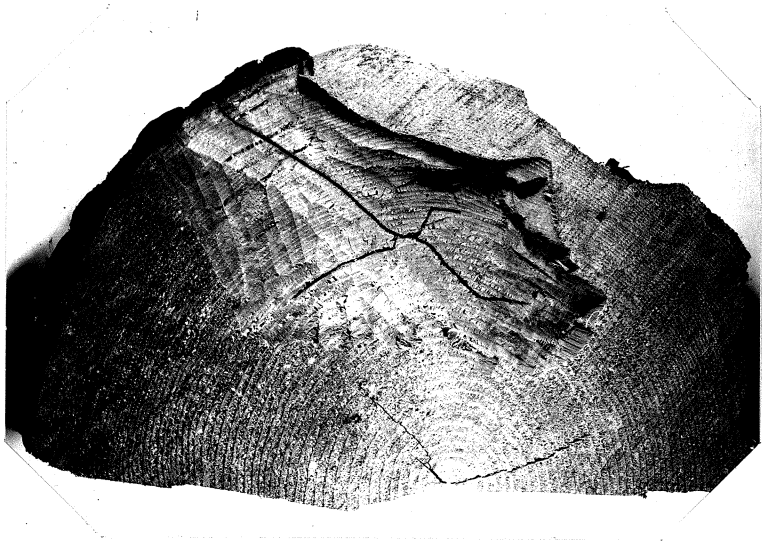


Figure 11.

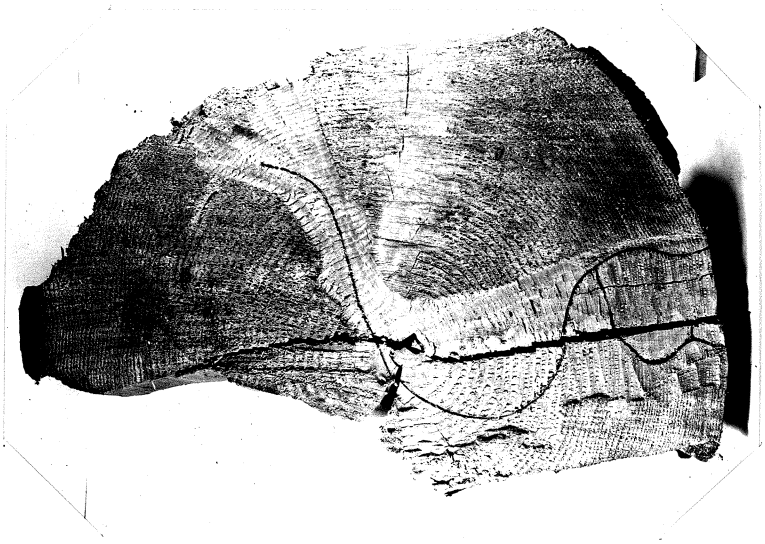


Figure 12.

Figure 13.

Showing the work of the madrona shield bearer, Coptodisca arbutiella Busck. X .7

Photo by W.G.M.

Figure 14.

Showing the work of Marmara arbutiella Busck in leaves of Madrona. X .7

Photo by W.G.M.

Figure 13.

Figure 14.

Figure 15.

Showing type of sitka spruce attacked by *Pissodes sitchensis* Hopk. in 1937 at the Green Timbers Forestry Station.

Photo by W.G.M.

Figure 16.

Showing damage resulting from attack by *Cryptorhynchus lapathi* L. on native willow in the vicinity of the Green Timbers Forestry Station.

Photo by W.G.M.

Figure 15.

Figure 16.

EXPENDITURES FOR THE FOREST INSECT LABORATORY, VERNON, B. C. FOR THE FISCAL YEAR 1937-1938.

Allotments

			Balance	Deficit.
2. Communications.....	Allot.	$ 210.00		
	Expend.	216.37		
	Deficit			$ 6.37
3. Equipment.....	Allot.	$1,855.00		
	Expend.	1,975.29		
	Deficit			$120.29
6. Buildings.....	Allot.	$ 799.99		
(Trans. from	Allot 3)	89.99		
	Expend	799.99		
7. Miscellaneous Current Expenses.....	Allot.	$ 15.00		
	Expend.	18.35		
	Deficit			$ 3.35
11. Rents	No. allotment			
	Expend.	$ 5.00		
	Deficit			$ 5.00
13. Supplies	Allot.	$ 325.00		
	Expend	411.88		
	Deficit			$ 86.88
14. Transportation of Things	Allot.	$ 20.00		
	Expend.	64.88		
	Deficit			$ 44.88
15. Trans. of Persons.....	Allot.	$1,575.00		
	Expend.	1,066.85		
	Balance		$508.15	

Expenditures for the Forest Insect Laboratory, Vernon, B. C., 1937-1938 (Continued) - 2 -

Total Allotments . . .	$4,799.99
Total Expenditures . .	4,558.61
Net Balance	$ 241.38

Salaries

(Actual Cheques Received)

Hopping, Ralph	Entomologist	$2,736.00
Hopping, Geo. R.	Asst. Entomologist	2,030.52
Mathers, Wm. G.	Jr. Entomologist	1,549.02
Richmond, H. A.	Jr. Entomologist	399.00
Leech, H. B.	Graduate Student	841.22
Graham, K.	Graduate Student	479.03
Cliff, H. N.	Student Assistant	222.58
Morgan, C.	Student Assistant	163.95
Jackson, Grace	Stenographer	76.00
Nager, E. F.	Stenographer	720.00
Downing, A.	Janitor	54.25
		$9,271.57

Total Allotment	$10,290.00
Total Salaries	9,271.57
Balance ...	$ 1,018.43

Note: This balance was largely due to the transfer of Richmond.

PUBLICATIONS

--- 1937 ---

Hopping, Ralph

The Lepturini of America North of Mexico Part II - Bulletin 85, Dept. of Mines and Resources.

New Coleoptera from Western Canada, Can. Ent., April.

Hopping, Geo. R.

Revision of the Clytini of Boreal America Part II, Ann. Ent. Soc. of Am., Sept.

Sawfly Biologies II - ~~Neodiprion tsugae Midd.~~ Alder Sawfly, Can. Ent., Nov.

Leech, H. B.

A New North American Agabus, Can. Ent., July.

A New Species of Gyrinus, Can. Ent., March, 1938.

Richmond, H. A.

Some Notes on the Periodicities of Certain Insects in Relation to the Sun Spot Cycle, Proc. Ent. Soc. of B. C., Feb. 1938.

INVENTORY

Vernon Forest Insect Laboratory

as of Dec. 31, 1937

Scientific Instruments

1 Bausch and Lomb compound microscope	120.00
1 Leitz binocular microscope	141.00
1 Spencer binocular microscope	143.00
1 Dissecting microscope	178.95
1 Zeiss Ikon Maximar camera and case	67.15
1 Klimax camera	65.00
1 Fan and Carbon Lamp	5.55
1 exposure calculator	10.00
2 Thermoregulators	16.08
1 substage condenser	13.00
1 Rectifying transformer	5.40
2 hygrothermographs (Negretti & Zambra)	150.00
1 Contactor	5.54
1 Topley's aneroid barometer	25.00
2 Abney levels	30.00
2 Maximum recording thermometers (N. & Z.)	21.00
2 Minimum " " "	21.00
2 Tycos maximum thermometers	15.00
2 " minimum "	15.00
2 " Maximum and minimum thermometers	15.00

Scientific Instruments (continued)

1 minimum recording pocket thermometer	6.75
1 wet and dry bulb thermometer (deficient)	7.50
3 Accoson nitro thermometers, pocket (one broken)	7.50
1 Zeiss camera lucida	25.00
1 monocular field glass	20.00
1 light directing lens and stand	5.00
1 7.5X triple Aplanat hand lens	6.00
1 Leitz 16X and 32X double hand lens	7.50
1 Zeiss 8X hand lens	6.61
1 8X hand lens	6.00
1 Balance scales	8.60
1 sling psychrometer	10.00
	$1179.13

Scientific Equipment

1 micrometer grid disc	3.50
1 Syringe and needles	1.90
1 micrometer slide	5.00
24 culture dishes	7.25
1 Barthel blast burner	8.45
1 graduate, pyrex	2.00
2 increment borers 6" and 9"	10.00
1 - 100' steel surveyor's tape	4.50
1 pair Starrett Mm. calipers	1.30
1 steel diameter tape	5.00
2 metric steel rules 6"	1.00
3 insect collecting nets	15.00

Scientific Equipment (continued)

3 dozen Schmitt insect cases	90.00
2 camera tripods	8.00
1 tilting tripod head	4.00
1 film pack adapter	2.00
6 plate holders	3.90
1 de Gryse insect trap	14.50
1 substage microscope lamp	6.50
1 Spencer microscope lamp	23.92
1 Spencer microscope lamp	23.00
1 drawing board	4.50
	$245.22

Laboratory Equipment

5 pairs entomological scissors	1.50
2 " large scissors	1.00
1 " curved dissecting scissors	.50
2 " dissecting scissors	.80
2 " dissecting forceps	1.20
2 " dissecting forceps	.60
4 " " "	1.44
7 " entomological tweezers	2.80
6 dissecting needles	..30
3 scalpels	1.50
3 mapping pens	7.50
1 box microscope slides	.65
100 slide mounting cells	16.67
144 microscope slides	.75

Laboratory Equipment (continued)

62 slide mounting cells and covers	6.57
4 boxes cover glasses	2.00
100 shell vials with corks	5.27
3000 aluminum tree tags	13.80
2 belljars	2.00
2 - 50 cc. graduates	1.00
2 - 250 cc. "	1.20
2 - glass funnels	.60
1 - 500 cc. beaker	.40
6 Petrie culture dishes	1.80
2 - 250 cc. beakers	.50
3 Pyrex beakers	.60
12 Petrie dishes	1.46
12 Large-mouth jars	1.20
2 gross screw cap sq. jars	12.00
5 crucibles	2.00
4 gross glass vials	14.20
2 books lens paper	.50
1 box charts	6.75
1 box filter paper	.20
6 Verichrome film packs	6.90
8 hygrometer wicks	1.20
6 Ferotype photo dryplates	7.50
5 gross assorted corks	2.50
200 cardboard shipping boxes	7.02
	$136.38

Chemicals

4 bottles fly repellent	1.00
1 bottle hydrogen peroxide	.25
1 " methyl hydrate	.65
1 quart 95% alcohol	3.00
1 bottle Xylol	1.00
1 " amyl acetate	.85
1 " sugar formalin	.65
1 " formaldehyde	.75
1 " collodion	.60
1 " acetic acid	.55
1 " carbon bisulphide	1.00
2 " Reeves fixative	.50
2 " Canada balsam	.50
1 " picric acid (crystal)	.60
1 " KOH (crystal)	.80
1 lb. sodium selenate	4.50
	$17.20

Office Equipment

1 Remington standard typewriter	160.00
1 Imperial portable typewriter	60.00
1 copy stand	2.00
1 file punch	2.65
1 double paper punch	4.50
1 pencil sharpener	3.10
1 leather manuscript carrying case	4.50
2 inkwells	.40
1 electric heater Nov/22	11.00

Office Equipment (continued)

2 paper cutters	.20
4 desk calendars	2.00
2 rubber stamps and ink pads	1.00
1 photographic trimming board	8.25
4 metal waste-paper baskets	7.20
	$255.80

Office Supplies

3500 sheets 8 x 10 plain typing paper (3T)
1000 " 8 x 13 " " " "
4500 " corn bond
2000 " letterhead paper
700 expense forms
3100 Dom. Entomologist envelopes
650 plain official envelopes (4" x 9") No. 9.
10 plain leave forms
25 pest survey forms.
10 application forms (Civil Service)
5 quires white stencil (Gestetner)
5 loose leaf binders
10 manuscript forms
6 pads sub-voucher receipts
12 stenographic note-books
15 medium-sized brown envelopes
25 large-sized " "
6 boxes carbon paper 8 x 10
1 box Prang Watercolours

Office Supplies (Continued)

1 box Dixon's coloured pencils

2 boxes paper fasteners No. 5

1 box fasteners No. 3.

2 boxes paper clips

6 crow-quill holders

2 bottles Higgins waterproof ink

1 tin le-Page's glue

4 copying pencils

10 experimental record books (large)

60 small " " "

11 ruled pads

6 plain pads (small) 3½ x 5

4200 3" x 5" white, ruled, filing cards

40 file folders

100 Dom. Ent. envelopes 11½ x 5 (white)

400 Insect Survey boxes (old style)

4000 sheets impression paper 8½ x 14

8500 " " " 8½ x 11

1 box adhesive labels No. 2001

1 box pen nibs (assorted)

100 copies (Extracts) "Instructions to Co-operators" (1937) - Forest Insect Survey.

2000 " "Memorandum to Co-operators and Prospective Co-operators" (1937) - Forest Insect Survey

1 doz. pencils (assorted)

1 box drawing pins No. 3.

1	box rubber bands (assorted)	
700	No. 1 Ent. pins	
500	No. 4 " "	
4000	Labels (Forest Insect Survey)	
9	desk blotters	
1500	"Fragile" labels	

Field Equipment

3	Coleman gas stoves (one worn out)	44.80
3	Coleman lanterns (one worn out)	29.00
6	rearing cages	28.20
22	glass rearing jars	5.50
7	Woods eiderdown sleeping-bags	280.00
2	steel cots	17.50
1	Baker tent 7' x 9'	12.50
2	duck tents 10' x 12'	80.00
1	cork tent 12' x 15'	33.13
1	large Amazon tent and fly	60.00
1	silk tent 10' x 12'	40.00
3	silk tents 7' x 9'	90.00
1	tent fly 10' x 12'	10.00
1	" " 16' x 16'	
2	tarpaulins 9' x 16'	16.00
1	pack sack	2.50
4	canvas manuscript carrying cases	8.00
2	boy's axes	3.00
2	pole axes	3.50
1	double bit axe	3.50
1	canvas water bag	.50

1 draw knife	3.25
2 cross-cut saws	17.65
3 hand-saws	6.75
2 shovels	2.20
2 rakes	1.65
1 mattock	1.25
2 hammers	2.00
2 tack hammers	.50
2 carborundum stones	550
2 coal-oil lanterns	3.50
1 cook stove (worn out)	25.00
3 wedges	2.90
2 airtight heaters	10.00
17 length stove pipe	3.20
1 wrecking bar	.75
1 water tank	4.00
3 wash tubs	5.00
2 pails	.85
1 hoe	1.25
1 broom	.35
Camping utensils for five men	28.00
	$906.79

Automotive Equipment

1 Chevrolet 4-door sedan, 1931	950.00
1 " 2-door coach, 1937	941.81
1 automobile trailer	25.00
	$1916.81

Books

Blatchley, Coleoptera of Indiana	10.00
Blatchley & Leng, Rhynchophora of N.E. America	7.50
Boving & Craighead, Larvae of Coleoptera	7.50
Bradley, Manual of the Genus of Beetles of America North of Mexico	5.00
Cassell's French Dictionary	2.50
Cassell's German Dictionary	2.50
Chamberlin, Forest Entomology (2 parts)	1.00
Comstock, An Introduction to Entomology	5.00
Concise Oxford Dictionary	2.50
Curran, North American Diptera	7.50
Essig, Insects of Western North America	10.00
Felt, Manual of Tree and Shrub Insects	2.50
Felt & Rankin, Insects & Diseases of Ornamental Shrubs	5.00
Graham, Forest Entomology (2 copies)	7.00
Henry, Flora of Southern B. C.	2.65
Hodgman & Lange, Handbook of Chemistry & Physics	5.00
Junk, Coleopterorum Catalogus, Parts, 39, 73 & 74	6.00
Leng, Catalogue of Coleoptera of America North of Mexico, with supplements	15.00
Needham, Frost & Tothill - Leaf-Mining Insects	6.00
Nusslin & Rhumbler - Forstinsektenkimde	7.50
Robinson & Fernald - Gray - New Manual of Botany	2.50
Schlich's Manual of Forestry	5.00
Smith, Glossary of Entomology	3.00
Smith's Latin-English Dictionary	2.50

Books (continued)

Trelease & Yuill - Prep. of Technical & Scientific Papers	2.00
Insects & Climate - Uvarov	10.00
Principles of Insect Morphology - Snodgrass	6.00
Also a great number of separates of individual articles.	
	$148.65

Buildings

Trinity Valley Station	519.40
Trinity Valley Insectary	279.89
	$799.29

INVENTORY

Vancouver Forest Insect Sub-Laboratory

As of Dec. 31, 1937

Scientific Instruments

1	Spencer binocular microscope, complete with 3 sets oculars, 3 objectives, stand & case	143.00
1	Negretti & Zambra hygrothermograph	75.00
1	Zeiss monocular field glass	18.00
2	" " minimum reg. thermometers	21.00
2	" " maximum " "	21.00
1	unmatched set max. & min. Tycos thermometers	15.00
1	set Tycos wet and dry bulb thermometers	7.50
2	Bak-Fin thermometers in cases	5.00
1	Edney swing psychrometer	10.00
1	pocket type aneroid barometer	25.00
1	cruiser's compass	8.10
1	Mattson increment borer	5.00
1	Zeiss Ikon Maximar camera & case	67.15
1	Luer B-D syringe	4.00
1	La Motte soil testing set	10.00
1	B. & L. hand lens	7.50
1	Exposure meter Drem Justophet	10.00
		$452.25

Scientific Equipment

1 B. & L. stage micrometer	5.00
1 micrometer ocular disc	3.50
1 metal tripod for camera	4.00
1 tilting head attachment for tripod	4.00
1 veriner type calliper	1.30
1 electric hot plate	3.60
5 Schmitt boxes	12.50
60 Riker mounts (43 used)	12.00
1 Zeiss Ikon sky filter	3.35
	$49.25

Laboratory Equipment

2 pairs scissors	.60
4 pairs forceps	1.50
1 ruling pen	1.20
3 Pyrex glass beakers	.75
1 - 100 Cc. graduate	.50
4 slide boxes	1.00
18 wide-mouth bottles	3.60
1 collecting net	3.50
1 steel tape, 50'	4.50
	$17.15

Office Equipment

1 desk lamp	$1.95

Field Equipment

1	eiderdown sleeping bag	40.00
1	tarpaulin 16' x 16'	12.50
1	canvas carrying case	2.50
1	Wood's pack sack	4.50
1	Coleman camp stove	14.00
1	Coleman lantern	10.00
1	2-man cooking outfit	12.00
1	McClarey 2-gallon coal oil can	1.10
1	SMP 1-gallon coal oil can	.75
1	double-bitted axe	2.50
1	boy's axe	1.50
1	Spear & Jackson hand saw	6.50
1	hand saw	4.50
1	cross-cut saw 4'	8.50
1	" " " 5'	10.00
2	hammers	2.00
1	long-handled shovel	1.50
1	rake	.85
1	chisel and 1 gouge	1.80
1	carborundu m stone	.60
1	United Drug Co. first-aid kit	4.50
12	portable insect rearing cages	50.40
6	glass rearing jars	1.50
6	plant pots 8" tops	2.00
		$196.00

SUMMARY

Vernon Forest Insect Laboratory

and

Vancouver Sub-Laboratory

Scientific Instruments	$1631.38
" Equipment	294.47
Laboratory Equipment	153.53
Chemicals	17.20
Office Equipment	450.80
Field Equipment	1102.79
Automotive Equipment	1916.81
Books	148.65
Buildings	799.29
Total ----------	$ 6514.92

GENERAL INDEX

- A -

- B -

B (Continued)

- C -

- D -

- E -

- F -

- G -

- H -

- I -

- J -

- K -

- L -

L (continued)

- M -

- N -

- O -

- P -

- Q -

- R -

-S -

- T -

- U -

- V -

- W -

- X -

- Y -

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