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A N N U A L R E P O R T

VERNON FOREST INSECT LABORATORY

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INTRODUCTION

Herewith is presented the annual report of the Vernon Forest Insect Laboratory for 1939 covering research, reconnaisance, and investigation of forest and shade tree insects, and those affecting forest products in British Columbia and western Alberta.

During the year considerable improvement has been made to the Trinity Field Station. Bath and kitchen facilities have been installed in the main building and a water system will be completed early in 1940. This will be a hydraulic ram system. The ram has already been purchased as well as 750 gallon tank. A seventeen foot tower which will support the tank was completed by the members of the Forestry Training Plan. In addition, these boys continued clearing logging debris from the experimental area, and the falling of snags. The area is now three-fourths cleared and reasonably safe from fire.

In the coastal area, a definite start has been made to remodel one of the buildings at the Cowichan Lake Forestry Station into a field laboratory and insectary for the forest insects unit. In addition to the European pine shoot moth work, control of shade tree insects along city boulevards is becoming imperative with the increase of the elm scale and maple aphis.

In the interior, the work of the forest insect survey has shown a marked increase both in territory covered and in number of co-operators. In view of certain virus diseases which have played an important part in the control of some of our defoliators in British Columbia, the Vernon laboratory has aquired considerable new equipment and supplies to facilitate studies of such problems.

Although fifteen major projects are listed for the Vernon laboratory, only a limited number of these are being intensively studied at any one time. Work on the coast for 1940 will be confined to control of shade tree insects and the pine shoot moth in Vancouver, investigation of insects injurious to forest plantations and those affecting forest products. In the interior, the forest insect survey will be the most important single project but intensive work will also be done on virus disease of the fir tussock moth, and on the present outbreak of the larch sawfly. Sample plot data in connection with the Kootenay Park outbreak of bark beetles will also be continued. The spruce budworm will be more intensively studied in accordance with the war-time classification of projects.

PERSONNEL

Geo. R. Hopping	- Entomologist in Charge, Vernon, B.C.
W. G. Mathers	- Junior Agric. Scientist, Vancouver Sub-Laboratory
K. Graham	- Agricultural Assistant, Vernon.
H. B. Leech	- Agricultural Assistant, Vernon.
C. V. G. Morgan	- Graduate Assistant, Vernon.
R. H. Longmore	- Graduate Assistant, Vancouver Sub-Laboratory.
Miss E. Eager	- Stenographer, Vernon.

PERSONNEL

Mr. W. G. Mathers has ably supervised the work of the Vancouver Sub-Laboratory for the past six years. During that period he has enlarged and improved the forest and shade tree insect work in that region and has made many valuable contacts with lumber concerns, the B.C. Forest Service and the Vancouver Parks Board. For the past two years he has been assisted by R. H. Longmore in carrying out studies relating to the sitka spruce weevil and the mottled willow borer. Control of the European pine shoot moth and shade tree insects in Vancouver has also occupied their attention.

Mr. H. B. Leech has successfully managed the sending and examination of all collection boxes in connection with the forest insect survey, besides answering most of the correspondence and preparing many of the specimens for Ottawa. Much of the tabulation of data has also been in his care. In view of the marked increase in the survey this season, this meant a tremendous amount of work and much overtime. Rearing of material, preparation of sheets of data were taken care of by K. Graham, and C.V.G. Morgan who were located at Trinity Field Station during the field season. They also conducted studies on the hemlock looper and Douglas fir tussock moth.

Mr. Graham returned to Toronto University in the fall to complete work for his PhD degree. Mr. Morgan has remained at the Vernon laboratory throughout the winter, assisting with survey material and data compilation. Mr. Longmore secured a teaching position at Keremeos, B.C. upon the termination of his appointment on December 31st.

VISITORS TO THE LABORATORIES

Mr. R. Glendenning, in charge of the Agassiz Entomological Laboratory, visited the Vancouver Laboratory on May 31 to discuss the transfer of certain shade tree insect problems to the forest insect unit.

Dr. I. Mounce, Associate Plant Pathologist, Ottawa, called at the Vancouver Laboratory on June 1. Inspection of Stanley Park was made in company with W. G. Mathers, and pathological problems in connection with the park were discussed. Dr. Mounce visited the laboratory again on June 23, accompanied by Dr. J. E. Bier, also of the Dominion Division of Plant Pathology.

Mr. J. J. de Gryse arrived at Vernon on June 13th to inspect the work of the laboratory. Dr. Arthur Gibson arrived on the night of June 13th and on the 14th, the above officers inspected the Trinity Valley Forest Insect Field Station. On June 16th, G. R. Hopping accompanied Mr. de Gryse to the Vancouver Laboratory.

Dr. J. M. Swaine, Director of Agricultural Research was a visitor to the Vernon Laboratory on July 6th. In the short time available, he reviewed the work of the Forest Insects Unit and inspected Trinity Field Station.

Dr. Swaine and Dr. Gibson visited Vancouver in June and on June 28 inspected the work at Green Timbers Forestry Station in company with W. G. Mathers.

On August 5th, C. McKinnon and H. Hodgins of Victoria, in charge of Silvicultural work for the B.C. Forest Service, visited the Vernon Laboratory and Trinity Field Station.

Dr. A. B. Baird was in Vernon from August 12th to 15th and spent the morning of the 14th at Trinity Field Station. He also called at the Vancouver Laboratory on August 10th and discussed parasite matters in connection with the holly leaf miner and satin moth.

The Dominion Director of Forestry, Mr. de Roy Cameron, and the Director of the Forest Products Laboratory at Vancouver, Mr. R. M. Brown, visited the Vernon Laboratory and the Trinity Field Station on August 20th.

Mr. A. E. Parlow, District Forester of Kamloops called at the laboratory on August 23rd to discuss the work of the Forestry Training Plan boys on the Trinity Experimental Area.

Mr. A. G. Dustan of Field Crop Insect Investigations Unit called at the Vancouver Laboratory on September 5th.

Mr. C. E. Petch of the Entomological Laboratory, Hemmingford, Quebec, was a visitor to the Vernon Laboratory during the early part of October.

Dr. I. Mounce visited the Vancouver Laboratory on October 12th and Dr. J. E. Bier visited the laboratory on October 28th.

Forty visitors were received at the Vancouver Laboratory on the evening of January 19th when the local branch of the C.S.T.A. met in the Agriculture Building at the University of British Columbia.

DIXON ENTRANCE

HECATE STRAIT

QUEEN CHARLOTTE SOUND

VANCOUVER ISLAND

BRITISH COLUMBIA

ALBERTA

PEACE RIVER

FRASER RIVER

Portland Canal

Prince Rupert

Hazelton

Skeena R.

Babine Lake

Francois Lake

Nechako River

Prince George

Dean Channel

Bella Coola

Chilcotin River

Quesnel

Fraser R.

Bridge R.

Lillooet

Thompson River

Ashcroft

Kamloops

South Thompson R.

Shuswap L.

Adams Lake

Columbia River

Revelstoke

Golden

Upper Arrow Lake

Lower Arrow Lake

Slocan Lake

Kootenay Lake

Kimberley

Cranbroat

Fernie

Elko

Red Deer R.

Banff

Canmore

CALGARY

Jasper

Pembina River

Smoky R.

Wapiti River

Brazeau R.

Athabasca R.

Obed R.

Nanaimo

VANCOUVER

VICTORIA

Trail

Rossland

Princeton

Merritt

Forest Insect Survey

1939

Species occurring in 20 or more collections

- Spruce budworm (21)
- Larch sawfly (23)
- Hemlock looper (21)
- Peronea variana (2)
- Semiothisa granitata (7)
- Pikonema alaskensis (23)
- " dimmockii (2)
- ~~Other collections~~
- ~~Negatives~~

ATTENDANCE OF OFFICERS AT CONFERENCES, ADDRESSES and LECTURES

W. G. Mathers gave a short talk on forest insect survey work at a meeting of rangers of the Provincial Forest Service at Vancouver, March 14-17. Results of the 1938 survey and suggestions for improving field collecting methods were presented.

G. R. Hopping attended a meeting of foresters in the Prince George district on April 20th at which instruction in forest entomology was given to rangers and other officers. The forest insect survey plans for 1939 were thoroughly discussed.

On April 27th, G. R. Hopping attended the rangers' convention of the Nelson Forest District. Chief Forester E. C. Manning, Game Department Officials, and Foresters from Washington were in attendance. Plans for the 1939 survey and recent developments in forest entomology were discussed.

At both the above meetings full support of the forest service was secured in making the survey collections, and the rangers expressed a willingness to make eight collections per year instead of four, one collection each month from spruce, and one from some other tree species, during June, July, August, and September.

G. R. Hopping accompanied J. J. de Gryse to Vancouver on June 16th where W. G. Mathers joined in a conference on forest insect work on the B. C. Coast. Other conferences were held with Dr. J. M. Swaine and B. C. Forestry officials.

G. R. Hopping was away from the Vernon Laboratory from August 9th to 19th, attending the Rocky Mountain Conference of Entomologists, held at Science Lodge near Boulder, Colorado. The first two days of this conference were devoted to forest insect problems of Western Canada and the United States. Mr. Hopping delivered an address on the Canadian Forest Insect Survey, with particular reference to forest insect work in British Columbia.

On September 1st, W. G. Mathers conferred with Mr. L. S. McLaine, Chief of Plant Protection Service, and Mr. H. F. Olds, in charge of inspection work in Vancouver, concerning the co-operative project for the eradication of the European pine shoot moth in Vancouver.

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On April 21st, W. G. Mathers visited Agassiz to confer with R. Glendenning on matters in connection with the satin moth and the elm and Lecanium scale projects.

W. G. Mathers accompanied C. R. Hopping to Victoria on February 28 to confer with Provincial Forestry officers on various phases of forest entomological work in British Columbia.

W. G. Mathers was a member of the convention committee of the 19th Annual Convention C.S.T.A. held in Vancouver June 19-22.

W. G. Mathers was in charge of the forest insect part of the joint display of insect pests and plant diseases shown by Dominion and Provincial laboratories at the Vancouver exhibition, August 28-September 4. The forest insect portion was also shown at the Provincial Agricultural Fair in Victoria.

RECONNAISSANCE

G. R. Hopping and C.V.G. Morgan examined infestations of tussock moth about farm houses in the Armstrong district in early April. Control measures were recommended.

W. G. Mathers spent May 11-16 on Vancouver Island in connection with spray experiments for control of the pine needle mite in plantations. On May 15, he made an examination of fire-killed timber near Courtenay. Fresh attacks by Trypodendron cavifrons and Dendroctonus pseudotsugae were found on the standing killed timber and also on recently felled logs. Salvage operations were under way and although some Siricid damage had occurred to some of the fire-killed cedar, no other Siricid work was found.

W. G. Mathers was absent from Vancouver July 16-23 examining spruce budworm infestations in the Barkerville district.

On June 28, G. R. Hopping examined an infestation of bark beetles in Douglas fir on a tie operation of the Canadian Pacific Railroad on Cherry Creek, near Kamloops.

G. R. Hopping was away from Vernon July 10-27 on reconnaissance work covering the recent larch sawfly outbreak in the Kootenay region; forest insect conditions at Waterton Lakes, the hemlock looper outbreak in the Big Bend district and an outbreak of the spruce budworm at Fortress Lake, near Jasper.

W. G. Mathers spent August 16-19 examining the Cowichan Lake Forestry Station experimental plots in company Dr. J. E. Bier of the Division of Plant Pathology.

G. R. Hopping examined injury to ornamental spruce and white pine by bark beetles in Fernie on September 11.

G. R. Hopping and C.V.G. Morgan were in the Kootenay region establishing sample plots in connection with the larch sawfly outbreak during the period September 8-16.

G. R. Hopping spent September 19-23 checking sample plots in connection with a bark beetle outbreak in Kootenay National Park.

G. R. Hopping spent October 5th to 7th inspecting work of the Vancouver Laboratory and accompanied by W. G. Mathers made an examination of the plantations of the Elk River Timber Company near Campbell River, Vancouver Island.

Several inspections were made of Stanley Park by W.G. Mathers during the year, in connection with the survey of dead and dying trees made in 1938. It is gratifying to note that by the end of 1939, the majority of the marked trees, over 400 in number, had been felled and removed and that a considerable number of windfalls had been removed as well. A Planting programme has been undertaken and 21,000 Douglas firs were set out ~~early in 1940 on 15 acres~~. in 1939 and 10,000 D. firs planted early in 1940 on an exp section of 15 acres.

Few trees in the park were found to have been killed entirely by insects, but top killing of hemlocks by the bark beetles Scolytus tsugae and Pseudohylesinus was found to be common and several spruce which had died were found to have been heavily attacked by the spruce gall aphid which hastened the death of the trees. Dead trees were heavily infested with roundheaded borers. Serropalpus sp. and Melasis tsugae were found in dead Douglas firs. Round headed borers showed considerable parasitism, a number of Hymenopterous parasites being reared from the material.

CO-OPERATION WITH OTHER ORGANIZATIONS

In connection with the forest insect survey, close co-operation was necessary between Science Service and the British Columbia Forest Service. In the face of a bad fire year, the collections were made with reasonable regularity and care. The Alberta Forest Service has also co-operated to the fullest. Mr. T. F. Blefgen, Director of Forestry for Alberta has been most helpful in any forest insect work suggested in his region. Other organizations which aided in the survey were the National Parks Branch, the Dominion Forest Service, the Malahat Logging Company, the Lake Logging Company, and the Comox Logging Company.

Through the Vancouver Laboratory co-operation has been obtained from the Vancouver Parks Board, in the suppression of shade tree insects and the European pine shoot moth in the city; the Dominion Forest Products Laboratories in reporting damage to forest products by insects and in making certain tests; the University of British Columbia in supplying Room D. of the Agriculture Building for the use of the Forest Insects Unit.

Science Service is also indebted to the B.C. Forest Service for the use of a building at Green Timbers Forestry Station and to the Provincial Government for the free use of a large suite of offices and laboratory in the Court House at Vernon.

A co-operative problem has been arranged between the Vancouver Laboratory and Mr. H. F. Olds of the Plant Protection Service in the eradication of the European pine shoot moth in the Vancouver area.

At the request of W. Downes, in charge of the Victoria Entomological Laboratory, six shipments of parasites of the holly leaf miner were liberated in the Vancouver district between June 16th and August 15th by W. G. Mathers. The shipments were received by air express from the Belleville Parasite Laboratory and consisted of over 13,000 parasites, including five species.

GENERAL INSECT CONDITIONS

Pristiphora erichsonii Hartig. increased in population to epidemic proportions over much of its range between Fernie and Slocan Lake. At the present time, this is the biggest defoliator problem in the interior of British Columbia.

Notolophus pseudotsugata McD., the Douglas fir tussock moth, increased to epidemic numbers in small isolated patches, a few square miles in extent, in the North Okanagan Valley region.

Dendroctonus monticolae Hopk. and Ips interpunctus Zich. increased markedly on one portion of the Kootenay Park infestation. Most of the area originally involved is now inactive.

Trypodendron cavifrons Mann has been troublesome in saw logs in the Vancouver district. Fire killed material was heavily attacked on Vancouver Island.

Myzaphis abietina Walk. Attacks on conifers by aphids have been reported from several coastal points, particularly the above species on spruce.

Drepanosiphum platanoides Shrank has been troublesome on boulevard maples in various sections of Vancouver. The city is planning a spray programme for control in 1940.

Phytodecta americana Kby. severely defoliated aspens at several points in Alberta. Chrysomela tremulae Fabr. did similar damage over an area of approximately 40 acres near Edmonton, Alberta.

Peronea variana Fern. Population of this defoliator has apparently risen sharply this season. Many were received in the forest insect survey and a fairly extensive outbreak was reported from Glacier Park.

Leptocoris trivittatus Say, the box-elder bug became extremely numerous during the fall around interior towns, where it caused annoyance by seeking hibernation quarters in private dwellings.

Halisidota argentata Pack., the Douglas fir webworm were reported to have been active in March at West Vancouver, B C.

Gossyparia spuria Modeer, the European elm scale has heavily infested elms in Vancouver and control measures will have to be undertaken in 1940.

Hyphantria cunea Drury, the fall webworm, has been reported as numerous on native alder on the B.C. Coast.

Fleas in stored sawdust in basements of private dwellings in Vancouver has been the cause of many complaints to sawdust dealers.

Pikonema dimmocki was found to be present in most districts of B.C. from which collections were made for the insect survey. No major outbreaks have been known.

Semiothisa granitata Wlk. is continually being sent in in the survey collections but no outbreaks have occurred.

Neodiprion tsugae Midd. appeared in abnormal numbers at Trout Lake, Lardeau District, and at Trinity Field Station in 1938. This had been reduced to a normal population in 1939.

Dichomeris marginella Fab. An attack by a webworm, believed to be this species, was reported from Vancouver.

Eulecanium coryli L. Light infestations have occurred at several points in the Vancouver district. The parasite introduced several years ago is expected to take care of it adequately.

Neodiprion sp. was very abundant at Trinity Valley. This, or an allied species has been reported from other points in the province. (hemlock?)

A species of Lyctus was found to be damaging ash used in ski manufacturing. The wood was imported from the United States.

Notolophus antiqua badia Hy. Edw., the rusty tussock moth, attacked ornamental blue spruces at Vernon during the summer.

Siricid attacks have occurred on cedar poles over a small area at Courtenay, B.C.

Pissodes sitchensis Hopk. The sitka spruce weevil, was less numerous this season at Green Timbers Forestry Station.

Cacoecia fumiferana Clem., the spruce budworm, is still active in the Barkerville region. The present infestation, which is undoubtedly a continuation of the outbreak active in 1929-32, has extended considerably. In conjunction with Dryocoetes, a heavy mortality of mature balsam is taking place. Smaller infestations of spruce budworm have been reported from the North Thompson Valley and Fortress Lake, B C.

Paratetranychus ununguis Jacobi, or a closely related species has occurred on an ornamental blue spruce at Vernon.

Zootermopsis angusticollis Hagen, has caused considerable damage to structural timbers of buildings in Vancouver. Attacks on older buildings in this district constitute a serious problem as instances of $300 to $500 expenditures for replacement work are not uncommon.

Ellopia fiscellaria lugubrosa Hlst., epidemics reported in 1938, have completely subsided. In comparison with previous years very few specimens were obtained in the Forest Insect Survey.

Malacosoma pluvialis Dyar, the western tent caterpillar occurred in huge numbers in certain of the outlying sections of Vancouver.

Sternochetus (Cryptorhynchus) lapathi L. emergence was later this year than last although there was an equal degree of infestation. The first record of attack on poplar in the Vancouver district was secured this year. This willow borer has been present in British Columbia for at least ten years.

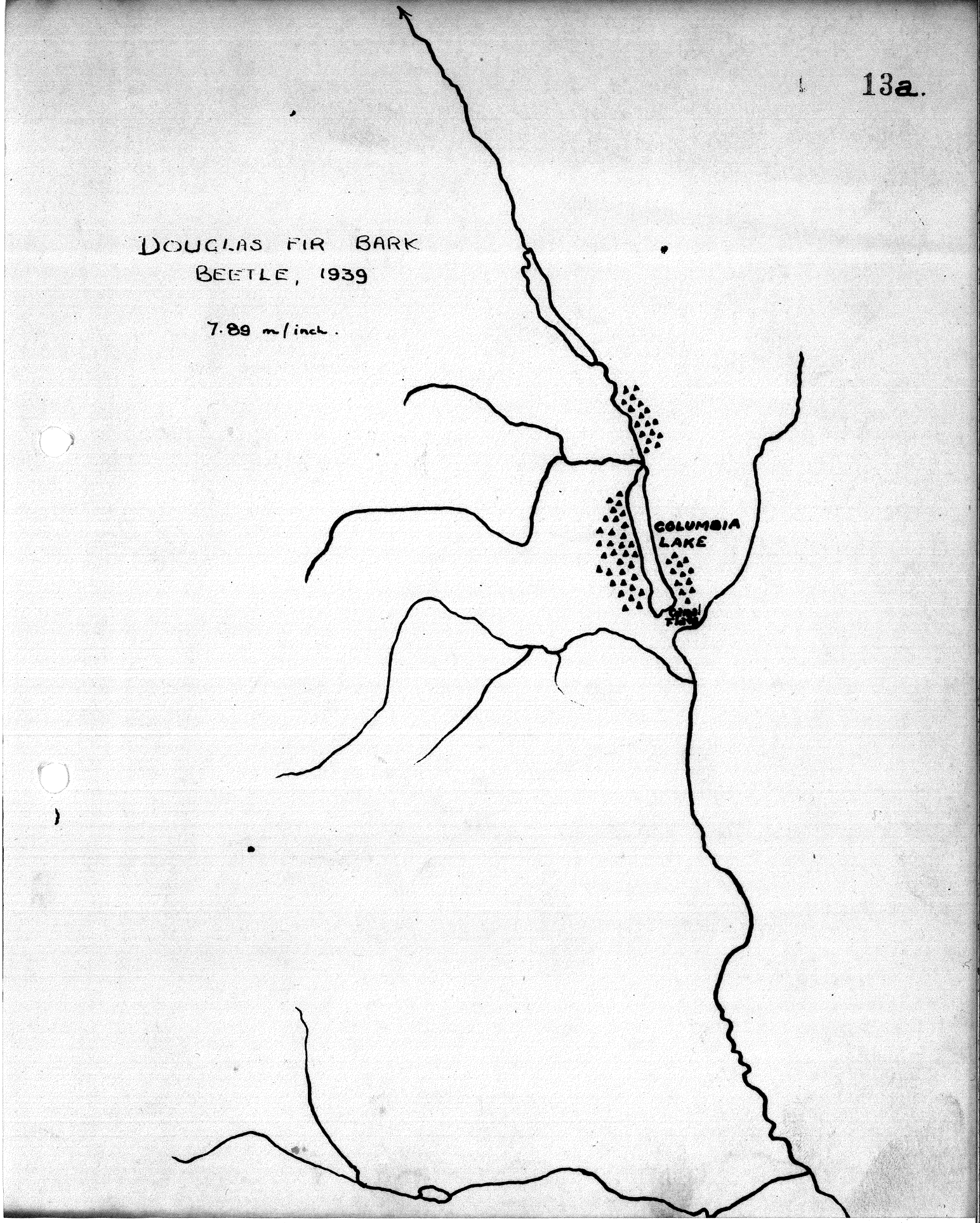
Pikonema alaskensis Roh. was reported from numerous places in the survey material, and there were localized outbreaks at Jasper and Jumping Pound, Alberta.

Dendroctonus pseudotsugae Hopk. has caused high mortality to timber surrounding Columbia Lake, and in the Lumby district. The C.P.R. tie operation at Cherry Creek, near Kamloops, experienced an outbreak and it became necessary to alter logging procedure to cope with the situation.

Vespa sp., yellow jackets, were very numerous in the forests this year. Parasitism in the nests was quite heavy.

DOUGLAS FIR BARK
BEETLE, 1939

7.89 m/inch.



LIST OF PROJECTS

E.30.01 Forest Insect Survey (for British Columbia and Alberta)
G. R. Hopping, H. B. Leech, K. Graham, C. V. G. Morgan.

E.30.03-2 Rearing and Identification of Miscellaneous Insects Affecting Forest and Shade Trees.
G. R. Hopping, C. V. G. Morgan, Vernon; W. G. Mathers, R. H. Longmore, Vancouver.

E.30.09-3 A Study of the Bionomics and Control of the Larch Sawfly in British Columbia.
G. R. Hopping, H. B. Leech, C. V. G. Morgan, Vernon.

E.30.07-3 Investigations of Spruce Budworm Outbreaks in Western Canada.
G. R. Hopping, W. G. Mathers.

E.30.14-2 European Pine Shoot Moth
G. R. Hopping, W. G. Mathers, R. H. Longmore.

E.30.19-3 Bark Beetle Sample Plot Studies
G. R. Hopping, K. Graham, C. V. G. Morgan.

E.30.20 A Study of the Biologies of the Economically Important Ambrosia Beetles of the British Columbia Coast.
G.R. Hopping, W. G. Mathers, H. B. Leech, K. Graham.

E.30.20-2 Prevention of Ambrosia Beetle Injury to Felled Timber
G. R. Hopping, W. G. Mathers

E.30.24 Ellopia sommiaria Hlst. A Reconnaissance of Outbreaks and an Investigation of Parasites.
G. R. Hopping, K. Graham, H. B. Leech, C. V. G. Morgan.

E.30.32-1 Elm Scale Control, Vancouver.
G. R. Hopping, W. G. Mathers.

E.30.37-2 Identification and Control of Miscellaneous Insects Affecting Forest Products (in co-operation with Dominion Forest Products Laboratory).
W. G. Mathers.

E.30.40 A Study of the Bionomics and Control of the Douglas Fir Tussock Moth.
G. R. Hopping, K. Graham, C. V. G. Morgan.

E.30.41 The Sitka Spruce Weevil, *Pissodes sitchensis* Hopk.
G. R. Hopping, W. G. Mathers, R. H. Longmore

E.30.42 The Lecanium Scale - Natural Control by Introduced Parasite
W. G. Mathers.

E.30.25-2 Study and Control of the Satin Moth by Introduced Parasites
W. G. Mathers.

NOTE

The estimated cost of the projects for 1941 are to be disregarded since these were made up before the drastic reduction in expenditures necessitated by the War.

DETAILED PROJECT REPORT

E.30.01 - The Forest Insect Survey

With the extension of forest insect survey collections to include other forest trees as well as spruce, and the increase in number of collections per man, it is apparent that the only further increase which can be expected willl be from the gradual inclusion of additional private lumber and logging concerns.

As will be seen by the accompanying table, the survey has been practically doubled in volume each year since its inception. This has been accomplished without any increase in staff, although it has resulted in neglecting other problems of less importance, but which should not be discontinued. During 1939 the following results have been obtained in the survey:--

Year	Boxes Sent Out	Boxes Returned	% Boxes Returned	Negative Reports	Totals
1937	401	189	47	138	327
1938	831	470	56	177	647
1939	1,877	933	50	120	1,053

Material Received

Insecta - Coleoptera	larvae ...	119
	pupae ...	8
	adults ...	1,169
Collembola		3
Dermaptera		5
Diptera	larvae ...	317
	puparia ..	50
	adults ...	211

Ephemeroptera			18
Heteroptera	Hemiptera		690
	Homoptera		793++
Hymenoptera	Symphyta	larvae	2,324
		cocoons	1,812
		adults	29
	Apocrita	larvae	1,603#
		cocoons	164
		adults	162
Lepidoptera		larvae	1,214
		pupae	193
		adults	98
Neuroptera		larvae	60
		cocoons	23
		adults	69
Orthoptera			9
Plecoptera			35
Psocoptera			471
Thysanoptera			4+
Thysanura			23
Trichoptera			33
Miscellaneous	Insect eggs		111++

Arthropoda Other Than Insects

Acarina	29
Araneida	227
Chilopoda	11
Diplopoda	23
Isopoda	21
Phalangida	6

All but 2 from 1 Lepidopterous larva.

Mollusca Gasteropoda (shells) 3

Totals

Coleoptera	1,296
Collembola	2
Dermaptera	5
Diptera	578
Ephemeroptera	18
Heteroptera	1,483+
Hymenoptera	6,094
Lepidoptera	1,405
Neuroptera	152
Orthoptera	9
Plecoptera	35
Psocoptera	471
Thysanoptera	4+
Thysanura	23
Trichoptera	33
Miscellaneous ..	111++
Total -	11,720+
Arthropoda other than insects	317
Mollusca (shells)	3
Grand Total -	12,040+

Complete summaries of material cannot be given at this time since much of it has not been determined. The adult material received in good enough condition for mounting and submission to Ottawa was composed of the following:--

Coleoptera

	Number of Collections	Number of Specimens
Alleculidae		
Hymenorus sp.	2	2
Isomira variabilis Horn	8	13
Anobiidae		
Coelostethus americanau Fall	1	1
" quadrulus Lec.	1	1
Ernobius gentilis Fall	2	2
" punctuatus Lec.	1	1
Microbregmus emarginatum Duft.	1	1
Ptilinum elegans Horn	1	1

	Number of Collections	Number of Specimens
Bostrichidae		
Stephanopachys sp.	1	7
Buprestidae		
Buprestis adjecta Lec.	1	1
" aurulenta L.	1	1
" fasciata langii Mann.	1	1
" nuttalli alternans Lec.	1	1
" maculiventris rusticorum Kby.	3	4
Chalcophora angulicollis Lec.	1	1
Chrysobothris sp.	1	1
Dicerca tenebrica Kby.	2	2
" prolongata Lec.	1	1
Melanophila drummondi Kby	3	5
Poecilonota cyanipes californica Chmb.	1	1
Cantharidae		
Lucidota corrusca L.	4	7
Malthodes sp.	2	4
Podabrus cavicollis Lec.	2	3
" excursus Fall.	5	8
" extremus Lec.	1	1
" fissilis Fall.	4	7
" laevicollis Kby.	5	8
" piniphilis Esch.	15	25
" pruinosus diversipes Fall	2	2
" puberulus ? Lec.	1	1
" scaber Lec.	2	2
" sp.	4	4
Silis difficilis Lec.	6	6
" " var carbo Van.D.	2	2
" pallida Mann.	3	4
" sp. ?	1	1
Carabidae		
Calathus sp.	3	4
Holciophorus ater Dej.	1	1
Notiophilus sylvaticus Esch.	1	1
Pemphus angusticollis Mann.	2	2
Platynus 4-punctatus Dej.	1	3
" sp.	6	8
Pterostichus sp.	1	1
Unidentified	2	2

	Number of Collections	Number of Specimens
Cephaloidae		
Cephaloon bicolor Horn	1	1
" tenuicorne Lec.	3	3
Cerambycidae		
Acmaeops proteus Kby.	1	1
Anoplodera dolorosa Lec.	1	1
" nigrella Say	1	1
Asemum atrum Esch.	4	4
Cortodera longicornis Kby.	1	1
Ergates spiculatus Lec.	1	1
Gaurotes cressoni Bland	1	1
Leptura obliterata Hald.	1	1
Monochamus oregonensis Lec.	4	5
Prionus californicus Mots.	1	1
Phymatodes dimidiatus Kby.	1	1
Pidonia scripta Lec.	1	1
Pogonocherus pictus Fall	1	1
Rosalia funebris Mots.	1	1
Saperda calcarata Say	1	1
Stenocorus lineatum Oliv.	1	2
Spondylis upiformis Mann.	2	2
Unidentified	3	4
Chrysomelidae		
Adoxus obscurus L.	2	2
Altica ambiens var. Lec.	1	1
" sp.	1	1
" tombaacina Mann.	2	2
Chrysomela scripta Fab.	3	10
" tremulae Fab.	1	20
" aeneicollis Schffr.	1	14
Galerucella carbo Lec.	7	9
Pachybrachys obsoletus Suffr.	1	1
Phytodecta americana Schffr.	5	15
Syneta carinata Mann.	5	5
" hamata Horn	3	3
" pilosa Br.	8	18
" simplex Lec.	3	3
Cleridae		
Enoclerus sphegeus Fab.	1	1
" lecontei Wolc.	3	3
Thanasimus undatulus Say	2	4
Trichodes ornatus Say	1	1

	Number of Collections	Number of Specimens
Coccinellidae		
Adalia frigida Schn.	5	5
" " var. melanopleura Lec.	1	2
Anisocalvia duodecimmaculata Gebl.	2	2
Anatis mali Say	3	3
Chilocorus bivulnerus Muls.	7	28
Cleis picta minor Csy.	30	40
Coccinella hieroglyphicus tricuspis Kby.	1	1
" trifasciata perplexa Muls.	3	3
Cycloneda sanguinea L.	3	8
Hippodamia 5-signata Kby.	1	1
" tibialis Say	1	1
Mysia randalli Csy.	6	6
Psyllobora 20-maculata Say	2	2
Scymnus sp.	3	4
Unidentified	1	2
Colydiidae		
Coxelus pacificus Horn	1	1
Dascillidae		
Macropogon sp.	1	2
Dermestidae		
Perimegatoma sp.	2	3
Dytiscidae		
Dytiscus sp.	1	1
Endomychidae		
Aphorista limbata Horn	1	1
Elateridae		
Agriotes ferrugineipennis Lec.	1	1
" tardus Br.	3	5
Ampedus bimaculatus Van D.	2	2
" moerens Lec.	2	2
" rhodopus Lec.	4	5
" varipilis columbianus Br.	1	1
" sp.	5	5

	Number of Collections	Number of Specimens
Elateridae (continued)		
Athous pallidipennis Mann.	3	3
" rufiventris Esch.	8	9
" scissus Lec.	1	1
" vittiger Lec.	1	1
Cardiophorus sp.	1	1
Dalopius spp.	17	21
Eanus albertanus Br.	1	1
" decoratus Mann.	1	1
Hemicrepidius morio Lec.	2	2
Lacon profusus Cand.	8	8
Limonius aeger Lec.	8	15
Ludius aereipennis Kby.	11	13
" Bombycinus Germ.	10	14
" callidus Br.	4	6
" castanicolor Fall	2	2
" cruciatus festivus Lec.	4	5
" glaucus Germ.	1	1
" kendalli Kby.	1	1
" lobatus caricinus Germ.	5	6
" lutescens Fall	2	2
" mendax Lec.	1	1
" nebraskensis Bland.	1	1
" nigricollis Bland.	3	3
" nitidulus Lec.	1	1
" ochreipennis Lec.	7	10
" propola Lec.	5	8
" " var. columbianus Br.	19	35
" pudicus Br.	7	9
" resplendens Esch.	4	5
" semimetallicus Walk.	10	11
" suckleyi Lec.	1	1
" sylvaticus V.D.	1	1
" triundulatus Rand	5	9
" umbripennis Lec.	1	1
" volitans Esch.	1	1
Helodidae		
Cyphon variabilis Thunb.	9	43
Lathridiidae		
Melanophthalma sp.	3	5

	Number of Collections	Number of Specimens
Leiodidae		
Agathidium concinnum Mann.	1	1
Leiodes sp.	1	1
Melandryidae		
Marolia holmbergi Mann.	1	1
Serropalpus obsoletus Hald.	1	1
Scotochroa basalis Lec.	8	8
Tetratoma concolor Lec.	2	3
Xylita laevigata Hellw.	1	3
Unidentified	3	3
Meloidae		
Epicauta sp.	1	2
Melyridae		
Hoppingiana brevilabris Blaisd.	24	54
Trichochrous sp.	4	5
Mordellidae		
Anaspis sp.	7	8
Nitidulidae		
Epuraea sp.	2	2
Ostomidae		
Calitys scabra Thunb.	1	1
Temnochila virescens chlorodia Mann.	1	1
Pyrochroidae		
Dendroides ephemeroides Mann.	1	1
Pythidae		
Sphaeriestes virescens Lec.	1	2

	Number of Collections	Number of Specimens
Rhynchophora		
Brachyrhinus ovatus L.	3	9
" sulcatus	1	1
Dorytomus sp.	1	1
Dyslobus verrucifer Csy.	16	23
" sp.	1	1
Geoderces melanothrix Kby.	4	6
Hypomolyx piceus Deg.	6	8
Lepyrus nordenskioldi var.	1	1
Lobosoma horridum Mann.	1	1
Magdalis gentilis Lec.	2	2
" hispoides Lec.	1	1
" lecontei Horn	1	1
" sp.	1	1
Orchestes sp.	1	1
Panscopus pallidus Buch.	1	1
Pissodes curvei Hopk. *curriei*	6	9
" engelmanni Hopk.	2	2
" fasciatus Hopk.	6	6
" rotundatus Lec.	2	2
" sp.	4	4
Phytonomus nigrirostris Fab.	1	1
Sciopithes obscurus Horn	3	28
Sitones hispidulus Lec.	1	1
Scythropus elegans Couper	3	3
" californicus Horn	6	7
Trichalophus didymus Lec.	1	1
Tychius picirostris Fab.	1	1
Staphylinidae		
Bryoporus sp.	1	1
Pelecomalium sp.	1	1
Quedius sp.	8	13
Tachyporus sp.	2	2
Silphidae		
Necrophorus vespilloides Hbst.	1	1
Pelatines latus Mann.	7	9
Scolytidae		
Crypturgus borealis Sw.	1	7
Dendroctonus monticolae Hopk.	1	1
Hylastes ruber Sw.	1	1
" nigrinus Mann.	1	2

	NUMBER OF Collections	NUMBER OF Specimens
Scolytidae (continued)		
Hylurgops lecontei Sw.	1	1
Ips interpunctus Eich.	1	13
" pini Say	1	9
" latidens Lec.	1	1
" perturbatus Eich.	1	1
Phloeosinus punctatus Lec.	1	1
Scierus annectans Lec.	1	1
Scolytus unispinosus Lec.	1	1
Trypodendron retusum Lec.	1	5
Scarabaeidae		
Dichelonyx backii Kby.	6	12
" fulgida	10	11
" oregona V. D.	3	3
Polyphylla perversa Csy.	1	1
Serica anthracina Lec.	1	1
Tenebrionidae		
Coelocnemis columbiana Csy.	1	1
Corticeus sp.	2	2
Helops pernitens Lec.	8	11
" sp.	1	1
Paratenetus sp.	1	1
Scaphidema aeneolum Lec.	9	20
Dermaptera		
Forficula auricularia Lec.	2	2
Diptera		
(By Families Only)		
Asilidae	7	7
Bibionidae	15	28
Cecidomyidae	17	19
Culicidae	1	1
Mycetophilidae and allies	10	10
Simuliidae	4	4
Syrphidae	3	4
Tabanidae	2	2
Tipulidae	2	2
Other Diptera	41	44

	Number of Collections	Number of Specimens
Ephemeroptera		
Several genera	5	6
Hemiptera-Homoptera		
(By Families Only)		
Aradidae	17	35
Anthocoridae	16	25
Cercopidae	34	58
Cicadidae	2	2
Coreidae	19	22
Cydnidae	2	2
Fulgoridae	40	47
Jassidae	30	37
Membracidae	4	4
Miridae	138	193
Nabidae	13	20
Neididae	10	15
Pentatomidae	25	29
Reduviidae	4	6
Scutelleridae	1	1
Tingididae	5	30
Hymenoptera		
Ants	10	12
Bees	6	12
Parasitic Hymenoptera	44	76
Sawflies Miscellaneous	6	6
Siricidae	6	8
Wasps and allies	5	5
Lepidoptera		
Lexis bicolor	2	2
Miscellaneous	11	15
Neuroptera		
Chrysopidae	3	3
Hemerobiidae	36	42
Raphididae	6	8

	Number of Collections	Number of Specimens
Orthoptera		
Acrididae	2	2
Gryllidae	1	1
Tettigonidae	1	1
Plecoptera		
Perlidae	20	30
Corrodentia		
Atropidae	4	6
Mesopsocidae	3	4
Psocidae		
Psocus sp.	19	43
Caeciliidae		
Caecilius sp.	23	46
Graphopsocus cruciatus (L.)	11	24
Polypsocus corruptus (Hagen)	1	1
Peripsocus sp.	3	5
Teliapsocus probably all conterminus Walsh	26	99
Trichoptera		
Miscellaneous	20	26

The above includes only insects received as adults. In addition, 3,500 larvae were reared at the Trinity Field Station. Adults including parasites and hosts emerging during the summer, numbered nearly 3,000. This included several large polyembryonic broods from individual caterpillars. Over 100 larvae were inflated, baked, and mounted for reference. Approximately 450 immature forms were either buried in soil in the insectary or placed in the overwintering vault. This material will be placed in the constant temperature chamber during the early part of February. Specific determinations for much of the material must be made at a later date. The defoliators most commonly received in the survey were the following:--

	Number of Collections
Pristiphora erichsonii Hartig	22
Neodiprion tsugae Midd.	2
Pikonema alaskensis	26
" dimmocki	44
Ellopia fiscellaria lugubrosa Hlst..	23
Semiothisa granitata Wlk.....	56
Cacoecia fumiferana Clem. 26	
Peronea variana Fern	80
Notolophus pseudotsugata McD.	1

Since only a rather general summary of the material can be given at this time it might be advisable to make a more detailed summary of the 1939 material in the 1940 annual report. The accompanying map shows the distribution of the more important species as indicated by the 1939 collections.

Organizations co-operating in the survey include the British Columbia Forest Service, the Alberta Forest Service, Dominion Forest Service, National Parks Branch, Topographical Survey, Comox Logging Company, Lake Logging Company, and Malahat Logging Company. It is felt that the ultimate number of boxes which may be expected from each collector has been reached and furthermore, that any addition in number of collectors must come from an increase in the ranger forces or the gradual inclusion of private logging concerns such as the ones cited. Consequently no marked increase is anticipated in the survey for 1940.

The cost of the survey has been approximately $3,035.69. Some increase in cost may take place with the detailing of another man to part-time work on the survey. The cost has been apportioned as follows:--

Salaries	$2,638.30
Postage & Express	60.00
Travel	219.91
Subsistence	117.48
	$3,035.69

E.30.03-2 - Miscellaneous Insects

Examination of Injury to White Pine

Following a report of injury to western white pine near the summer home of Mr. W. J. Shields of Lumby, an investigation was made on August 10, 1939, by K. Graham.

Mr. Shields' summer home is located at the south end of Mabel Lake. The trees on the place are all young, not exceeding 30 feet in height. The affected ones show a characteristic reddening of part or all of the tree. This colouring, unlike the yellow-brown seen in a bark-beetle tree, is darker and more reddish, and the needles more persistent. Some trees showed death of one or more branches; others were completely dead. The number of affected trees varied from place to place, but for some sites, a third of the trees or more showed injury. On other sites there was no injury apparent.

Masses of pitch were evident on the trunks, especially near the bases of branches. From the oldest of these pitch masses projected the empty pupal case of a Lepidopteran; within the others, all stages from small caterpillars to pupae were present. The mature larva is about 2.5 cm. long, and may be white, gray, yellowish or reddish with darker spots at the base of the hairs. An adult was obtained on August 31; the wing expanse was nearly 3 cm., the colour gray. It appears to be closely related to, if not identical with, the Zimmerman pine moth, Pinipestis zimmermanni.

The control recommended was removal of the badly infested trees, and trimming out of the affected parts ofothers and burning the trimmings.

Examination of Bark Beetle Damage

On September 13, 1939, a report was received at the Trinity Field Station, of insect injury to Douglas fir on a 40-acre tract of timber in the Bessette Creek valley near Lumby. This tract, belonging to Mr. R. Saunders of Trinity Valley, is on a side hill in a south easterly direction from Turnbull's sawmill. The owner wished, as far as possible, to conserve the timber until some future date when it could be used as a slow but steady source of income.

A patch of about 25 to 30 dying trees is visible from a distance. Of these, a half dozen or so are on the south side of Mr. Saunders' plot; the remainder are on a tract belonging to a Mr. Switzer of Lumby. The infested trees are approaching maturity and therefore represent good commercial timber. The younger trees, which are about 6-8 feet in diameter, are yet uninfested.

Dendroctonus pseudotsugae Hopk. is undoubtedly responsible for death of the trees but Cerambycids also are present in some. A few of this years adult bark beetles are to be found in some trees, at least near the butt. One parasite cocoon was found.

It is difficult, on the basis of examination of the tree ne ar the base, to state the actual condition of the insects in the main part of the trunk. It would be necessary to examine several trunks completely

A tentative recommendation made was removal of the infested trees before spring emergence, with destruction of the bark containing the beetles. This would involve the cooperation of Mr. Switzer.

Bark Beetle Infestation
C.P.R. Tie Operation
Cherry Creek, Kamloops District, B. C.

An examination of this area by G.R. Hopping on June 28 indicated that a bark beetle infestation was developing southwest of the main camp along Beaton or Dairy Creek. One group of approximately 85 trees was attacked in May, and other freshly attacked scattered, individual trees occur around the edges of the original cutting. With the exception of this area, these timber limits are relatively free from fresh bark beetle attack. There is one small group (6 or 7 trees) at the extreme western edge of the present cutting but these, it is understood would be cut before any secondary borers have a chance to spoil the sapwood.

Throughout the area there is evidence that a previous bark beetle epidemic occurred about ten years ago taking a considerable number of the larger trees. This, however, is not connected with the present trouble.

In view of the fact that these limits will be cut over in three years time it is quite probable that the operation will be finished on most of the area before the bark beetles increase sufficiently to cause serious loss, particularly if care is taken to lay down slash continuously, and reasonably contiguous to previous recent cutting. This, however does not apply to the area on Beaton or Dairy Creek, previously mentioned. On this location, considerable loss will be sustained unless the timber is utilized as soon as possible.

The cause of the infestation here is quite obvious. After cutting for a time in this location and leaving much slash, including tops and logs with ring-shake, the operation moved some distance to the westward. Thus the broods of the beetles which bred in the slash, found no fresh slash available when emergence took place, and so they attacked the standing green trees. This has happened on a great many Douglas fir operations, where, for some reason, it has become advisable to shift cutting operations from one part of an area to another, or in cases of shut-downs, where fresh slash ceases to be available to the emerging insects. In such cases, it does not always follow that attack on the standing trees occurs, because climatic factors also play an important part, as well as parasites and predators which keep the bark beetle population down to normal numbers. If, however, the climatic factors, such as a prolonged dry spell in summer are favourable, and predators and parasites, for some reason, are at low ebb, the standing trees suffer from the large bark beetle population built up in the slash.

Control: In order to avoid bark beetle damage on Douglas fir operations, or at least keep the damage to a minimum, the following precautions should be observed:

1. Adequate slash disposal.

2. If the above is not feasible, then the operation should be so planned that fresh slash is always laid down contiguous to the last area cut, thus providing material to absorb the broods of beetles emerging from previous slash.

Box-Elder Bugs

This year, the box-elder bug, Leptocoris trivittatus Say., has caused considerable annoyance to householders in the interior of British Columbia. Because of the past two mild winters, allowing a large percentage of the adults to survive hibernation, this bug has become extremely numerous, particularly in the Okanagan district.

In one instance naphthalene was used with success to keep the bugs from entering a room through cracks beneath a baseboard although the naphthalene caused headache to the householder for the first day, until it had dissipated somewhat.

It has been pointed out by Felt and Rankin, 1932,* that the females lay their eggs on the fruit of the maple in the spring and that by avoiding planting pistillate trees near buildings much of the trouble can be overcome. This, however, does not hold true in Kansas where Smith and Shepherd 1937**, found that the eggs are deposited on stones, leaves, bushes, grass blades and any object which seemed handy, and that there was no specific place of oviposition.

It is probable that there are two generations per year in the Okanagan region. In 1940 the adults started coming out of hibernation in late March. Mating was noted early in April. This season, however, is fully ten weeks ahead of the average season, according to phenological records.

Control: Although spraying has been recommended by some workers to kill the nymphs when feeding, the results have not proved satisfactory. The control recommended is for the householder to attack the bugs when they are congregated immediately after coming out of hibernation or just before going into hibernation in the fall. At such times a large percentage of the bugs may be killed by application of hot water, kerosene, or any good fly spray. With one small can of fly spray, the writer was able to clean up practically all of the bugs congregating on his house after emerging from hibernation.

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* Insects and Diseases of Ornamental Trees and Shrubs, p. 178
** Trans. Kansas. Acad. of Sci., 40, p. 149.

Bark Beetle Damage near Okanagan Mission.

In November, 1939, a localized outbreak of Ips interpunctus and Dendroctonus monticolae near Okanagan Mission was reported by the ranger J. Wood. This area was examined on November 9 when it was found that the attack was confined to about 75 yellow pine surrounding a cattle corral. It was quite obvious that the building of the corral had caused the infestation.

The trees range in height from 3 or 4 feet up to 70 feet. About a year previously many young trees were cut for rails to build the corral and the builders failed to peel the logs. Ips and Dendroctonus, but principally the former were attracted for considerable distances and not only attacked the freshly cut rails but also the surrounding trees. It appears likely, judging by the age of the stand, presence of predators and parasites, etc. that the infestation will be confined to the acre affected.

This is a case where a little care on the part of the land owner would have prevented the loss of 75 thrifty young yellow pines. This could have been accomplished by peeling the poles used in the corral construction.

Bark Beetle Attack on Ornamentals

In answer to a request from P. J. Elkington of Fernie, to examine spruce trees on his lawn, an inspection was made on September 11. The trees were being killed by Ips aided by secondary bark beetles, but the primary cause was a weakening of the trees by exposure of the roots due to constant tramping on the lawn and mowing. An ornamental white pine about 13 inches D.B.H. on the Harley Wilson estate was also killed this season by Dendroctonus monticolae. Recommendation was made to remove and destroy all trees containing broods of bark beetles in order to prevent spread to other ornamental conifers.

Tussock Moth on Blue Spruce.

Two ornamental blue spruces on the farm of P.E. French were heavily attacked by Notolophus antiqua badia Hy. Edw. These same trees were attacked by this insect two years ago. Spraying with lead arsenate 6 lbs. to 100 gallons of water controlled the caterpillars in 1937. This same control was used in 1939 with apparent success. An examination will be made in 1940 to see what the condition of the trees is and if any caterpillars are present.

Chermes on Ornamental Spruce

At the request of Mr. George Heggie, examination was made of ornamental spruce of various species on his estate in the BX district, four miles from Vernon. Galling was found to be severe on several trees and on one or two it appeared serious enough to cause death of the trees unless control was undertaken. Accordingly an oil emulsion spray was recommended as indicated in Bulletin 175 of the Extension Division, University of Michigan. The trees were treated early in spring before any growth had started. Subsequent examination indicated a wonderful improvement in the trees with new growth on the branches which were heavily galled last year. No galls are apparent this year (1940) although the new growth is well out.

Project E.30.03-2 - Rearing, Identification and Control of Miscellaneous Insects Affecting Forest and Shade Trees

Object of Project:

The aim of this project, commenced in 1934, has been to assemble information on the numerous miscellaneous insects affecting forest and shade trees in the Vancouver district. The project also provides for the formulating of control measures, when necessary, of species found to be destructive.

Location of Work:

Vancouver, B.C., and district.

Officers in Charge and Complete Personnel:

Geo. R. Hopping - Direction of project.
W.G. Mathers - Supervision and execution of work
R.H. Longmore - Assistant, 1938 and 1939.

Co-operation with Other Organizations:

In 1939, one phase of the project, spray experiments for the control of the pine needle mite, was carried out in co-operation with the Provincial Forest Service.

Procedure:

Miscellaneous material has been reared in containers under laboratory conditions or in rearing jars or cloth cages under field conditions.

In 1938, preliminary field studies of the willow borer, Sternochetus (Cryptorhynchus) lapathi (L.) were conducted at the Green Timbers Forestry Station in conjunction with the sitka spruce weevil project. Similar studies were continued in 1939 with data being obtained from field observations, the rearing of specimens from 100 linear feet of infested willow and the dissection of over 135 feet of similar material.

In 1939, spray experiments for the control of the pine needle mite, Eriophyes pini, causing serious damage to lodgepole pine were also carried out on an experimental plantation

near Campbell River, B.C. Preliminary field observations were made on insects connected with dying Douglas fir at the Provincial Forest Experiment Station at Cowichan Lake, and data obtained on insects affecting forest trees.

Progress Report:

Willow Borer Investigations

The field studies of the willow borer, Sternochetus lapathi (L.), were again conducted this year by R.H. Longmore who was located at the Green Timbers Forestry Station from April 11 to September 28. The generic name Sternochetus takes precedence over Cryptorhynchus according to L.L. Buchanan, "Changes of Names in Carabaeidae and Rhynchophora", Proc. Ent. Soc. Wash., Vol. 41, No. 3, March, 1939.

Spring Activities of Overwintering Adults: Our studies have shown that the adults of this willow borer survive for almost a full year from the time of emergence, with hibernation occurring from late fall to April or May.

In 1939, the first adult was observed in the field on May 12 and Mr. Longmore reported that by May 26 they were almost as numerous in the field as in the previous fall and were to be observed frequently in copulation and at times apparently feeding at the edge of old borings. These old adults continued to be present in the field throughout June and into July, the last being observed on July 20, at which time a pair was found in copulation. Adults taken in the field on May 23 and placed in a rearing jar containing small sections of willow stem were still alive on July 17, a period of 55 days. The main egg laying period is in the fall, but apparently a few eggs are also laid in the spring. Although actual oviposition in the spring was not recorded by Mr. Longmore, the wide variation in the size of larvae found in infested material in June, July and August indicated that it must have taken place. For instance, in a section dissected on June 15, several very small larvae were found in the cambium while large larvae were present in the wood well towards the centre of the stem. Moreover, of the 35 larvae in the section dissected on July 10, (see Table I) 3 were quite small, and a few half grown larvae were also encountered on July 17 and 20, while of the 8 weevil larvae found in the section dissected on July 27, 1 was listed as being quite small.

Table I

Showing Data Secured from Dissection of Willow Infested with Sternochetus.

Green Timbers Forestry Station - 1939

Date	Willow Length	Dissected Ave. Diam.	Sternochetus lapathi Larvae	Pupae	Adults	Totals	Miscel. Larvae
June 1	42"	2 3/8"	118	-	1#	119	2
" 5	72"	1 1/2"	72	-	-	72	2
" 8	72"	1 1/2"	62	-	-	62	-
" 12	40"	1 7/8"	98	-	-	98	-
" 15	40"	1 5/8"	54	-	-	54	-
" 19	72"	1 5/8"	74	-	-	74	1
" 22	84"	1 1/2"	95	2	-	97	-
" 26	78"	1 3/4"	59	-	-	59	-
" 29	78"	1 1/2"	110	-	-	110	2
July 3	60"	1 7/8"	34	29	-	63	1
" 6	72"	1 1/2"	23	19	-	42	-
" 10	132"	1 5/8"	35	23	-	58	-
" 13	42"	1 5/8"	26	23	-	49	-
" 17	66"	2 1/8"	18	79	3	100	-
" 20	36"	1 5/8"	4	27	53	84	-
" 24	36"	1 1/4"	-	3	37	40	-
" 27	36"	1 3/8"	8	1	-	9	-
" 31	36"	1 "	3	7	2	12	-
Aug. 3	84"	1 "	1	7	37	45	1
" 7	36"	1 7/8"	1	4	2	7	4
" 10	72"	1 3/8"	1	1	13	15	4
" 14	36"	2 "	1	6	19	26	1
" 17	36"	1 1/4"	-	-	13	13	-
" 25	18"	1 1/8"	-	2	1	3	-
" 28	30"	1 1/4"	-	-	5##	5	-
Sept. 1	40"	1 1/2"	-	-	4###	4	-
" 6	90"	2 "	-	-	-	-	-
" 11	45"	2 1/2"	-	-	-	-	-
" 14	45"	2 "	-	-	-	-	-
June 1 - July 27 incl.	1058"	1 5/8"	890	206	94	1190	8
July 31 - Sept. 1 incl.	388"	1 3/8"	7	27	96	130	10
Totals	1626"	1 5/8"	897	233	190	1320	18

- Dead. ## - 4 dead. ### - 3 dead.

Development of the New Brood: Considerable data on the development of the new brood summarized in Table I were obtained this year through the dissection of infested material by Mr. Longmore supplemented by field observations during June, July and August.

Larval activity apparently re-commences in late April or early May. Fresh frass was first noticed being ejected from infested material in the field on May 9 and by May 14 such frass was much in evidence. The young larvae first feed in the cambium, later penetrating into the wood. On June 12, mature larvae were found cutting pupal chambers but the first pupa was not encountered until June 22. Pupae first exceeded the larvae in number on July 17 and following this date relatively few larvae were to be found. The last live larva, a small specimen, was encountered in the dissections on August 14 and the last pupa on August 25. The first new adult was found on July 17, 25 days after the first pupa was recorded, but the first emergence from the caged material did not take place until July 28, 11 days later. The dead adult encountered in the dissection on June 1 was considered to be of the 1938 brood.

The maximum density of population was 1.22 specimens per cubic inch of stem, found in the section dissected on June 26, while the average population for the 88 linear feet of material examined June 1 to July 27 inclusive, was approximately .55 per cubic inch. The 11½ feet of material dissected July 17 to 24 inclusive, was from one tree which gave a total borer population of 224 specimens. The infested willow on the area ranged up to about 20 feet in height but no attacks were found to have occurred higher than 12 feet.

Emergence of New Adults: Emergence data were obtained this year from 100 linear feet of infested willow stem with an average diameter of approximately 1.8 inches and cut into 3 foot sections. 30 feet of the material was placed in the cage on July 7 while the balance was caged on July 27.

As shown in Table II and the accompanying graph, the emergence of the adults extended from July 28 to September 22 with the highest single day emergence occurring on August 10. The main emergence, however, was completed by September 5 and in the dissections of infested material no live adults were encountered after September 1. A total of 703 adult borers were taken in the cage, an average of 7 per linear foot of willow. The sex ratio was 1:1, 351 males and 352 females being recovered. As shown in the graph, there was a slight tendency for the males to emerge first. The emergence this year commenced over 2 weeks later than in 1938 and the peak emergence also occurred about 2 weeks later. However, the total length of the emergence period was about the same as in 1938. The later emergence this year was due largely to unfavorable weather experienced in the latter part of May and throughout the month of June. (See Weather Graph appended.)

Table II

Showing Emergence of Sternochetus lapathi L.

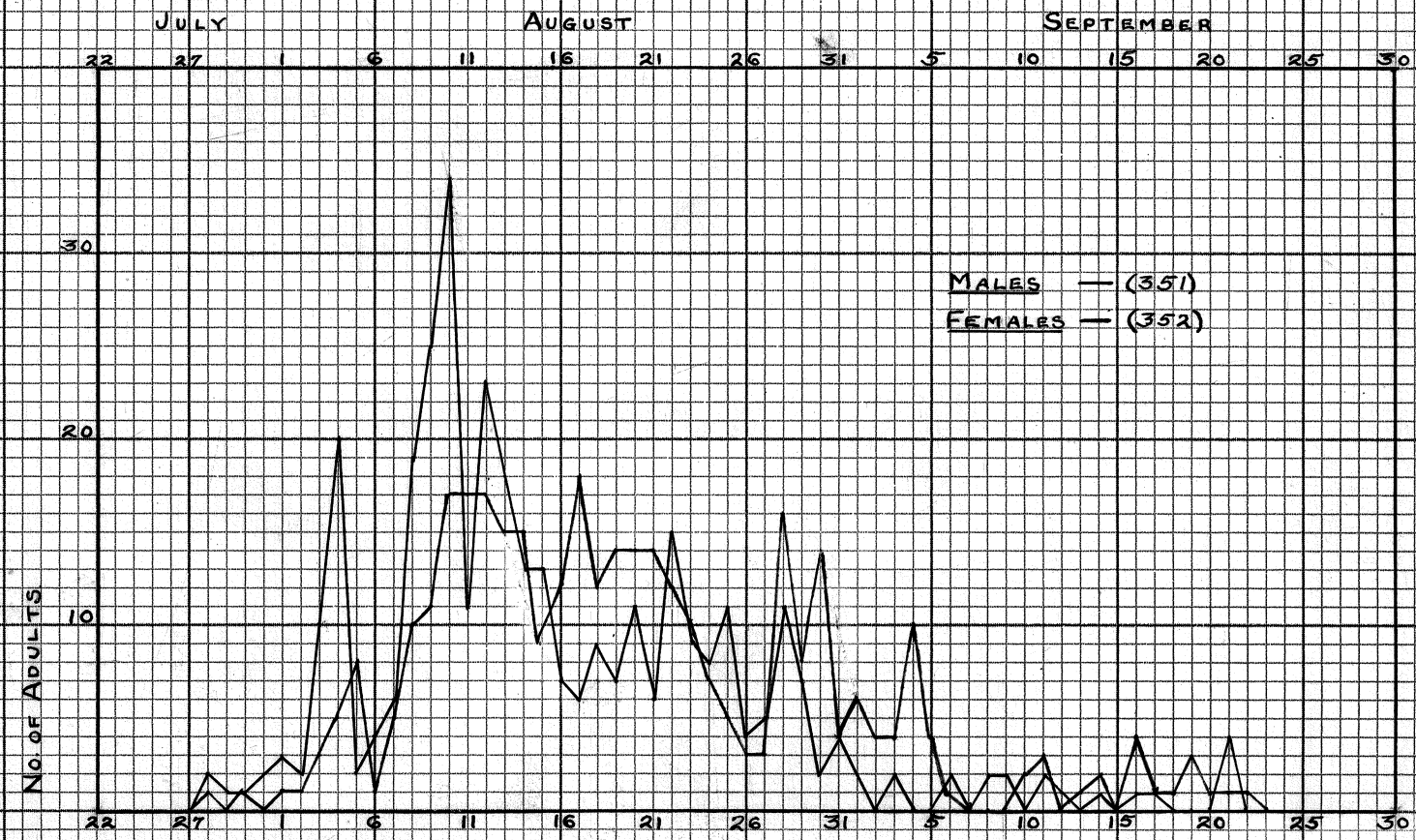
Adults from Caged Infested Willow

Green Timbers Forestry Station - 1939

Date	Males	Females	Totals	Date	Males	Females	Total
July 28	2	1	3	Aug. 25	11	5	16
" 29	1	-	1	" 26	4	3	7
" 30	1	1	2	" 27	5	3	8
" 31	2	-	2	" 28	11	16	27
Aug. 1	3	1	4	" 29	7	8	15
" 2	2	1	3	" 30	2	14	16
" 3	10	3	13	" 31	4	4	8
" 4	20	5	25	Sept. 1	2	6	8
" 5	2	8	10	" 2	-	4	4
" 6	4	1	5	" 3	2	4	6
" 7	6	5	11	" 4	-	10	10
" 8	19	10	29	" 5	-	4	4
" 9	25	11	36	" 6	2	1	3
" 10	34	17	51	" 7	-	-	-
" 11	11	17	28	" 8	2	-	2
" 12	23	17	40	" 9	2	-	2
" 13	18	15	33	" 10	-	2	2
" 14	13	15	28	" 11	2	3	5
" 15	13	9	22	" 12	1	-	1
" 16	7	12	19	" 13	-	1	1
" 17	6	18	24	" 14	1	2	3
" 18	9	12	21	" 15	-	-	-
" 19	7	14	21	" 16	1	4	5
" 20	11	14	25	" 17	1	1	2
" 21	6	14	20	" 18	-	1	1
" 22	15	12	27	" 19	-	3	3
" 23	9	10	19	" 20	-	1	1
" 24	8	7	15	" 21	4	1	5
"				" 22	-	1	1
				Totals	351	352	703

Showing Emergence of Sternochetus (Cryptorhynchus) lapathi

Green Timbers Forestry Station B.C. 1939



Activities of New Adults: New adults were not observed in the field until August 12 when one specimen was found feeding on current year's growth. On August 16, a pair was taken in copulation but it was apparently the latter part of August before the weevils were to be observed in numbers in the field. On August 31 a willow tree was topped 6 feet from the ground and the remaining portion which had several current year's sprouts, was enclosed in a cloth cage. By September 12, 100 new adults had been released in the cage for observations on their habits. The sprouts were completely riddled with feeding punctures by October 6 at which time a number of the weevils were found to be still feeding and in copulation in the cage.

Associated Species; Although close to 1,000 adults of the willow borer have been reared from infested material during 1938 and 1939, no parasite adults have been recovered. However, 9 adults of an Aegeriid, identified by Dr. J. McDunnough as Synanthedon albicornis Hy. Edw., were recovered from the caged infested material this year. 2 of the adults emerged on July 28, another 2 on August 1 while single specimens were recovered on July 30 and 31 and on August 9, 14 and 25. This Aegeriid has been recorded as being frequently found in the tunnels of Cryptorhynchus lapathi in the East.

18 miscellaneous larvae were encountered in the dissections this year, of which 4 were undoubtedly Aegeriid larvae. The remaining 14 have not been identified nor has their status been determined.

Hosts: Prior to 1939 all recorded attacks by the willow borer in this district have been on native willow. However, this year, attacks were found to have taken place on two second growth poplars, Populus trichocarpa, at the Green Timbers Forestry Station. The attacks on this host is of particular importance in view of the experimental plantings of hybrid poplars being made at the Station.

Extent of Infestation: The infestation was again severe this year throughout the second growth willow at the Forestry Station and scouting by Mr. Longmore showed that the borer was distributed generally as far east as Sumas, B C.

Spray Experiment for the Control of Pine Needle Mite

In co-operation with the Provincial Forest Service, a spray experiment was carried out this year for the control of the pine needle mite, Eriophyes pini, infesting lodgepole pine on a plantation at Camp 8 of the Elk River Timber Company, Campbell River, B.C. (see photos). Each of the following three spray mixtures were applied on May 12, to 17 infested pines:

Lodgepole pine plantation (foreground) near Campbell River, B.C.

Showing pine needle mite injury to top of lodgepole pine. Tree on right, infested; tree on left, uninfested.

Photos by W.G.M.

L. Nursery Volck, 1:50
Nicotine sulphate, 1:800
Water, 4 gallons.

2. Nicotine sulphate, 1:800
Emulsified herring oil, 1%
Water, 4 gallons.

3. Polvo (derris), 1 oz. (1 lb.: 80 gals.)
Emulsified herring oil, 1%
Water, 4 gallons.

The Provincial Forest Service supplied the chemicals used and also provided a man to assist W.G. Mathers in the application of the sprays. The temperature at the time of application was approximately 70 degrees in the shade, and the current year's needle growth had already commenced. A 4-gallon "Indian" fire pump, equipped with a disc spray nozzle, was first tried out for applying the sprays but as it proved unsatisfactory it was abandoned in favour of a bucket pump sprayer.

The results of the experiment were checked on October 13 by W.G. Mathers and Geo. R. Hopping, but none of the three mixtures used were found to have given satisfactory results. Trees sprayed with the first two mixtures showed no improvement over unsprayed trees. However, the derris spray showed some slight improvement and will be further tested locally on a few trees in the spring of 1940.

Relation of Insects to Dying Douglas fir at Cowichan Lake Forestry Station.

A joint inspection was made by W.G. Mathers with Dr. J.E. Bier of the Division of Botany and Plant Pathology on August 17 and 18, of dying second growth Douglas firs at the Provincial Forestry Station at Cowichan Lake, B.C. Special attention was paid to marked trees known to be infected with either Armillaria mellea, an undetermined root rot, or Phomopsis sp. and which also showed insect attack. The chief insects concerned included Pseudohylesinus nebulosus and Scolytus unispinosus in the trunk and limbs and Pissodes fasciatus at the root collar. In the cases of trees infected with Armillaria or the undetermined root rot, the insects were evidently secondary. However, the dying tops of several Douglas firs growing on a very poor site had apparently been attacked first by Scolytus, followed by the Phompsis which was found spreading from the

tunnels of the bark beetle. During the inspection, samples of the insects were taken from several of the trees, concerning which the following notes were recorded:

Tree No. 1 - Douglas fir, located near Reference Post A8 - 4" DBH, green in spring, foliage turning in July. Felled Aug. 15 - red top. Armillaria in root and base up for distance of about 9" on trunk. P. nebulosus and S. unispinosus in trunk - larvae, pupae and callow adults. Pissodes larvae working in cambium about 1 foot from ground level.

Tree No. 2 - Douglas fir, located near Ref. Post A3 - 9" DBH - windthrown but top lodged in nearby tree. Roots broken off, foliage green in June but now red. Infested with root rot. Pissodes mature larvae and pupae at base. P. nebulosus in trunk - pupae and adults. Roundheaded larvae also active in trunk.

Tree No. 3 - Douglas fir, supporting top of Tree No. 2. 9" DBH - Fresh Pissodes attack at base, larvae very small.

Tree No. 4 - Douglas fir - located on Exp. Plot, north side of Lake. 10" DBH, about 36 years old. Windthrown, foliage dried. All roots rotted. Dendroctonus pseudotsugae attack from root collar up to 6" top dia. Dryocoetes pseudotsugae attack near top. Undetermined Siricid attack midway on bole, 8" dia.

Tree No. 5 - Douglas fir, located on Exp. Plot, north side of Lake. 9" DBH - windthrown, no foliage. Root rot. Pissodes in exposed root just below root collar, larvae, pupae and adults. Gnathotrichus sulcatus attack on trunk.

Tree No. 6 - Douglas fir, located on Exp. Plot, north side of Lake. 4" DBH - foliage green. Root rot. Fresh Pissodes attack at base. No other insects evident.

Tree No. 7 - Douglas fir, located near Ref. Post B9, on rocky knoll. Dying from top. DBH 3". S. unispinosus attack in top, parent adults present. Phomopsis infection extending from egg tunnels.

Miscellaneous Insects

Vespamima sequoiae Hy.Edw. (Det. by G. Engelhardt). This Aegeriid was found on October 13 to be causing considerable damage to lodgepole pine in a plantation near Campbell River, B.C. The plantation is about 3 acres in extent and consists of pure pine about 7 years old. The pitch moth attacks occurred on the lower part of the main stems and an examination of 145 trees showed approximately 24 per cent to be infested. A number of larvae ranging from ⅜" to over 1" in length were recovered and an adult specimen emerged in January from a sample of infested material which had been transferred to the laboratory in October. A larva of what was presumed to be the same species was also recovered on October 14 from a lodgepole pine at the Cowichan Lake Forestry Station but no evidence of the species had been found in native lodgepole reproduction on Lulu Island nor in the lodgepole pine plantation at the Green Timbers Forestry Station.

Petrova luculentana Hein. (Det. by Dr. J. McDunnough). A light infestation of this pitch nodule moth was found on November 15 in native lodgepole pine reproduction on Lulu Island, near Vancouver, B.C. The attack occurs at the base of the current year's growth causing the formation of pitch nodules. A few samples of infested material was transferred to the laboratory for rearing and several moths emerged in January. According to Dr. McDunnough, this is a new record not only for British Columbia but for Canada.

Douglas Fir Webworm - Halisidota argentata Pack. An active colony of this webworm on Douglas fir was received on March 22. The colony was reared in the laboratory and an adult parasite, Uramyia halisidotae, was recovered on April 27. On December 20 two active colonies of the same species were found feeding on Douglas fir in the vicinity of the campus of the University. The colonies, consisting of caterpillars from 5 to 10 mm. in length, were transferred to a rearing cage under field conditions and as a result of the extremely mild winter, have continued to feed and develop. By the end of March specimens up to 18 mm. in length were present.

Tent Caterpillar - Malacosoma sp. On May 18, a colony of tent caterpillars taken on oak at the Green Timbers Forestry Station by Mr. Longmore was placed in a cage with branches of willow, alder and poplar. However, the caterpillars refused to take to either of these hosts, but on oak being added to the cage on May 22, quickly stripped it of all its leaves, and continued to maintain a distinct preference for its original host throughout the two weeks that they were kept under observation.

Mindarus abietinus Koch. What was believed by A.D. Heriot to be the spring form of this aphid was found in April to be infesting a number of tips of an Abies grandis on the campus of the University. The species causes a distortion of the needles.

Seed Insects. Liberal samples of light Douglas fir and sitka spruce seed were obtained on November 15 from the local Seed Extraction Plant and on December a quantity of light seed of Abies grandis was obtained from the same source. The seed was from 1939 crop and was placed in containers in the laboratory for rearing. Large series of the chalcids, Megastigmus pinus and M. spermotrophus were recovered from the Abies seed during January, February and March but no emergence has occurred to date from either the Douglas fir or spruce seed.

Future Work:

Owing to the present war emergency this project will be for the most part discontinued. However, tests on a small scale, will be made with derris spray for the control of the pine needle mite infesting lodgepole pine, and in the event of a forest insect field station being established at the Cowichan Lake Forestry Station, a detailed investigation of the factors causing the death of the Douglas fir at the Station should be undertaken in co-operation with the Division of Botany and Plant Pathology.

E.30.07-3 - Spruce Budworm Outbreaks

The only work possible on this project during 1939 was the examination of two areas of infestation, one at Barkerville, B.C. and one at Fortress Lake, B.C. and the collection of a limited amount of larval material.

Fortress Lake Area:

This is a most inaccessible outbreak and to reach it one must travel south from Jasper along the Jasper-Banff highway to Sunwapta Falls. From there saddle horse and pack must be taken on a days journey necessitating the fording of the Athabasca and Chaba Rivers numerous times. At Fortress Lake the horse feed is scant and only a day could be spent examining the outbreak and collecting larval material. During this time it rained almost steadily, adding to the difficulty.

The stand of timber surrounding Fortress Lake and extending down the Chaba Valley is a spruce-balsam type with the spruce predominating in the mature timber and the balsam predominating in the reproduction. The latter is the more severely affected by the budworm but the mortality of trees will be very small owing to the two year cycle of the budworm, similar to the development in the Barkerville region.

At the time of examination on July 18th, the larvae were small ~~second~~ third or ~~third~~ fourth instar forms and had fed only on the new terminal growth of the current season, turning the tips brown. Examination of many of these tips disclosed that a considerable percentage contained no larvae, either due to destruction by parasites or due to transference of larvae from one tip to another.

Evidence of budworm feeding was noted about the shores of Fortress Lake extending for at least a mile in width and for three miles down the Chaba Valley. Thus, the infestation lies partly in Jasper Park, Alberta, and partly in British Columbia. The inter-provincial boundary passes within one-fourth mile of the eastern end of Fortress Lake.

So many of the infested tips collected were devoid of larvae that a much smaller number than expected reached Trinity Station. Practically all of these died before reaching full growth.

Barkerville Area

This area was examined on July 18 when collections of ~~second~~ third and ~~third~~ fourth instar larvae were made and observations taken on the development of the outbreak which seems to be more or less continuous in this region.

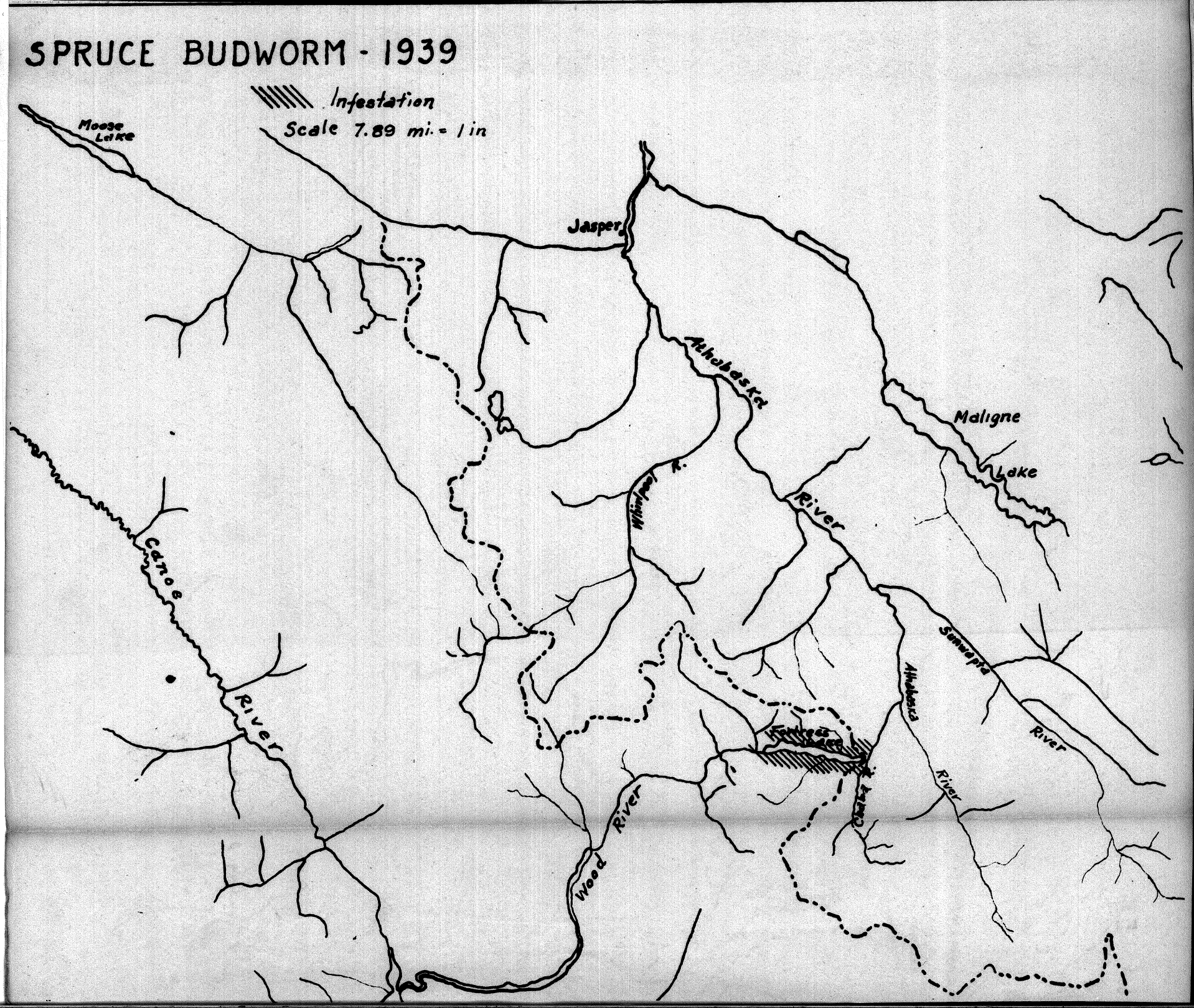
Spruce budworm activity was found from just west of Beaver Pass Creek west of Barkerville to Cunningham Creek, east of Barkerville, and from Meridian Mountain south of Barkerville northward for approximately eighteen miles. Within this area is a smaller one on which the infestation is medium. This extends from Cunningham Creek on the east to Timon Creek on the west, and is nine miles wide in a north and south direction. Within this area near the eastern boundary is a heavy infestation on Antler Creek. This area is one and one half miles wide by nine miles in length. ~~See accompanying map~~.

A total of 69 larvae were sent to the Trinity field station but all died before the end of August. This mortality, both in the Barkerville and Fortress Lake material seems to be associated with the two year cycle of the budworm in interior British Columbia localities.

Next year will be the flight year at Barkerville and since the spruce budworm problem has been classified under "A" in the project classification, it will be advisable for an officer to make several visits to the Barkerville area to obtain large larval collections, delimit the present areas of infestation more carefully, and possibly establish sample plots for a study of inter-relationship between the spruce budworm and the bark beetle Dryocoetes confusus.

The cost of the budworm work for 1939 was approximately $117.60 made up of salaries $71.50 and travel $46.10. The cost for 1940 will be considerably higher inasmuch as this project has been placed in the "A" category in the war time project classification. The cost will not exceed $800.00.

SPRUCE BUDWORM - 1939



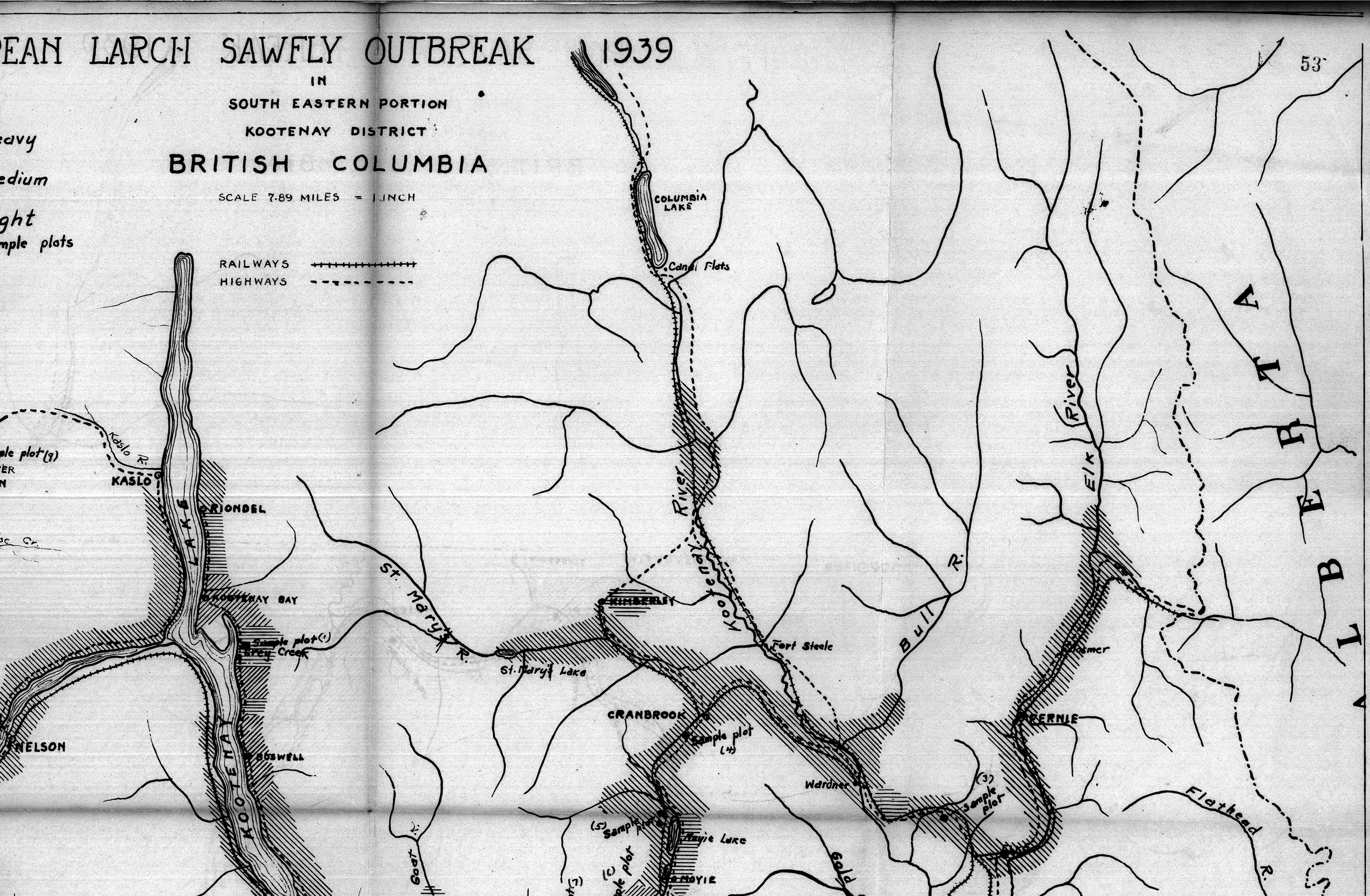
E.30.09-3 - A Study of the Bionomics and Control of the Larch Sawfly in British Columbia.

The European larch sawfly, Pristiphora erichsonii Hartig. was first noted in British Columbia in August, 1933. In the following years 1934-1937 inclusive, detailed studies were made of the distribution, bionomics, and various factors influencing the spread of the sawfly. Liberation and colonization of the parasite Mesoleius tenthredinis Morley was carried on and this parasite became well established and fairly widely dispersed over the infested area at that time. A Tachinid from Japan was also introduced but up to the present time no field recoveries have been made.

In 1934 the sawfly was confined to the area between Columbia Lake on the north extending into Montana on the south and in an east-west direction from Corbin to Rosen Lake. Since then, the sawfly has spread westward to Slocan Lake but has not reached the larch stands of the Arrow Lakes Valley.

The initial infestation in the Fernie area subsided in 1936 and has not appeared since in epidemic numbers until the present year.

In 1939, the infested areas were examined in mid-July, when numerous larval collections were made and the larvae sent to Trinity Station. The mortality in transit was high and considerable mortality took place after receipt of the material. The following table indicates the number of larvae received in each collection, the cocoons obtained and parasitism, mainly by Bessa selecta.


EAN LARCH SAWFLY OUTBREAK 1939
IN
SOUTH EASTERN PORTION
KOOTENAY DISTRICT
BRITISH COLUMBIA
SCALE 7.89 MILES = 1 INCH
RAILWAYS
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COLUMBIA LAKE
Canal Flats
Kaslo R.
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LAKE
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Sample plot (1)
Grey Creek
NELSON
BOSWELL
KOOTENAY
St. Mary's R.
St. Mary's Lake
KIMBERLEY
Kootenay River
Fort Steele
CRANBROOK
Sample plot (4)
Wardner
Sample plot (3)
Sample plot (5)
Moyie Lake
MOYIE
Goat R.
Bull R.
Elk River
FERNIE
Flathead R.
ALBERTA

EUROPEAN LARCH SAWFLY OUTBREAK 1939

IN

SOUTH EASTERN PORTION

KOOTENAY DISTRICT

BRITISH COLUMBIA

SCALE 7.89 MILES = 1 INCH

Heavy

Medium

Light

■ Sample plots

RAILWAYS

HIGHWAYS

Wilson Cr.

Sample plot (9)

NEW DENVER

SILVERTON

Kaslo R.

KASLO

SLOCAN LAKE

ORIONDEL

Enterprise Cr.

SLOCAN

KOOTENAY BAY

Sample plot (1)

Lardeau Creek

NELSON

BOSWELL

KOOTENAY LAKE

COLUMBIA LAKE

Canal Flats

Columbia River

St. Mary's R.

St. Mary's Lake

KIMBERLEY

Fort Steele

Bull R.

CRANBROOK

Sample plot (4)

Wardner

(3) Sample plot

FERNIE

Elk R.

(5) Sample plot

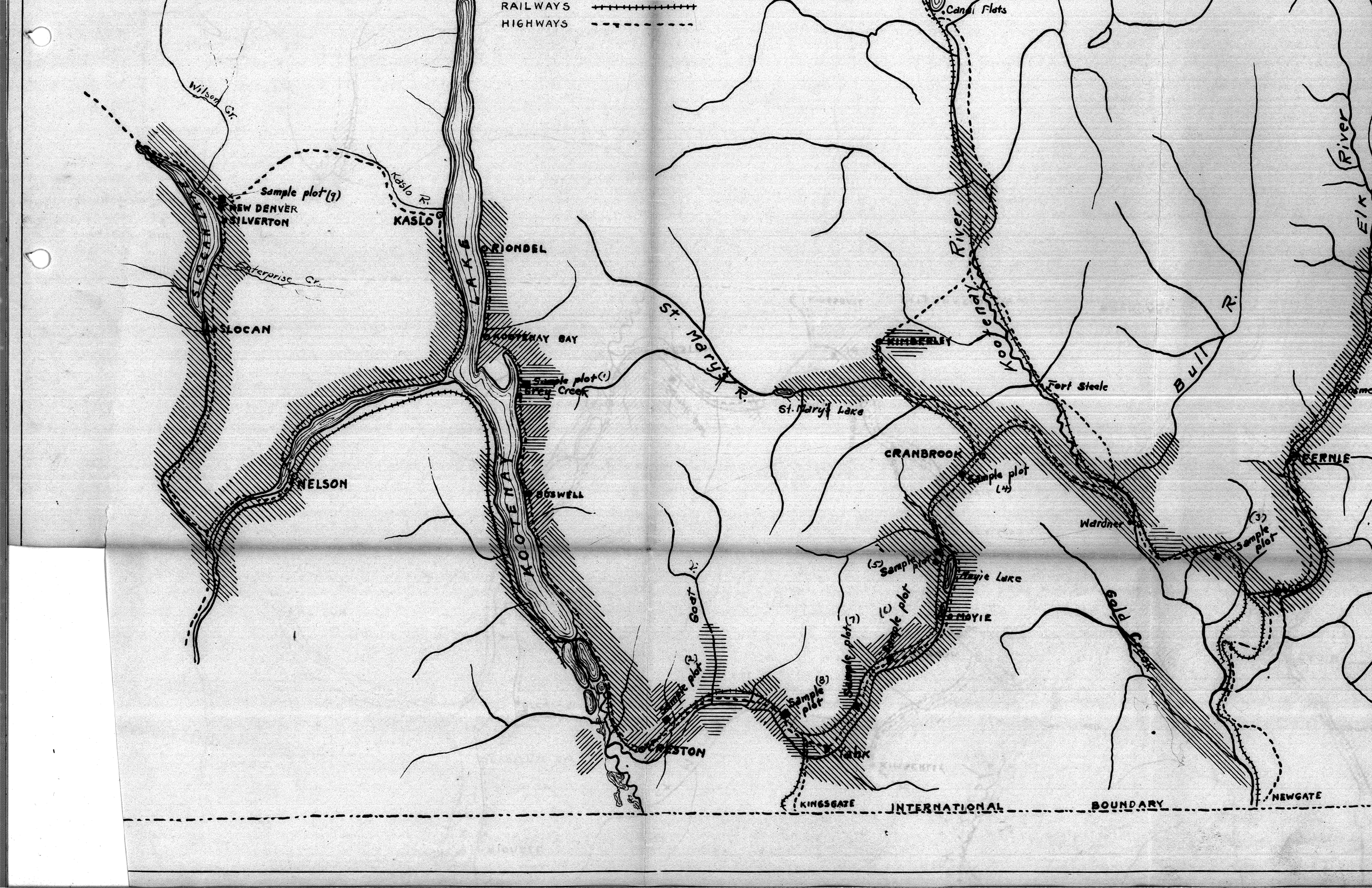
Moyie Lake

(6) Sample plot

MOYIE

(7) Sample plot

Goat R.


RAILWAYS
HIGHWAYS
Canal Flats
Wilson Cr.
Sample plot (9)
NEW DENVER
SILVERTON
Kaslo R.
KASLO
RIONDEL
Enterprise Cr.
SLOCAN
SLOCAN LAKE
KOOTENAY BAY
Sample plot (1)
Grey Creek
St. Mary's R.
St. Mary's Lake
KIMBERLEY
Kootenay River
Fort Steele
Bull R.
Elk River
CRANBROOK
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NELSON
BOSWELL
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Moyie Lake
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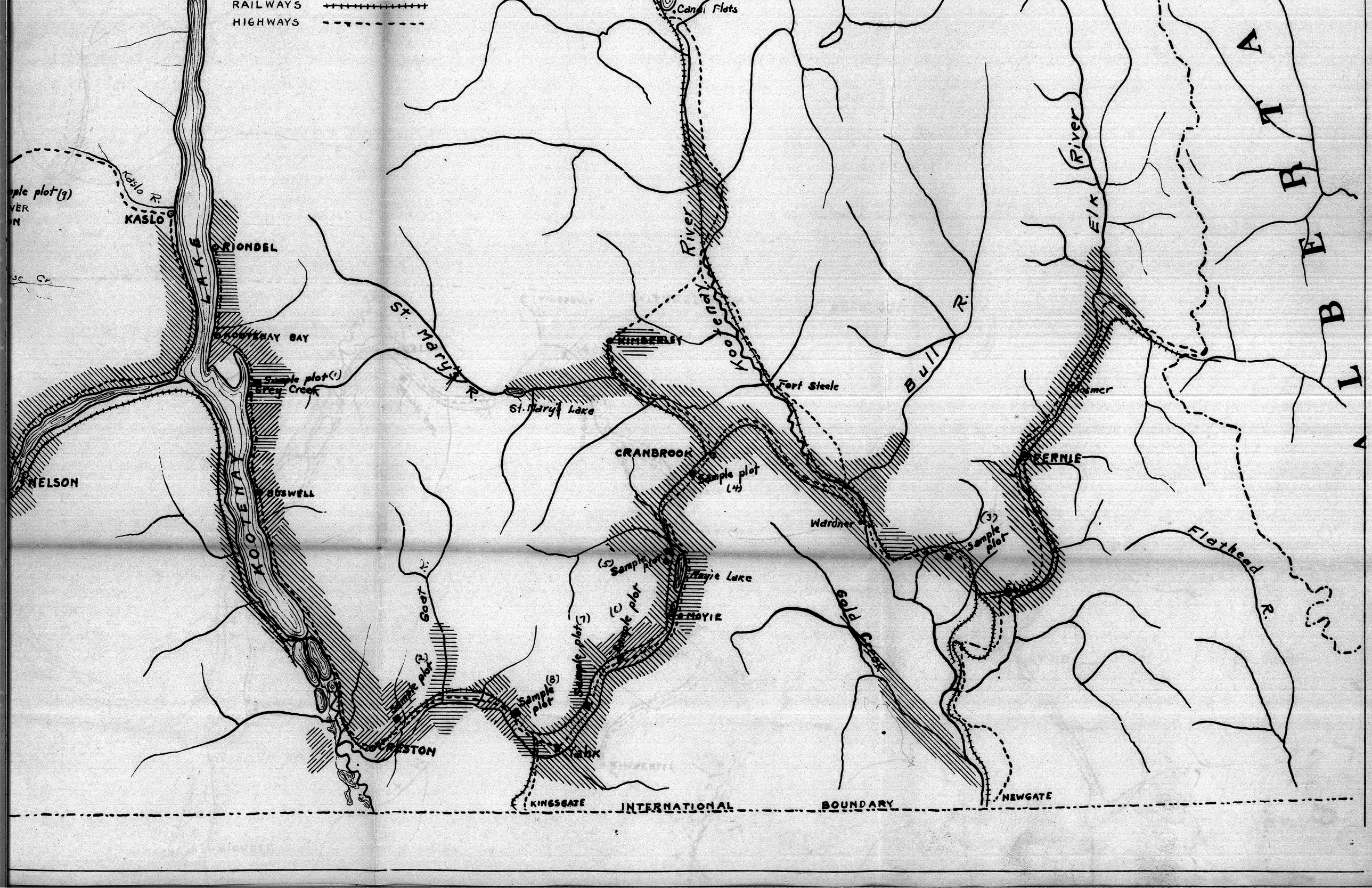
Goat R.
(6) Sample plot
(7) Sample plot
(8) Sample plot
(2) Sample plot
Gold Creek
CRESTON
Tank
KINGSGATE
INTERNATIONAL BOUNDARY
NEWGATE


RAILWAYS
HIGHWAYS
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Sample plot (1)
Grey Creek
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Fort Steele
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Sample plot (4)
Wardner
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Flathead R.
NELSON
BUSWELL
KOOTENAY
Goat R.
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Moyie Lake
(6) Sample plot
MOYIE
(7) Sample plot
(2) Sample plot
(8) Sample plot
Gold Creek
CRESTON
Yahk
KINGSGATE
INTERNATIONAL BOUNDARY
NEWGATE
ALBERTA

Sample or Record Number	Received		Total cocoons obtained at End of Season	Adults Bessa selecta reared	Parasite puparia overwintered
	Larvae	Cocoons			
638	34	0	0	0	
765	4 (2 dead)	2	4	0	
782	60 (36 dead)	3	3	0	
783	80 (1 dead)	0	9	0	
784	60	0	1	0	
785	91 (2 dead)	0	1	0	
827	5 (1 dead)	0	1	0	1
829	42	5	9	5	
830	116	0	1	3	
831	100	0	15	3	
832	97	0	10	0	
833	70	36	42	0	
834	95	8	13	5	
839	103 (3 dead)	3	15	7	5
917	16 (16 dead)	0	0	0	
974	91	9	26	0	
985	56 (4 dead)	46	47	3	
986	56	43	49	5	
987	95 (18 dead)	19	18	1	
988	78 (14 dead)	25	25	0	
1021	32 (10 dead)	0	3	2	
1022	18 (3 dead)	2	2	0	
1080	0	1	1	0	
1087	33	16	17	1	
Totals-1432		218	312	35	6

For the study of density of population of the sawfly and for parasitism and seasonal data, nine sample plots were established in September. These are indicated in the following data:--

Sample Plot I

Location - Grey Creek, Kootenay Lake, B.C.
Area - One acre
Exposure - Westerly, bench land beneath high range.
Stand - Almost pure, second growth larch.

Tree No.	D.B.H. inches	Height feet	Attack	Tree No.	D.B.H. inches	Height feet	Attack
1101	5	40	light	1132	8	65	light
1102	14	75	heavy	1133	4	45	medium
1103	12	75	medium	1134	6	45	"
1104	8	65	"	1135	6	45	"
1105	8	75	"	1136	6	45	light
1106	8	65	"	1137	8	75	"
1107	8	65	"	1138	6	55	medium
1108	8	65	"	1139	6	45	"
1109	6	55	"	1140	8	55	light
1110	10	65	"	1141	4	40	heavy
1111	8	55	light	1142	8	55	light
1112	12	75	medium	1143	8	55	heavy
1113	10	65	light	1144	6	45	medium
1114	8	55	heavy	1145	4	35	heavy
1115	6	55	light	1146	10	75	light
1116	4	55	"	1147	8	65	medium
1117	4	45	medium	1148	4	45	"
1118	4	55	light	1149	6	45	light
1119	8	65	"	1150	6	45	"
1120	10	75	"	1151	8	55	"
1121	8	75	"	1152	8	65	"
1122	8	65	"	1153	6	55	medium
1123	8	75	medium	1154	10	75	light
1124	6	45	"	1155	10	75	"
1125	4	45	"	1156	8	55	medium
1126	8	65	"	1157	6	45	"
1127	8	65	"	1158	6	45	"
1128	6	45	"	1159	6	45	"
1129	8	65	light	1160	10	65	light
1130	8	55	"	1161	10	75	"
1131	10	65	"	1162	10	75	medium

Tree No.	D.B.H. inches	Height feet	Attack	Tree No.	D.B.H. inches	Height feet	Attack
1163	10	75	light	1182	6	45	heavy
1164	10	75	medium	1183	10	55	medium
1165	8	65	light	1184	6	35	"
1166	10	75	"	1185	10	65	light
1167	6	45	"	1186	8	65	medium
1168	10	75	"	1187	12	55	heavy
1169	6	45	heavy	1188	8	65	"
1170	4	30	light	1189	12	65	light
1171	6	45	"	1190	6	45	medium
1172	10	65	medium	1191	12	75	"
1173	6	45	"	1192	8	55	"
1174	6	55	light	1193	8	45	"
1175	8	65	"	1194	8	55	light
1176	6	45	"	1195	6	55	"
1177	8	55	heavy	1196	12	75	medium
1178	6	55	medium	1197	10	75	light
1179	4	45	"	1198	6	45	"
1180	6	45	light	1199	6	45	heavy
1181	14	75	medium	1200	6	45	medium

Sample Plot II

Location - 6 miles east of Creston up side road ¼ mile.
Area - ⅛ acre
Exposure - east - in draw
Stand - pure larch

Tree No.	D.B.H. inches	Height feet	Attack	Tree No.	D.B.H. inches	Height feet	Attack
1201	4	35	light	1213	8	65	light
1202	6	45	"	1214	4	45	"
1203	8	55	"	1215	6	55	"
1204	6	45	"	1216	8	65	"
1205	4	45	"	1217	6	65	"
1206	6	65	"	1218	6	55	Medium
1207	6	65	"	1219	8	65	light
1208	4	55	"	1220	4	55	"
1209	4	55	"	1221	6	65	"
1210	6	55	"	1222	6	65	"
1211	6	65	"	1223	6	65	"
1212	4	45	"	1224	6	65	"

Tree No.	D.B.H. inches	Height feet	Attack
1225	6	55	light
1226	6	65	"
1227	8	75	"
1228	6	55	"
1229	8	75	"
1230	6	55	"
1231	6	55	"
1232	8	65	"
1233	8	75	"
1234	12	65	"
1235	8	55	"
1236	4	45	"
1237	6	45	heavy
1238	4	35	light
1239	8	65	"
1240	6	55	"
1241	12	75	"
1242	8	65	"
1243	14	75	"
1244	8	55	"
1245	12	65	"
1246	10	75	"
1247	8	65	"
1248	6	55	"
1249	6	55	"
1250	6	55	"
1251	12	75	"
1252	6	55	"
1253	12	65	medium
1254	8	65	light
1255	6	55	"
1256	8	65	"
1257	8	75	"
1258	4	45	"
1259	4	35	"
1260	6	55	"
1261	6	55	"
1262	4	55	"
1263	8	65	"
1264	6	65	"
1265	8	75	"
1266	8	65	"
1267	6	55	"
1268	6	65	"
1269	6	65	"

Tree No.	D.B.H. inches	Height feet	Attack
1270	8	75	light

Sample Plot III

Location - Near Jaffray - 30.8 miles East of Cranbrook
Area - ½ acre
Exposure - Nearly flat - slightly north exposure
Stand - Almost pure larch, young reproduction.

Tree No.	D.B.H. inches	Height feet	Attack
1271	3	15	heavy
1272	3	15	"
1273	3	15	"
1274	2	10	light
1275	3	15	"
1276	4	25	"
1277	4	20	"
1278	3	15	heavy
1279	2	15	"
1280	3	20	"
1281	6	30	"
1282	2	15	"
1283	3	15	"
1284	2	15	light
1285	2	15	heavy
1286	3	15	medium
1287	2	10	"
1288	1	10	heavy
1289	1	10	"
1290	2	15	"
1291	3	20	"
1292	2	15	heavy
1293	4	25	light
1294	2	15	heavy
1295	3	20	medium
1296	3	25	"
1297	2	20	heavy
1298	3	25	medium
1299	3	25	"
1300	1	10	light
1301	1	15	heavy
1302	2	20	light
1303	2	20	medium
1304	1	15	"
1305	1	15	heavy
1306	1	15	"
1307	1	15	"
1308	1	15	"
1309	3	25	heavy
1310	2	20	"
1311	1	15	"
1312	1	15	"
1313	1	15	heavy
1314	1	15	light
1315	1	15	"
1316	1	15	"
1317	1	10	medium
1318	1	15	heavy
1319	1	15	medium
1320	3	25	light
1321	1	15	"
1322	1	20	heavy
1323	1	15	"
1324	1	10	"
1325	1	10	medium
1326	1	15	heavy
1327	2	20	"
1328	1	15	"
1329	2	15	"
1330	3	25	"
1331	2	25	"
1332	2	25	"
1333	2	25	"
1334	3	25	medium
1335	1	8	light
1336	1	15	medium
1337	1	15	heavy
1338	1	8	"
1339	1	20	light
1340	1	8	heavy
1341	1	15	"
1342	2	20	medium
1343	1	15	heavy
1344	2	15	medium
1345	1	15	heavy
1346	1	20	"

Tree No.	D.B.H. inches	Height feet	Attack
1347	2	20	medium
1348	3	25	light
1349	1	15	"
1350	3	25	"
1351	1	15	"
1352	2	25	"
1353	1	15	"
1354	2	15	"
1355	3	25	"
1356	2	20	"
1357	2	20	
1358	1	15	"
1359	3	25	"
1360	3	30	"
1361	1	15	heavy
1362	1	15	medium
1363	3	20	heavy
1364	2	15	"
1365	1	10	light
1366	3	30	medium
1367	2	25	heavy
1368	1	15	"
1369	1	15	"
1370	1	15	"
1371	1	15	medium
1372	1	15	heavy
1373	1	15	light
1374	1	10	medium
1375	1	10	"
1376	2	20	heavy
1377	3	25	medium
1378	4	30	light
1379	1	15	"
1380	1	10	"
1381	1	20	"
1382	1	20	light
1383	2	20	"
1384	2	20	"
1385	2	20	medium
1386	1	10	"
1387	4	30	light
1388	2	15	"
1389	1	15	medium
1390	4	30	light
1391	1	15	"
1392	2	20	"
1393	1	20	"
1394	1	20	"
1395	1	15	"
1396	1	15	"
1397	4	30	"
1398	4	25	"
1399	1	15	"
1400	2	20	"
1401	3	25	"
1402	3	25	"
1403	3	20	heavy
1404	2	15	medium
1405	2	20	"
1406	1	15	"
1407	2	20	light
1408	1	10	heavy
1409	1	20	light
1410	2	25	"
1411	1	20	medium
1412	1	15	light
1413	2	25	medium
1414	4	30	"
1415	2	20	light

Sample Plot IV

Location - 4 miles West of Cranbrook, B.C.
Area - ½ acre
Exposure - Floor of valley - nearly flat
Stand - almost pure larch - a few lodgepole pine

Tree No.	D.B.H. inches	Height feet	Attack
1416	2	20	light
1417	2	20	"
1418	4	30	"
1419	4	30	"
1420	1	15	"
1421	2	15	"
1422	6	50	"
1423	4	15	medium
1424	8	65	light
1425	6	55	"
1426	6	55	"
1427	2	15	medium
1428	3	20	light
1429	6	55	"
1430	3	30	"
1431	2	15	medium
1432	6	65	light
1433	1	15	"
1434	2	20	"
1345	2	20	"
1436	6	55	"
1437	4	40	"
1438	6	35	"
1439	6	55	medium
1440	6	35	light
1441	8	75	"
1442	8	65	"
1443	6	65	"
1444	6	55	"
1445	6	65	"
1446	4	55	"
1447	6	55	"
1448	4	35	"
1449	1	15	"
1450	1	15	"
1451	1	10	" (suppressed)
1452	3	20	light
1453	2	15	"
1454	8	75	"
1455	2	15	"
1456	3	20	"
1457	3	20	"
1458	6	55	"
1459	4	35	"
1460	3	25	"
1461	3	35	"

Tree No.	D.B.H. Inches	Height feet	Attack
1462	2	20	light
1463	4	35	"
1464	3	25	"
1465	6	45	"
1466	6	45	"
1467	4	35	"
1468	6	45	"
1469	4	35	"
1470	4	30	"
1471	4	35	"
1472	6	45	"
1473	2	25	"
1474	3	35	"
1475	4	35	"
1476	2	25	"
1477	4	20	"
1478	8	45	"
1479	3	20	"
1480	4	35	"
1481	4	30	"
1482	6	35	medium
1483	4	30	light
1484	2	25	light
1485	4	45	"
1486	4	35	medium
1487	8	65	"
1488	6	55	light
1489	6	55	"
1490	3	35	"
1491	3	25	"
1492	6	45	"
1493	8	55	"
1494	6	45	medium
1495	6	50	light
1496	6	35	medium
1497	8	55	light
1498	8	55	"
1499	4	35	"
1500	3	25	"
1501	3	25	"
1502	2	15	"
1503	4	25	"
1504	2	20	" (sickly)
1505	4	35	light
1506	4	35	"
1507	2	25	"

Tree No.	D.B.H. inches	Height feet	Attack
1508	6	45	light
1509	4	45	"
1510	6	55	"
1511	6	45	"
1512	4	45	"
1513	2	25	"
1514	1	15	"
1515	2	20	medium
1516	6	55	light
1517	4	30	"
1518	4	30	"
1519	10	75	"
1520	6	35	"
1521	4	25	"
1522	4	25	"
1523	2	25	"
1524	6	50	"
1525	6	45	"
1526	8	65	"
1527	8	65	"
1528	6	40	"
1529	2	25	"
1530	4	30	"
1531	2	25	"
1532	4	30	"
1533	8	65	"
1534	8	55	"
1535	4	35	"
1536	2	30	"
1537	6	45	light
1538	2	25	"
1539	4	35	"
1540	4	30	"
1541	4	35	"
1542	4	30	"
1543	4	30	"
1544	3	30	"
1545	3	30	"
1546	2	20	"
1547	2	15	"
1548	6	45	"
1549	3	15	"
1550	2	20	"
1551	4	20	"
1552	3	25	"
1553	3	25	"
1554	3	25	"
1555	3	20	"
1556	6	55	"
1557	6	55	"
1558	4	45	"
1559	6	45	"
1560	4	35	"
1561	6	45	"
1562	4	35	"
1563	4	35	"
1564	2	25	"

Sample Plot V

Location - North end Moyie Lake - at Green Bay turn-off.

Area - ¼ acre

Exposure - East

Stand - Almost pure larch

Tree No.	D.B.H. inches	Height inches	Attack
3201	4	25	light
3202	4	35	"
3203	4	25	"
3204	3	25	"
3205	3	20	"
3206	5	55	"
3207	2	25	"
3208	4	40	"
3209	5	55	"
3210	4	35	"
3211	4	40	"
3212	3	40	"
3213	2	35	"
3214	4	55	"
3215	4	45	"
3216	4	45	"
3217	4	45	"
3218	4	35	"
3219	4	30	"
3220	6	55	"
3221	2	30	"
3222	4	45	"
3223	3	25	"
3224	3	25	"
3225	3	40	"
3226	3	40	"
3227	4	50	"
3228	3	50	"
3229	5	50	"
3230	3	35	"
3231	4	55	"
3232	3	40	"
3233	2	30	"
3234	3	35	"
3235	3	40	"
3236	3	35	"
3237	2	25	"
3238	2	30	"
3239	3	35	"
3240	2	35	"
3241	4	45	"
3242	2	35	"
3243	2	35	"
3244	4	35	"
3245	3	35	"
3246	2	35	"
3247	3	30	"

Tree No.	D.B.H. inches	Height feet	Attack
3248	4	45	light
3249	4	45	"
3250	3	30	"
3251	6	55	"
3252	4	30	"
3253	2	15	"
3254	3	20	"
3255	4	40	medium
3256	2	35	light
3257	4	45	"
3258	3	40	"
3259	2	35	"
3260	3	35	"
3261	2	25	"
3262	2	30	"
3263	2	25	"
3264	3	45	"
3265	2	45	"
3266	2	30	"
3267	4	45	"
3268	2	30	"
3269	3	40	"
3270	3	35	"
3271	3	40	"
3272	2	30	"
3273	4	45	"
3274	4	50	"
3275	4	50	"
3276	4	45	"
3277	3	40	"
3278	4	40	"
3279	3	35	"
3280	2	25	"
3281	3	40	"
3282	2	30	"
3283	2	30	"
3284	2	25	"
3285	3	30	"
3286	4	36	"
3287	4	35	"
3288	2	20	"
3289	4	40	"
3290	3	35	"
3291	2	30	"
3292	3	35	"
3293	2	35	"
3294	4	45	"

Tree No.	D.B.H. inches	Height feet	Attack
3295	4	45	light
3296	3	25	"
3297	3	40	"
3298	2	35	"
3299	3	35	"
3300	6	50	"
3301	8	55	"
3302	4	25	"
3303	6	45	"
3304	2	25	"
3305	4	25	"
3306	6	45	"
3307	6	50	"
3308	2	20	"
3309	5	50	"
3310	3	30	"
3311	2	25	"
3312	3	35	"
3313	4	45	"
3314	3	35	"
3315	4	35	"
3316	3	40	"
3317	4	35	"
3318	3	40	"
3319	3	40	"
3320	3	30	"
3321	5	50	"
3322	3	35	"
3323	2	30	"
3324	2	35	"
3325	2	35	"
3326	2	30	"
3327	2	30	"
3328	3	35	"
3329	3	40	"
3330	2	25	"
3331	2	20	"
3332	3	40	"
3333	3	30	"
3334	3	35	"
3335	3	35	"
3336	2	35	"
3337	3	40	"
3338	3	40	"
3339	2	30	"
3340	3	40	"

Tree No.	D.B.H. inches	Height feet	Attack
3341	4	45	light
3342	3	35	"
3343	4	40	"
3344	6	55	"
3345	3	30	"
3346	6	50	"
3347	3	35	"
3348	4	40	"
3349	6	60	"
3350	2	35	"
3351	3	35	"
3352	3	30	"
3353	4	40	"
3353	4	40	"
3354	3	30	"
3355	2	25	"
3356	4	40	"
3357	2	35	"
3358	2	30	"
3359	3	40	"
3360	4	45	"
3361	3	30	"
3362	3	30	"
3363	6	60	"
3364	2	20	"
3365	4	45	"
3366	3	40	"
3367	2	30	"
3368	5	45	"
3369	5	45	"
3370	4	40	"
3371	5	40	"
3372	5	40	"
3373	2	15	"
3374	3	20	"
3375	2	20	"
3376	6	55	"
3377	5	50	"
3378	3	25	"
3379	5	40	"
3380	2	30	"
3381	4	50	"
3382	2	30	"
3383	2	30	"
3384	2	30	"
3385	2	30	"

Sample Plot VI

Location - 22.4 miles West of Cranbrook, B.C.
Area - ½ acre
Exposure - Almost flat - slightly south slope
Stand - Nearly pure larch

Tree No.	D.B.H. inches	Height feet	Attack	Tree No.	D.B.H. inches	Height feet	Attack
3386	10	55	medium	3425	6	40	light
3387	6	50	light	3426	8	55	"
3388	6	45	medium	3427	5	35	"
3389	6	45	heavy	3428	3	30	"
3390	4	40	light	3429	2	20	"
3391	2	25	"	3430	2	25	"
3392	4	30	"	3431	3	30	"
3393	2	25	"	3432	3	40	"
3394	5	35	"	3433	5	50	"
3395	4	30	"	3434	3	30	"
3396	4	30	"	3435	2	20	"
3397	8	50	"	3436	5	40	"
3398	2	15	heavy	3437	8	55	medium
3399	8	45	light	3438	3	20	"
3400	3	25	"	3439	6	40	light
3401	2	30	"	3440	8	65	"
3402	4	40	"	3441	8	65	medium
3403	2	15	"	3442	6	60	light
3404	5	40	"	3443	8	65	"
3405	8	55	"	3444	8	65	"
3406	8	45	"	3445	8	60	medium
3407	2	15	"	3446	2	30	light
3408	10	55	medium	3447	2	15	"
3409	2	20	light	3448	8	65	"
3410	6	40	"	3449	6	35	"
3411	4	35	"	3450	2	30	"
3412	2	25	"	3451	6	45	medium
3413	2	20	"	3452	4	35	light
3414	2	20	"	3453	8	55	"
3415	5	35	"	3454	4	40	"
3416	5	35	"	3455	8	60	"
3417	10	65	"	3456	5	40	"
3418	8	60	"	3457	4	35	"
3419	3	30	"	3458	8	55	"
3420	10	65	"	3459	8	60	"
3421	2	20	"	3460	4	40	"
3422	4	35	"	3461	10	65	"
3423	5	40	"	3462	8	65	"
3424	10	70	"	3463	3	35	"

Tree No.	D.B.H. inches	Height feet	Attack
3464	10	65	light
3465	2	25	"
3466	8	55	"
3467	2	25	"
3468	2	25	"
3469	8	45	"
3470	10	65	"
3471	3	30	"
3472	8	55	"
3473	3	25	"
3474	2	15	medium
3475	2	25	"
3476	4	40	light
3477	10	65	"
3478	2	20	medium
3479	4	35	light
3480	3	30	medium
3481	6	40	light
3482	5	35	"
3483	6	55	"
3484	6	65	"
3485	8	55	"
3486	6	50	"
3487	8	55	light
3488	3	25	"
3489	3	25	"
3490	2	20	"
3491	2	25	"
3492	2	20	"
3493	4	35	"
3494	6	45	medium
3495	3	30	light
3496	8	55	"
3497	2	25	"
3498	10	55	"
3499	2	25	"
3500	2	25	"
3501	4	35	"
3502	4	45	"
3503	3	30	"
3504	8	55	"
3505	2	30	"
3506	8	65	"
3507	6	40	"
3508	8	65	"
3509	2	20	"

Sample Plot VII

Location - 11.8 miles west of Moyie
Area - ½ acre
Exposure - East - gentle slope
Stand - Pure larch

Tree No.	D.B.H. inches	Height feet	Attack
3513	4	25	heavy
3514	8	45	"
3515	8	55	"
3516	8	55	"
3517	3	25	"
3518	4	25	"
3519	8	40	"
3520	4	30	"
3521	4	30	light
3522	4	35	medium
3523	4	30	light
3524	8	60	medium
3525	4	30	light
3526	8	55	"
3527	5	40	heavy
3528	5	35	"
3529	2	20	"
3530	4	35	"

Tree No.	D.B.H. inches	Height feet	Attack
3531	8	55	light
3532	6	45	heavy
3533	3	20	"
3534	2	20	"
3535	6	45	"
3536	6	40	"
3537	2	20	"
3538	12	20	"
3539	5	35	"
3540	4	30	"
3541	4	20	"
3542	2	20	"
3543	3	25	"
3544	3	30	medium
3545	6	50	light
3546	2	15	"
3547	4	35	heavy
3548	4	35	light
3549	4	35	"
3550	4	35	medium
3551	3	30	light
3552	5	40	medium
3553	3	30	light
3554	3	30	dead (recent)
3555	3	30	medium

Tree No.	D.B.H. inches	Height feet	Attack
3556	2	25	medium
3557	8	55	light
3558	4	35	"
3559	5	40	medium
3560	2	25	"
3561	6	45	heavy
3562	2	20	"
3563	3	20	"
3564	6	45	"
3565	3	20	"
3566	2	20	"
3567	5	40	"
3568	4	35	"
3569	2	15	light
3570	2	20	heavy
3571	2	15	"
3572	4	40	medium
3573	3	35	light
3574	5	50	medium
3575	3	40	"
3576	2	20	heavy
3577	6	55	light
3578	3	40	"
3579	4	45	"

Sample Plot VIII

Location - 5.5 miles West of Yahk
Area - 3/8 acres
Exposure - Almost level, slightly south exposure
Stand - Mixed larch.

Tree No.	D.B.H. inches	Height feet	Attack
3580	5	50	light
3581	5	55	"
3582	5	55	"
3583	4	45	"
3584	14	60	heavy
3585	6	50	"
3586	14	65	"
3587	5	50	light
3588	10	60	medium
3589	14	75	light

Tree No.	D.B.H. inches	Height feet	Attack
3590	10	70	light
3591	6	50	heavy
3592	6	55	light
3593	8	55	"
3594	14	75	"
3595	10	75	"
3596	14	80	"
3597	10	65	medium
3598	8	70	light
3599	8	60	"

Tree No.	D.B.H. inches	Height feet	Attack
3600	12	80	light
3601	10	80	"
3602	4	50	"
3603	10	80	"
3604	12	80	"
3605	4	50	"
3606	6	70	"
3607	8	75	light
3608	5	55	"
3609	14	85	"
3610	6	75	"
3611	8	80	medium
3612	5	70	light
3613	10	80	"
3614	14	85	"

Sample Plot IX

Location - South End Slocan Lake Golf Course
Area - ¼ acre
Exposure - East - on knoll
Stand - larch mixed with young cedar and hemlock.

Tree No.	D.B.H. inches	Height feet	Attack
3615	8	45	light
3616	8	40	"
3617	5	35	"
3618	8	50	"
3619	8	55	"
3620	5	45	"
3621	6	50	"
3622	5	45	"
3623	6	45	"
3624	4	35	"
3625	4	35	"
3626	5	35	"
3627	4	35	"
3628	2	35	"
3629	3	30	"
3630	3	30	"
3631	2	30	"
3632	5	45	"
3633	3	35	"
3634	5	40	"
3635	8	55	"
3636	3	40	"
3637	3	40	"
3638	2	30	"
3639	4	45	light
3640	5	50	"
3641	2	35	"
3462	2	35	"
3643	8	55	"
3644	2	25	"
3645	2	35	"
3646	3	30	"
3647	2	40	"
3648	5	55	"
3649	3	45	"
3650	5	45	"
3651	6	55	"
3652	8	65	"
3653	6	65	"
3654	6	45	"
3655	3	45	"
3656	4	40	"
3657	8	65	"
3658	6	45	"
3659	8	50	"
3660	3	45	"
3661	4	45	"
3662	4	40	"

Tree No.	D.B.H. inches	Height feet	Attack	Tree No.	D.B.H. inches	Height feet	Attack
3663	3	35	light	3670	5	55	light
3664	5	45	"	3671	2	25	"
3665	4	45	"	3672	4	30	"
3666	2	35	"	3673	6	45	"
3667	5	50	"	3674	3	20	"
3668	3	45	"	3675	5	45	"
3669	5	50	"	3676	5	45	"

Random cocoon samples were taken near each of four plots at the time of laying out the areas, in order to gain some idea of parasitism, and the probable trend of the outbreak in 1940. This might also give some indication of suitable collecting places for cocoons to ship to Belleville. Analysis data for samples follows:--

	Sample 1.	Sample 2.	Sample 3.	Sample 4.
No. of *Pristophora erichsonii* cocoons	258	240	417	417
No. sawfly larvae alive	0	67	0	4
No. sawfly larvae dead	3	1		
No. sawfly larvae killed by *Isaria* fungus	102	72	62	152
No. sawfly larvae killed by *Coelopisthia nematicida*	3			
No. sawfly cocoons with *Coelopisthia* exit holes	53	21	26	50
No. sawfly cocoons with *Coelopisthia* larvae killed by fungus	4		2	
No. sawfly cocoons with rodent-made holes	72	22	42	55
No. sawfly cocoons with normal sawfly emergence holes (old)	14	3	168	69
No. sawfly cocoons empty, cause unknown	7	7		
No. sawfly cocoons with eggs of *Coelopisthia*		1	3	4
No. sawfly cocoons with larvae of *Coelopisthia*		35	59	60
No. sawfly cocoons with adults of *Coelopisthia*		7	8	8
No. sawfly cocoons with pupae of *Coelopisthia*		1	35	3
No. sawfly cocoons with dipterous larvae		1		
No. sawfly cocoons with dipterous puparia		1	4	5
No. sawfly cocoons with hymenopterous larvae				1
No. sawfly cocoons showing unknown emergence holes		1	8	6
	258	240	417	417

Sample I - From near Plot I - IX-15-39
II - " " Plot VI- IX-13-39
III - " " Plot VII-IX-14-39
IV - " " Plot VIII-IX-14-39

If the above samples can be taken as a criterion, the sawfly population will drop sharply in 1940 and much less severe defoliation may be expected. Plans have been made for systematic cocoon sampling on the plots in 1940.

The cost of the project this season has been as follows:--

Salaries	$94.45
Travel	38.15
Total	$132.60

The cost in 1940 will undoubtedly be more than the above because of more intensive work, particularly in cocoon sampling which takes considerable time both in the field and at the laboratory. This is an "A" project and therefore of primary importance. The cost for 1940 should approximate $800.00.

The sampling will be done by the quadrat system similar to that used in the east for the spruce sawfly. The sampling, however, will be done under approximately 10 per cent of the trees on any one plot. These trees will be selected so as to have a fairly uniform distribution over the plot, and representative of average conditions.

Project E.30.14-2 - European Pine Shoot Moth, Rhyacionia buoliana Schiff.

Object of Project:

The chief aims of this project, commenced in 1938, have been;

a. The determination of the distribution of the European pine shoot moth in British Columbia and the possible source of the current outbreak in the city of Vancouver.

b. The control and, if possible, the eradication of the species.

Location of Work:

City of Vancouver, B.C.

Officers in Charge and Complete Personnel:

Geo. R. Hopping - Direction of Project.
W. G. Mathers - Supervision and Execution of Work.
R.H. Longmore - Assistant in execution of work.

Co-operation with other Organizations:

This project has been undertaken in co-operation with the Dominion Plant Protection Service, through Mr. H. F. Olds, District Inspector, with the Parks Board of the City of Vancouver, and with the British Columbia Forest Service.

Methods Employed:

The current infestation was first discovered in 1938 but too late to organize and carry out control measures that year. However, as stated in the annual report for 1938, preliminary scouting was undertaken and parasites were recovered from caged infested material.

On February 2, 1939, a conference, attended by Messrs. de Gryse and Watson of the Forest Insect Investigations Unit and Messrs. McLaine, Keenan and Olds of the Plant Protection Service, was held at Ottawa to discuss the infestation and as a result of that meeting the following methods of procedure and division of responsibilities were decided upon and employed in 1939:

1. Additional scouting and detailed survey of infested Area: Carried out by Plant Protection Service, under the supervision of Mr. Olds, District Inspector.

2. Eradication Work:

   a. With permission of owners, removal and destruction of as many of the infested pines as possible. Interviewing of owners and supervising removal of trees conducted jointly by Messrs. Olds and Mathers. In this connection, the Vancouver Parks Board supplied trees from its nurseries, free of charge, to replace the trees destroyed, and the Provincial Forest Service also co-operated in the removal of the trees by providing a truck and men for the work.

   b. Removal and destruction of infested shoots from remaining trees. Carried out by the Plant Protection Service under the supervision of Mr. Olds.

   c. Application of a precautionary spray. Directed by W.G. Mathers and the Forest Insect Investigations Unit also supplied the ingredients for the spray. The Vancouver Parks Board provided its power sprayer mounted on a truck, and also a driver and two assistants for this work.

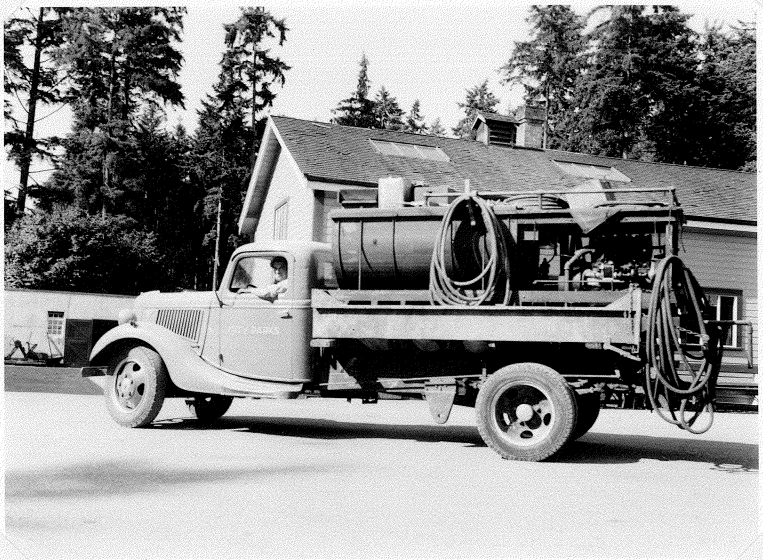
Detailed Progress Report:

Scouting

The scouting conducted this year showed that the pine shoot moth was restricted to an area slightly less than one mile square in a newer residential section of the city of Vancouver in the vicinity of 43rd Avenue and Granville Street, and that the infestation was confined almost entirely to native lodgepole pine, Pinus contorta, ranging from about 3 to 20 feet in height. The shoot moth has not been found elsewhere in the district nor has the source of the infestation been determined.

A detailed survey showed 232 pines, of which 170 were lodgepoles, in the infested area. Moreover, 113 pines immediately outside the infested area were also spotted and a map showing the location of all of the above trees was prepared by W.G. Mathers in order to show the trend of the infestation and to simplify the control work.

Showing truck load of shoot moth infested pines, to be hauled away and burned.



Showing Parks Board's spray outfit used in European pine shoot moth eradication work.

Photos by W.G.M.

Removal of shoot moth infested pine. Lower limbs cut off and soil being removed from around base of tree.

Removal of shoot moth infested pine. Cutting main roots.

Photos by W.G.M.

Showing bush-shaped lodge-pole pine which was found to be heavily infested with the European pine shoot moth. Such a tree might harbour the shoot moth for many years without being detected.

Showing typical type of lodgepole pine found to be infested with the shoot moth. Spreading of sack to protect lawn was the first step in the removal of the tree.

Photos by W.G.M.

Control Work

(See Photos)

With the permission of the owners, a total of 88 pines, 84 lodgepole and 4 Mughus, were removed and destroyed on March 29 and 30 and May 10. These trees were located on 33 different lots or properties and approximately 75 per cent were infested; the uninfested trees, being of little value, were removed in order to reduce the amount of spraying necessary.

The remaining pines were then carefully inspected and all infested shoots removed and destroyed.

The spray work was carried out on July 11 at about the time eggs, if present, would be hatching. A total of 143 pines, located on 61 lots and scattered over 29 city blocks in the infested area, were treated. The driver of the truck also operated the spray machine while Mr. R. H. Longmore handled the spray gun. The two extra men from the Parks Board assisted in handling the hose of which 150 feet were used. One tank full of spray was applied, the ingredients of which were:

Arsenate of lead, powder	18 pounds
Nicotine sulphate	5 "
Spreader (Red Drum, an emulsified herring oil)	2½ pints
Water	240 gallons

Due to the scattered nature of the trees, the spray machine was in use on the area for five and a half hours. A maximum temperature of 68 degrees was recorded in Vancouver on the day the spraying was done and although the following day, July 12, was also clear and warm, showers occurred on the afternoon of July 13 and also on the following two days.

Future Work:

A careful survey of the area will be made in the spring of 1940 to determine the effectiveness of the above control work and as to whether or not the complete programme should be repeated. However, even if no infested material is found the application of another precautionary spray in 1940 would be advisable.

E.30.19-3 - Bark Beetle Sample Plot Studies

The seven sample plots, located near McLeod Meadow, Kootenay National Park, have been checked each year since 1934, with observations made on parasites and predators. Green unattacked, green, attacked; turning; and dead trees have been recorded each year as well as those which have fallen. In 1939 the plots were checked in late September.

The older parts of the infestation remain the same as in 1938, except that more dead trees have fallen and many have been cut and disposed of in the immediate vicinity of the McLeod Meadow camp site. There is a marked increase in the infestation on the east side of the valley between the fire lookout tower and McLeod Meadow, an area of approximately six square miles.

Of the parasites which are working against the bark beetles, the most important is Spathius tomici Ashm. Of predators, the Stratiomyid, Zabrachia polita Coq. seems to be the most effective, aided by Mediterus sp., Lonchaea, and Coeloides.

The biggest percentage of tree mortality has been caused by Dendroctonus monticolae Hopk. but Ips interpunctus Eich. is also primary. The latter species seems to cause more damage when the infestation is declining than when it is rising, the Dendroctonus taking the lead when the outbreak is on the increase as it was in 1939. It may be that the Ips make successful attacks on those trees which have previously been attacked by Dendroctonus, and the latter drowned out by pitch. Many cases of drowning out of initial attacks have been noted on the area. Sample plot data is as follows:--

G	- tree green, alive
G, attack	- tree green but with fresh attack.
D	- dead. Foliage brown or absent.
D, down	- tree dead and fallen
T	- tree infested and foliage turning colour.
*	- denotes a light attack - scattered or on one side of tree.

Sample Plot I

Location	- .2 miles south Meadow Creek Bridge
Tree species	- Pinus contorta
Tree numbers	- 1-192
Area - 1 acre	- plot established 1935.
Current examination	- September, 1939.

Tree No.	D.B.H. inches	1938	1939
1	15	G	G
2	16	D	cut
3	8	D	"
4	14	D	"
5	4	D	"
6	16	D	"
7	12	D (Down)	D (Down)
8	6	D (Down)	D (Down)
9	4	D	cut
10	10	D	" "
11	8	D	"
12	12	D	"
13	12	D	"
14	16	D	"
15	18	D	"
16	10	D	"
17	20	D	"
18	20	D	"
19	18	D	D
20	16	D	cut
21	14	D	"
22	14	D	"
23	10	D	"
24	16	G	?
25	12	D	cut
26	12	D	"
27	17	D	"
28	16	D	"
29	12	D	"
30	12	D	D
31	14	D	D
32	14	D	D
33	10	D	D
34	10	D	D
35	24	D	cut
36	10	D	"
37	14	D	D
38	16	D	D
39	20	D	D
40	18	D	D
41	10	D	D
42	14	D	cut
43	6	D	D
44	12	D (Down)	D (Down)
45	16	D	D
46	22	D	D
47	8	D (Down)	D (Down)
48	14	D	D
49	12	D	D
50	12	D	D
51	20	D	D
52	16	D	D
53	8	G	G
54	10	D	cut
55	14	D	"
56	12	G	G
57	14	G	G
58	14	D	cut
59	12	D	D
60	10	D	cut
61	20	D	"
62	18	D	D
63	16	D	D
64	12	D	cut
65	14	D	D
66	14	D	cut
67	12	D	"
68	10	D	"
69	12	D	"
70	10	D	"
71	8	D	"
72	12	D	"
73	14	D	"
74	14	D	"
75	10	D	"
76	12	D	"
77	12	G	G
78	10	G	G
79	14	D	cut
80	6	D	"
81	6	D	"
82	16	D	"
83	12	D	"
84	14	D	"
85	12	D	"
86	18	D	"
87	6	G	G
88	14	G	G
89	12	G	G
90	10	D	cut
91	12	G	G
92	12	D	cut

Tree No.	D.B.H. inches	1938	1939
93	6	D	cut
94	14	D	"
95	6	G	G
96	14	G	G
97	14	D	cut
98	16	D	"
99	16	D (Down)	D (Down)
100	20	D	cut
101	12	D	"
102	12	D	"
103	12	D	"
104	12	G	G
105	6	D (Down)	D (Down)
106	20	D	cut
107	14	D (Down)	D (Down)
108	14	G	G
109	6	G	G
110	22	D	cut
111	8	D	"
112	12	D	"
113	16	D	"
114	18	D	"
115	14	D	"
116	20	D	"
117	10	G	G
118	10	G	G
119	12	D	cut
120	18	D	"
121	12	D	D
122	8	D	D
123	10	D	D
124	14	D	D
125	10	G	G
126	10	D	D
127	22	D	cut
128	18	D	"
129	8	G	G
130	8	D	D
131	12	D	D
132	12	D	D
133	14	D	D
134	10	G	G
135	24	D	D
136	8	D	D
137	14	D	D
138	10	D	D

Tree No.	D.B.H. inches	1938	1939
139	10	D	D
140	10	G	G
141	10	D	D
142	10	D	D
143	10	D	D
144	12	D	D
145	8	D	D
146	12	G	G
147	10	D	D
148	14	D	D
149	8	D	D
150	10	G	G
151	18	D	D
152	18	D	D
153	10	D (Down)	D (Down)
154	16	D	D
155	12	D	cut
156	14	G	G
157	10	D	D
158	12	D	D
159	12	D	cut
160	10	G	G
161	12	G	G
162	14	D	cut
163	20	D	"
164	12	D	"
165	14	D	D
166	14	D	D
167	8	D	D
168	12	D	cut
169	12	D	"
170	12	D	"
171	10	D	"
172	8	D	"
173	10		"
174	12	D	"
175	18	D	"
176	16	D	"
177	22	D	"
178	10	D	"
179	12	G	?
180	14	D	cut
181	12	D	"
182	10	D	"
183	10	G	G
184	6	G	G

Tree No.	D.B.H. inches	1938	1939	Tree No.	D.B.H. inches	1938	1939
185	12	G	G	189	20	G	G
186	10	D	cut	190	10	D	cut
187	10	D	"	191	12	G	G
188	8	cut	"	192	14	D (Down)	D (Down)

Sample Plot II

Location - .4 miles north of Meadow Creek Bridge
Tree Species - Lodgepole pine
Tree numbers - 193-425
Area - 1 acre
Current Examination - September, 1939.

Tree No.	D.B.H. inches	1938	1939	Tree No.	D.B.H. inches	1938	1939
193	12	G	G	218	12	D	D
194	10	G	G	219	6	D	D
195	6	D	D	220	8	G	G
196	12	G	G	221	12	G	G
197	6	G	G	222	12	G	G
198	10	D	D	223	10	D (Down)	D (Down)
199	8	G	G	224	8	D	D
200	4	G	G	225	8	D	D
201	8	D	D	226	4	D	D
202	8	D	D	227	8	D	D
203	6	D(Down)	D (Down)	228	8	D	D
204	10	D	D	229	8	D	D
205	12	G	G	230	12	D	D
206	10	G	G	231	10	G	G
207	8	G	G	232	8	G	G
208	8	G	G	233	10	D	D
209	12	G	G	234	12	G	G
210	10	G	G	235	16	D	D
211	12	G	G	236	8	D	D
212	14	G	G	237	16	D	D
213	10	D	D	238	12	D	D
214	10	G	G	239	14	G	G
215	14	G	G	240	16	G	G
216	8	G	G	241	10	D	D
217	10	G	G	242	16	D (snag)	D (snag)

Tree No.	D.B.H. inches	1938	1939
243	12	G	G
244	8	D	D (Down)
245	8	D (Down)	D (Down)
246	12	G	G
247	10	G	G
248	8	D (Down)	D (Down)
249	10	D (Down)	D (Down)
250	16	G	?
251	14	D (Down)	D (Down)
252	12	D	D
253	12	G	G Attack
254	10	G	G
255	4	G	G
256	8	G	G
257	8	G	G
258	10	G	G
259	12	G	G
260	8	G	G
261	10	G	G
262	6	D	D
263	12	D	D
264	10	G	G
265	10	D	D
266	10	G	G
267	10	D (Down)	D (Down)
268	14	G	G
269	12	G	G
270	8	G	G
271	18	G	G
272	10	G	G
273	10	G	G
274	10	G	G
275	6	D	D
276	4	?	?
277	10	G	G
278	10	D	D
279	10	D	D
280	10	D (Down)	D (Down)
281	5	D (Down)	D (Down)
282	8	D	?
283	8	G	G
284	8	G	G
285	12	G	G
286	6	D	D
287	10	G	G
288	12	G	G
289	6	G	G
290	8	D	D
291	10	G	G
292	12	G	G
293	10	G	D
294	10	G	G
295	missing		
296	missing		
297	8	D	D (Down)
298	12	G	G
299	12	G	G
300	6	D (Down)	D (Down)
301	8	G	G
302	10	G	G
303	10	D (Down)	D (Down)
304	6	D (Down)	D (Down)
305	10	G	G
306	8	G	G
307	6	D	D (Down)
308	8	D	D
309	10	G	G
310	14	G	G
311	10	G	G
312	12	D (Down)	D (Down)
313	10	G	G
314	10	G	G
315	10	D	D
316	10	G	G
317	10	D	D
318	8	D (Down)	D (Down)
319	10	D	D
320	12	G	G
321	8	G	G
322	10	G	G
323	8	G	G
324	8	D	D
325	12	G	G
326	6	D	D
327	12	D	D
328	10	D	D
329	12	D	D
330	12	D	D
331	10	G	G
332	12	G	G
333	12	G	G
334	8	G	G
335	12	D	D
336	12	G	G
337	14	G	G
338	14	G	G

Tree No.	D.B.H. inches	1938	1939
339	10	D (Down)	D (Down)
340	12	D	D
341	12	D	D
342	12	D	D
343	10	D	D (Down)
344	12	D	D (Down)
345	14	G	G
346	14	G	G
347	6	G	G
348	6	D	D
349	8	G	G
350	10	G	G
351	10	D	D
352	8	G	G
353	10	G	G
354	10	G	G
355	6	D	D
356	14	G	G
357	10	G	G
358	12	G	G
359	12	G	G
360	6	G	G
361	12	G	G
362	10	G	G
363	10	D	D
364	10	D	D
365	8	G	G
366	6	G	G
367	14	G	G
368	16	G	G
369	16	G	G
370	14	G	G
371	12	D	D
372	10	D	D (Down)
373	14	G	G
374	14	G	G
375	8	D (Down)	D (Down)
376	10	D	D
377	14	G	G
378	14	G	G
379	18	G	G
380	10	G	G
381	12	D (Down)	D (Down)
382	12	D	D
383	8	G	G
384	12	D	D
385	12	G	G
386	8	D	D
387	6	D	D
388	8	D	D
389	8	D (Down)	D (Down)
390	8	D	D
391	10	G	G
392	12	D	D (Down)
393	8	D	D
394	12	G	G Attack
395	8	G	G
396	12	G	D Ips
397	14	G	G
398	10	D	D
399	14	D	D
400	10	D (Down)	D (Down)
401	14	D	D
402	14	G	G
403	14	G	G
404	12	G	G
405	14	G	G
406	12	G	G
407	10	G	G
408	10	D	D
409	10	D	D (Down)
410	12	D (Down)	D (Down)
411	12	?	?
412	6	D (Down)	D (Down)
413	12	D (Down)	D (Down)
414	16	D (Down)	D (Down)
415	12	D	D
416	14	D	D
417	8	D (Down)	D (Down)
418	14	D	D
419	16	D	D
420	10	D	D (Down)
421	missing		
422	8	D	D
423	14	G	G
424	8	G	G
425	16	G	G

100 12%

Sample Plot XII

Location - .9 miles north of Meadow Creek Bridge
Tree Species - lodgepole pine
Tree Numbers - 426-762
Area - 1 acre
Current Examination - September, 1939.

Tree No.	D.B.H. inches	1938	1939
426	14	G	G Attack
427	12	G	G Attack
428	12	G	G Attack
429	12	G	G
430	8	G	G
431	10	D	D
432	10	D	D
433	8	G	G
434	6	D	D
435	6	G	G
436	10	G	G
437	20	G	G Attack
438	14	G	G
439	12	G. Attack	D
440	18	G. Attack	T
441	14	G	G.Attack
442	10	G (sickly)	G
443	6	D	D
444	6	G	G
445	6	D (Down)	D (Down)
446	18	G	G Attack
447	12	G	G
448	10	D	D
449	10	D	D
450	10	D	D (Down)
451	10	G	G
452	12	G	G
453	10	G	G
454	10	G	G
455	10	D	D
456	12	D	D (Down)
457	6	D	D
458	10	G	G
459	8	G	G
460	12	G	G
461	4	D	D
462	8	G	G
463	6	D	D
464	12	G	G
465	8	G	G
466	8	D	D
467	4	D (Down)	D (Down)
468	6	d	D
469	8	G	G
470	12	G	G
471	12	G	G
472	8	G	G
473	12	G	G Attack
474	8	G	G Attack
475	12	G	G Attack
476	10	G	G
477	6	D (Down)	D (Down)
478	8	D	D
479	10	G (sickly)	G Attack
480	4	D	D
481	8	G	G
482	8	G	G
483	8	G	G
484	4	D	D
485	8	G	G
486	8	G	G
487	14	D (Down)	D (Down)
488	14	G	G (lightning struck)
489	8	G	G Attack
490	10	C	G Attack
491	10	G	G
492	10	G	G
493	8	G	G
494	10	G	G
495	10	D	D
496	10	G	G Attack

Tree No.	D.B.H. inches	1938	1939
497	8	D	D
498	16	G	G Attack
499	16	G	G Attack
500	10	G	G Attack
501	6	D	D (Down)
502	10	G	G Attack
503	12	G	G Attack
504	10	G	G Attack
505	8	G	G
506	10	G	G Attack
507	6	D	D
508	12	G	G
509	12	G	G
510	8	G	G
511	10	G	G Attack
512	10	G	G
513	10	G	G
514	12	G	G
515	12	G	G
516	8	D	D
517	14	G	G Attack
518	14	G	T
519	14	G Attack	G Attack
520	10	G	G Attack
521	12	G	G Attack
522	12	G	G Attack
523	14	D	D
524	10	D	D
525	12	D	D
526	8	D	D
527	10	G	G
528	12	G	G
529	12	D	D
530	14	G	G
531	12	G	D
532	10	G	G
533	12	G	G
534	12	G	G
535	10	G	G
536	6	G	G
537	8	G	G
538	14	D	D
539	12	D	D
540	10	D	D
541	12	D	D
542	12	G	G
543	12	G	G
544	8	G	G
545	12	D	D
546	8	D	D
547	12	G	G
548	10	G Attack	G Attack
549	16	G	G
550	16	G Attack	D
551	10	G Attack	G Attack
552	12	G Attack	D
553	6	G	G
554	8	G	G
555	10	D	D
556	8	D	D
557	8	D	D
558	6	D	D
559	12	G	G
560	6	D	D
561	6	D (Down)	D (Down)
562	14	G	G
563	8	G	G
564	12	D	D
565	8	G	G
566	14	G	G
567	8	G	G
568	16	G	G
569	8	G	G
570	8	G	G
571	10	G	G
572	8	D (Down)	D (Down)
573	12	G	G
574	8	G	G
575	10	G	G
576	12	G	G
577	10	G	G
578	12	G	G
579	8	G	G
580	8	D	D
581	10	G	G
582	10	D	D
583	10	G	G
584	12	G	G
585	12	D	D

Tree No.	D.B.H. inches	1938	1939
586	12	G	G
587	14	G	G
588	12	G	G
589	4	D	D
590	14	G	G
591	10	G	G
592	8	G	G
593	12	G	G
594	6	D	D
595	8	G	G
596	8	G	G
597	10	G	G
598	8	G	G
599	8	G	G
600	10	G	G
601	12	G	G
602	8	G	G
603	10	G	G
604	6	D	D
605	10	G	G
606	10	D	D
607	12	D	D
608	10	D	D
609	10	D	D
610	14	D	D
611	6	D	D
612	12	D	D
613	8	G	G
614	8	G	G Attack
615	6	G	G Attack
616	4	D	D
617	4	D	D
618	6	D	D
619	8	G	G
620	10	G	G
621	8	D	D
622	8	G	G
623	6	G	G
624	8	D	D
625	10	D	D
626	10	G	G
627	8	D	D (hung up)
628	10	G	G
629	10	G	G
630	12	G	G
631	12	G	G
632	8	D	D
633	8	G	G
634	8	G	G
635	12	G	G
636	14	D	D
637	12	G	G
638	8	G	G
639	14	G	G
640	10	G	G
641	8	G	G
642	8	D	D
643	8	D	D
644	14	G	G
645	10	D	D
646	14	G	G
647	12	G	G
648	12	G	G
649	4	G	G
650	8	D	D
651	12	G	G
652	14	G	G
653	14	G	G Attack
654	18	G	G
655	12	G Attack	G (Drowned)
656	6	D	D
657	10	G	G
658	10	G	G
659	10	G	G
660	10	G	G
661	10	G	G
662	4	G	G
663	12	G	G Attack
664	8	D	D
665	12	G	G Attack
666	8	G (sickly)	D
667	16	G	G
668	10	G	G
669	10	G	G
670	10	G	G
671	8	G	G
672	8	D	D
673	12	?	G
674	8	G	G
675	8	G	G
676	8	G	G
677	10	G	G
678	10	G	G
679	6	D	D
680	10	G	G
681	8	D	D
682	6	D	?

Tree No.	D.B.H. inches	1938	1939
683	12	G	?
684	14	G	?
685	8	C	G
686	12	G	G
687	14	G Attack	D
688	10	D	D (snag)
689	12	G	G
690	10	D	D
691	10	G	G
692	10	D	D
693	4	G	G
694	12	G	G
695	10	G	G
696	8	D	D
697	6	D	D
698	12	G	G
699	14	G	G
700	12	G	G
701	10	D	D
702	12	G	G
703	12	G	G
704	14	G	G
705	12	G	G
706	12	G	G
707	10	D	D
708	12	G	G
709	12	G Attack	D
710	10	D	D
711	12	G	G
712	10	G	G
713	10	G	G
714	10	D (down)	D (down)
715	6	D (down)	D (down)
716	12	D	D
717	12	G	G
718	8	G (sickly)	G (sickly)
719	10	G	G
720	12	G Attack	A Attack
721	12	G	G
722	10	G	G

Tree No.	D.B.H. inches	1938	1939
723	12	G	G
724	10	G	G
725	12	G	G
726	10	G	G
727	16	G	G Attack
728	12	G Attack	D
729	16	G Attack	G Attack
730	12	D	D
731	10	G	G
732	12	G Attack	D
733	12	G	G
734	10	D	D
735	10	D	D
736	8	D	D
737	8	G (sickly)	G (sickly)
738	4	G	D
739	6	D	D
740	8	G	G
741	12	G	G
742	12	G	D
743	8	D	D (Down)
744	8	D	D
745	12	G	G (skinned by tree)
746	12	D	D
747	12	D	D
748	8	D	D
749	12	G	G
750	12	G	G
751	12	G	G
752	12	G	G
753	10	G	G
754	12	G	G Attack
755	6	D	D
756	12	G	G Attack
757	10	G	G Attack
758	14	G	G Attack
759	12	G	G Attack
760	10	G	G
761	8	G	G
762	6	D	D

Sample Plot IV

Location - 4.0 miles north of Meadow Creek Bridge
Tree Species - Lodgepole pine
Tree Designations - 3961-4000, 1582-1600, 3155-3200, 186-200 (1601-1656.
Area - 1 acre
Current Examination - September, 1949.

* denotes light attack

When this plot was established in 1935, only three trees were infested, and no further infestation occurred until 1939. Therefore all trees on the plot were not numbered until 1939. Consecutive numbers ran out so odd lots were used.

Tree No.	D.B.H. inches	1938	1939	Tree No.	D.B.H. inches	1938	1939
3961	6	G	G	3992	14	G	G Attack
3962	8	G	G Attack	3993	8	G	G Attack
3963	10	G	G Attack	3994	10	G	G Attack
3964	10	G	G Attack	3995	10	G	G Attack
3965	14	G	G	3996	8	G	G Attack*
3966	6	G	G	3997	8	G	G Attack
3967	8	G	G	3998	5	G	G
3968	8	G	G Attack	3999	10	G	G Attack
3969	8	G	G	4000	8	G	G
3970	16	G	G Attack	1582	6	G	G
3971	8	G	G Attack	1583	6	G	G
3972	6	G	G	1584	6	G	G
3973	6	G	G Attack*	1585	14	G	G Attack
3974	8	G	G Attack	1586	8	G	G Attack
3975	14	G	G Attack	1587	8	G	G Attack
3976	6	G	G	1588	5	G	G
3977	6	G	G	1589	5	G	G
3978	10	G	G Attack*	1590	16	G	G Attack
3979	6	G	G	1591	10	G	G Attack
3980	8	G	G	1592	6	G	G
3981	5	G	G	1593	10	G	G Attack
3982	8	G	G	1594	6	G	G Attack*
3983	10	G	G Attack	1595	6	G	G
3984	8	G	G Attack	1596	8	G	G
3985	5	G	G	1597	10	G	G
3986	10	G	G Attack	1598	6	G	G
3987	8	G	G Attack	1599	6	G	G
3988	10	G	G Attack	1600	8	G	G
3989	5	G	G Attack	3155	8	G	G Attack
3990	10	G	G Attack	3156	10	G	G Attack
3991	6	G	G	3157	8	G	G

Tree No.	D.B.H. inches	1938	1939
3158	6	G	G
3159	12	G	G Attack
3160	10	G	G Attack
3161	8	G	G
3162	6	G	G
3163	8	G	G
3164	8	G	G
3165	8	G	G
3166	8	G	G
3167	8	G	G Attack
3168	8	G	G
3169	8	G	G
3170	10	G	G Attack
3171	10	G	G Attack
3172	6	G	G
3173	8	G	G Attack
3174	6	G	G Attack
3175	5	G	G
3176	10	G	G Attack
3177	8	G	G Attack
3178	10	G	G Attack
3179	6	G	G
3180	8	G	G
3181	6	G	G
3182	10	G	G Attack
3183	8	G	G Attack
3184	8	G	G Attack
3185	6	G	G
3186	6	G	G
3187	8	G	G Attack
3188	10	G	G Attack
3189	10	G	G Attack
3190	6	G	G
3191	10	G	G Attack
3192	8	G	G
3193	8	G	G
3194	5	G	G
3195	6	G	G
3196	10	G	G Attack
3197	6	G	G
3198	12	G	G Attack
3199	6	G	G
3200	10	G	G Attack
186	8	G	G
187	14	G	G Attack
188	6	G	G Attack
189	12	G	G Attack

Tree No.	D.B.H. inches	1938	1939
190	10	G	G Attack
191	8	G	G "
192	6	G	G "
193	8	G	G "
194	8	G	G "
195	10	G	G "
196	10	G	G "
197	8	G	G "
198	12	G	G "
199	10	G	G "
200	10	G	G "
1601	14	G	G "
1602	6	G	G "
1603	8	G	G "
1604	10	G	G "
1605	8	G	G "
1606	12	G	G "
1607	8	G	G "
1608	10	G	G "
1609	8	G	G "
1610	8	G	G "
1611	8	G	G "
1612	8	G	G "
1613	8	G	G "
1614	10	G	G "
1615	8	G	G "
1616	8	G	G "
1617	6	G	G "
1618	10	G	G "
1619	10	G	G "
1620	8	G	G "
1621	10	G	G "
1622	10	G	G "
1623	8	G	G "
1624	8	G	G "
1625	12	G	G "
1626	8	G	G "
1627	10	G	G "
1628	10	G	G "
1629	8	G	G "
1630	8	G	G "
1631	10	G	G "
1632	12	G	G "
1633	10	G	G "
1634	12	G	G "
1635	8	G	G "
1636	8	G	G "

Tree No.	D.B.H. inches	1938	1939		Tree No.	D.B.H. inches	1938	1939	
1637	8	G	G	Attack	1647	8	G	G	Attack
1638	14	G	G	"	1648	6	G	G	"
1639	10	G	G	"	1649	10	G	G	"
1640	10	G	G	"	1650	8	G	G	"
1641	12	G	G	"	1651	14	G	G	"
1642	12	G	G	"	1652	8	G	G	"
1643	8	G	G	"	1653	10	G	G	"
1644	10	G	G	"	1654	8	G	G	"
1645	8	G	G	"	1655	8	G	G	"
1646	12	G	G	"	1656	10	G	G	"

Sample Plot V

Location - 5.1 miles north Meadow Creek Bridge
Tree species - Lodgepole pine
Tree numbers - 768-772, 3701-3960
Area - 1 acre
Current examination - September, 1939.

When this plot was established in 1935 only five trees were killed by bark beetles, 768-772. No further attack has occurred but in view of the increase in attack on plots just south of Plot V it became advisable to mark all trees on the plot. This plot is north of the main epidemic area.

Tree No.	D.B.H. inches	1938	1939	Tree No.	D.B.H. inches	1938	1939
768		D	D	3712	12	G	G
769		D	D	3713	10	G	G
770		D	D	3714	8	G	G
771		D	D	3715	8	G	G
772		D	D	3716	6	G	G
3701	8	G	G	3717	6	G	G
3702	8	G	G	3718	10	G	G
3703	12	G	G	3719	14	G	G
3704	6	G	G	3720	6	G	G
3705	10	G	G	3721	8	G	G
3706	5	G	G	3722	10	G	G
3707	8	G	G	3723	5	G	G
3708	6	G	G	3724	12	G	G
3709	8	G	G	3725	10	G	G
3710	12	G	G	3726	10	G	G
3711	5	G	G	3727	14	G	G

Tree No.	D.B.H. inches	1938	1939
3728	10	G	G
3729	6	G	G
3731	12	G	G
3732	8	G	G
3733	6	G	G
3734	10	G	G
3735	12	G	G
3736	6	G	G
3737	12	G	G
3738	10	G	G
3739	10	G	G
3740	14	G	G
3741	6	G	G
3742	8	G	G
3743	5	G	G
3744	6	G	G
3745	8	G	G
3746	8	G	G
3747	8	G	G
3748	10	G	G
3749	6	G	G
3750	8	G	G
3751	8	G	G
3752	6	G	G
3753	8	G	G
3754	5	G	G
3755	5	G	G
3756	8	G	G
3757	6	G	G
3758	8	G	G
3759	6	G	G
3760	8	G	G
3761	8	G	G
3762	8	G	G
3763	8	G	G
3764	5	G	G
3765	10	G	G
3766	10	G	G
3767	8	G	G
3768	6	G	G
3769	8	G	G
3770	6	G	G
3771	8	G	G
3772	8	G	G
3773	10	G	G
3774	6	G	G
3775	8	G	G

Tree No.	D.B.H. inches	1938	1939
3776	8	G	G
3777	8	G	G
3778	10	G	G
3779	8	G	G
3780	12	G	G
3781	8	G	G
3782	5	G	G
3783	8	G	G
3784	6	G	G
3785	10	G	G
3786	5	G	G
3787	8	G	G
3788	10	G	G
3789	8	G	G
3790	6	G	G
3791	14	G	G
3792	5	G	G
3793	6	G	G
3794	10	G	G
3795	8	G	G
3796	8	G	G
3797	6	G	G
3798	6	G	G
3799	8	G	G
3800	8	G	G
3801	5	G	G
3802	6	G	G
3803	10	G	G
3804	10	G	G
3805	6	G	G
3806	6	G	G
3807	10	G	G
3808	8	G	G
3809	8	G	G
3810	8	G	G
3811	8	G	G
3812	8	G	G
3813	6	G	G
3814	8	G	G
3815	6	G	G
3816	8	G	G
3817	6	G	G
3818	5	G	G
3819	8	G	G
3820	8	G	G
3821	8	G	G
3822	6	G	G
3823	8	G	G

Tree No.	D.B.H. inches	1938	1939
3824	8	G	G
3825	8	G	G
3826	10	G	G
3827	10	G	G
3828	5	G	G
3829	8	G	G
3830	6	G	G
3831	6	G	G
3832	10	G	G
3833	6	G	G
3834	6	G	G
3835	8	G	G
3836	5	G	G
3837	8	G	G
3838	6	G	G
3839	10	G	G
3840	6	G	G
3841	6	G	G
3842	6	G	G
3843	10	G	G
3844	8	G	G
3845	6	G	G
3846	8	G	G
3847	6	G	G
3848	6	G	G
3849	6	G	G
3850	6	G	G
3851	14	G	G
3852	8	G	G
3853	10	G	G
3854	5	G	G
3855	6	G	G
3856	6	G	G
3857	8	G	G
3858	8	G	G
3859	6	G	G
3860	10	G	G
3861	8	G	G
3862	5	G	G
3863	8	G	G
3864	6	G	G
3865	6	G	G
3866	6	G	G
3867	6	G	G
3868	8	G	G
3869	6	G	G
3870	6	G	G

Tree No.	D.B.H. inches	1938	1939
3871	8	G	G
3872	8	G	G
3873	6	G	G
3874	8	G	G
3875	8	G	G
3876	8	G	G
3877	6	G	G
3878	6	G	G
3879	8	G	G
3880	10	G	G
3881	6	G	G
3882	6	G	G
3883	6	G	G
3884	6	G	G
3885	8	G	G
3886	8	G	G
3887	6	G	G
3888	8	G	G
3889	6	G	G
3890	6	G	G
3891	8	G	G
3892	6	G	G
3893	8	G	G
3894	8	G	G
3895	8	G	G
3896	8	G	G
3897	8	G	G
3898	5	G	G
3899	5	G	G
3900	8	G	G
3901	8	G	G
3902	6	G	G
3903	8	G	G
3904	6	G	G
3905	8	G	G
3907	8	G	G
3908	6	G	G
3909	8	G	G
3910	6	G	G
3911	6	G	G
3912	8	G	G
3913	8	G	G
3914	8	G	G
3915	6	G	G
3916	8	G	G
3917	6	G	G
3918	8	G	G
3906	8	G	G

Tree No.	D.B.H. inches	1938	1939	Tree No.	D.B.H. inches	1938	1939
3919	8	G	G	3940	6	G	G
3920	6	G	G	3941	10	G	G
3921	6	G	G	3942	6	G	G
3922	5	G	G	3943	10	G	G
3923	6	G	G	3944	8	G	G
3924	6	G	G	3945	8	G	G
3925	8	G	G	3946	8	G	G
3926	5	G	G	3947	6	G	G
3927	6	G	G	3948	6	G	G
3928	10	G	G	3949	5	G	G
3929	8	G	G	3950	8	G	G
3930	8	G	G	3951	8	G	G
3931	6	G	G	3952	10	G	G
3932	6	G	G	3953	6	G	G
3933	6	G	G	3954	10	G	G
3934	6	G	G	3955	8	G	G
3935	8	G	G	3956	6	G	G
3936	6	G	G	3957	8	G	G
3937	8	G	G	3958	6	G	G
3938	6	G	G	3959	6	G	G
3939	6	G	G	3960	5	G	G

Sample Plot VI

Location - 3.6 miles north of Meadow Creek Bridge. South line N.80°W. S.E. corner is Mt. Selkirk sign.

Tree species - Lodgepole pine

Tree Numbers - 774-776, 902-1100, 3677-3700, 1565-1581.

Area - 1 acre.

Current Examination - September, 1939.

Numbers 932 onward were numbered in 1939.

Tree No.	D.B.H. inches	1938	1939
774	12	D	D
775	12	D	D
776	10	D	D
902	12	D	D
903	12	G	D
940	12	D	D
905	6	D	D
906		T	D
907		T	D
908		G Attack	D
909		G Attack	D
910		G Attack	D
911		G Attack	D
912		G Attack	D
913		G Attack	D
914		G Attack	D
915		G Attack	G
916		G Attack	G
917		G Attack	D
918		G Attack	D
919		G Attack	D
920		G Attack	D
921		G Attack	D
922		G Attack	D
923		G Attack	D
924		G Attack	G Attack
925		G Attack	D
926		G Attack	D
927		G Attack	D
928		G Attack	D
929		G Attack	D
930		G Attack	G
931		D	D
932	8	G	G Attack
933	8	G	G Attack
934	6	G	G Attack
935	8	G	G Attack
936	5	G	G Attack
937	8	G	G Attack
938	6	G	G
939	10	G	G Attack
940	8	G	G Attack
941	8	G	G Attack
942	10	D	D
943	8	G	G Attack
944	8	D	D
945	10	D	D
946	10	G	G

Tree No.	D.B.H. inches	1938	1939
947	6	G	G
948	8	G	G Attack
949	5	G	G
950	10	G	G Attack
951	8	G	G Attack
952	8	G	G Attack
953	8	G	G Attack
954	8	G	G
955	6	G	G
956	10	G	G Attack
957	8	G	G Attack
958	10	G	G Attack
959	10	G	G Attack
960	8	G	G
961	8	G	G Attack
962	8	G	G G
963	6	G	G
964	5	G	G
965	8	G	G Attack
966	8	G	G
967	6	G	G attack
968	10	G	G Attack
969	6	G	G Attack*
970	10	G	G Attack
971	8	G	G Attack*
972	6	G	G
973	8	G	G Attack
974	6	G	G Attack
975	12	G	G Attack
976	10	G	G Attack
977	10	G	G Attack
978	6	G	G
979	10	G	G Attack
980	6	G	G
981	10	G	G Attack
982	8	G	G Attack
983	6	G	G
984	8	G	G Attack
985	10	G	G Attack
986	8	G	G Attack
987	10	G	G Attack
988	5	G	G Attack*
989	6	G	G
990	8	G	G Attack
991	10	G	G Attack*
992	12	G	G Attack
993	12	G	G Attack
994	10	G	G Attack*

Tree No.	D.B.H. inches	1938	1939
995	8	G	G Attack
996	8	G	G Attack
997	5	G	G Attack
998	8	G	G
999	8	G	G Attack
1000	5	G	G
1001	8	G	G attack
1002	10	G	G Attack
1003	8	G	G Attack*
1004	8	G	G Attack
1005	8	G	G Attack
1006	8	G	G Attack
1007	8	G	G Attack*
1008	10	G	G Attack
1009	6	G	G
1010	6	G	G
1011	8	G	G Attack
1012	8	G	G Attack
1013	8	G	G Attack
1014	8	G	G Attack
1015	6	G	G Attack
1016	8	G	G Attack
1017	6	G	G Attack
1018	8	G	G Attack
1019	10	G	G Attack
1020	5	G	G
1021	6	G	G Attack
1022	8	G	G Attack
1023	14	D	D
1024	12	G	G Attack
1025	10	G	G Attack
1026	12	G	G Attack
1027	10	G	G Attack
1028	5	G	G
1029	8	G	G Attack
1030	8	G	G Attack
1031	14	D	D
1032	12	D	D
1033	8	G	G Attack
1034	12	G	G Attack*
1035	6	G	G
1036	8	G	G Attack
1037	8	G	G
1038	10	G	G Attack
1039	6	G	G
1040	5	G	G
1041	6	G	G
1042	5	G	G
1043	8	G	G
1044	8	G	G Attack*
1045	8	G	G Attack*
1046	5	G	G Attack*
1047	8	G	G Attack
1048	5	G	G
1049	8	G	G Attack
1050	6	G	G Attack
1051	8	G	G Attack
1052	6	G	G
1053	8	G	G Attack
1054	8	G	G Attack
1055	6	G	G
1056	8	G	G Attack
1057	8	G	G Attack
1058	8	G	G Attack
1059	8	G	G Attack
1060	14	G	G Attack
1061	10	G	G Attack
1062	12	G	G Attack
1063	8	G	G Attack
1064	10	G	G Attack
1065	10	G	G
1066	8	G	G Attack
1067	8	G	G Attack
1068	8	G	G Attack
1069	10	G	G Attack
1070	10	G	G Attack
1071	10	G	G Attack
1072	8	G	G Attack
1073	6	G	G
1074	8	G	G
1075	6	G	G
1076	6	G	G
1077	8	G	G Attack
1078	10	G	G Attack
1079	8	G	G Attack*
1080	8	G	G Attack
1081	5	G	G
1082	8	G	G
1083	6	G	G
1084	6	G	G
1085	8	G	G Attack*
1086	8	G	G
1087	8	G	G
1088	8	G	G
1089	6	G	G
1090	10	G	G Attack

Tree No.	D.B.H. inches	1938	1939	Tree No.	D.B.H. inches	1938	1939
1091	6	G	G	3693	10	G	G Attack*
1092	8	G	G Attack	3694	8	G	G Attack
1093	10	G	G Attack	3695	14	G	G Attack
1094	6	G	G	3696	8	G	G
1095	8	G	G	3697	6	G	G
1096	6	G	G	3698	8	G	G Attack
1097	10	G	G Attack	3699	12	G	G Attack
1098	10	G	G Attack	3700	6	G	G
1099	8	G	G	1565	6	G	G
1100	8	G	G Attack	1566	10	G	G Attack
3677	8	G	G Attack	1567	10	G	G Attack
3678	10	G	G Attack	1568	10	G	G Attack
3679	10	G	G Attack	1569	8	G	G
3680	8	G	G	1570	6	G	G
3681	8	G	G Attack	1571	8	G	G
3682	10	G	G Attack	1572	5	G	G
3683	10	G	G Attack	1573	8	G	G Attack
3684	8	G	G Attack	1574	6	G	G
3685	8	G	G Attack	1575	8	G	G Attack
3686	8	G	G	1576	6	G	G Attack
3687	8	G	G Attack	1577	8	G	G
3688	8	G	G	1578	8	G	G
3689	6	G	G	1579	5	G	G
3690	8	G	G	1580	10	G	G Attack
3691	8	G	G	1581	6	G	G
3692	6	G	G				

Sample Plot VII

Location - 1.5 miles south of Meadow Creek Bridge.

Tree species - Lodgepole pine
Tree numbers - 778-901
Area - 1 acre
Current Examination - September, 1939.

Tree No.	D.B.H. inches	1938	1939
778	12	G	G
779	8	G	G
780	12	D	D
781	12	D	D
782	8	D	D
783	12	G	G
784	10	G	G
785	14	G	G
786	14	G	G
787	14	G	D
788	12	G	G
789	6	G	G
790	12	G	G
791	8	D	?
792	10	D	D
793	8	G	G
794	10	D	D
795	8	D	D
796	12	G	G
797	6	G	G
798	8	G	G
799	10	G	G
800	8	G	G
801	14	G	G
802	12	G	G
803	missing		
804	10	G	G
805	10	G	G
806	12	G	G
807	12	G	G
808	10	G	G
809	10	G	G
810	12	G	G
811	14	D	D
812	10	G	D
813	10	D	D
814	10	G	D
815	10	G	G
816	16	D	D
817	8	G	G
818	10	G	G
819	12	G	G
820	8	G	G
821	10	G	G
822	10	D	D
823	10	G	G
824	8	G	G
825	10	G	D

Tree No.	D.B.H. inches	1938	1939
826	10	G	G
827	10	G	G
828	8	G	G
829	8	G	D
830	10	G	G
831	10	G	G
832	10	G	G
(850)			
833	8	G	G
834	10	G	G
835	10	G	G
836	10	G	G
837	12	D	D
838	12	G	G
839	12	D	?
840	12	D	D
841	12	D	D
842	6	D	D
843	8	G	G
844	10	G	G
845	10	G	G
846	10	D	D
847	10	G	G
848	8	D	D
849	10	G	G
850	10	G	G
(832)			
851	10	G	G
852	10	G	G
853	8	G	G
854	10	G	G
855	8	G	G
856	12	G	G
857	8	G	G
858	10	D	D
859	14	D	D
860	10	D	D
861	14	D	D
862	10	D	D
863	12	G	G
864	10	G	G
865	8	G	G
866	8	G	G
867	10	G	G
868	12	D	D
869	12	G	G
870	14	D	D
871	10	D	D

Tree No.	D.B.H. inches	1938	1939
872	10	G	D
873	10	G	G
874	10	G	G
875	12	G	G
876	12	G	G
877	12	G	G
878	16	G	G
879	10	G	G
880	10	D	D
881	14	G	G
882	14	G	G
883	16	G	G
884	14	G	G
885	10	G	G
886	14	D	D
887	10	G	G
888	10	D	D
889	12	G	G
890	12	G	G
891	14	G	G
892	12	G	G
893	10	G	G
894	12	G	G
895	6	G	G
896	10	G	G
897	12	G	G (windthrown)
898	10	G	G
899	12	G	G
900	14	D	D
901	14	G	?

(see next page for plot analyses)

PLOT ANALYSES

Data Taken September 1938 and September 1939

	Trees Dead	Trees Green		Trees Turning	Trees Down	Unaccounted for
		Unattacked	Attacked			
Plot I						
1938	159	33	0	0	8	0
1939	158	31	0	0	104 (94 cut	3
% change	-.6	-6.1	0	0	+1200	∞
Plot II						
1938	102	126	0	0	22	2
1939	103	121	2	0	34	4
% change	+.98	-4.0	∞	0	+35.3	-100
Plot III						
1938	106	215	13	0	8	3
1939	110	180	42	2	12	3
% change	+4	-16.3	+223.0	∞	+50	0
Plot IV						
1938	3	176	0	0	13	0
1939	3	53	123	0	13	0
% change	0	-70.0	∞	0	0	0
Plot V						
1938	3	261	1	0	0	0
1939	5	260	0	0	0	0
% change	+.67	-.4	-100	0	0	0
Plot VI						
1938	6	212	24	1	0	0
1939	35	73	135	0	0	0
% change	+483.3	-65.5	+308.3	-100	0	0
Plot VII						
1938	27	94	0	0	1	2
1939	34	85	0	0	2 (1 green)	4
% change	+26.0	-9.6	0	0	+100	+100

In this analysis the plots to note particularly are III, IV, and VI. On plot III, the number of freshly attacked trees in 1939 increased 223% over that of 1938. The increase on plot IV was from 0 in 1938 to 123 trees in 1939. On plot VI, the increase in number of trees attached was 308.3%. These percentages of increase do not mean very much unless an appreciable number of trees are involved which is the case in all three instances. This indicates a tremendous increase in the bark beetle population on these three plots probably due to the mild winter preceding, which allowed a high percentage of the overwintering broods to come through in a healthy condition. On the accompanying map, the location of these plots should be noted in conjunction with the area where the infestation is still active.

On the remaining plots viz. I, II, V, and VII, there has been little change in number of trees attacked and this number has been very low, indicating a stationery bark beetle population on these older portions of the infestation. In other words the bark beetle population on the greater part of the infested area is back to normal, with a minimum of fluctuation from year to year.

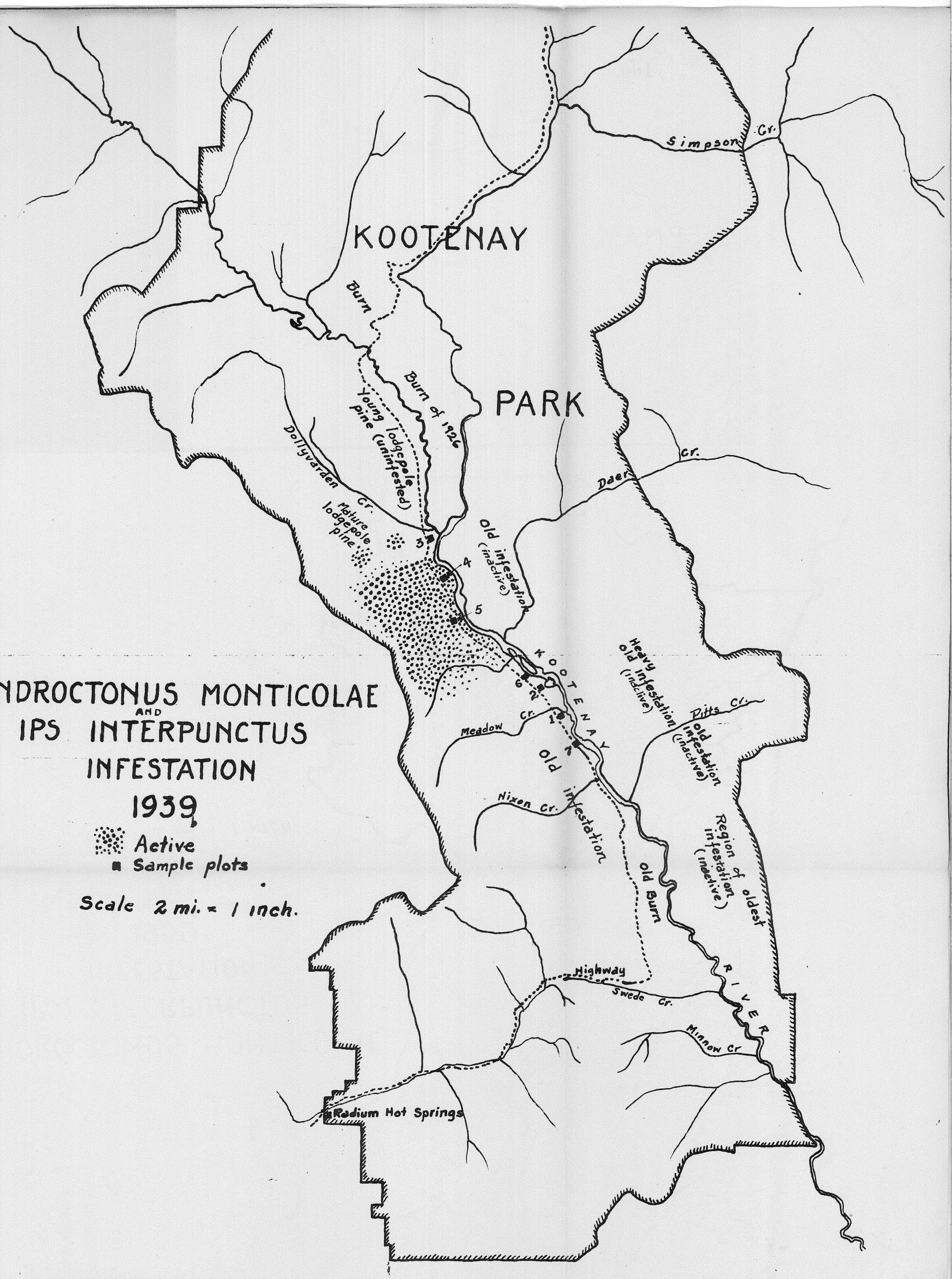
The work planned for 1940 is similar to that done in 1939 viz. a checking of the plots to determine the increase or decrease of the bark beetle population.

The cost for 1939 was as follows:

Salaries $50.00
Travel $49.78

Total - $99.78

There will be an increase in the cost of the work for 1940 to $233.46 as it is planned to make a more extensive examination of the area.



NDROCTONUS MONTICOLAE AND IPS INTERPUNCTUS INFESTATION 1939

Active

Sample plots

Scale 2 mi. = 1 inch.

Project E.30.20-1 - A Study of the Biologies of the Economically Important Ambrosia Beetles of the British Columbia Coast.

Object of Project:

The determination of the seasonal development and habits of the ambrosia beetles, Platypus wilsoni Sw., Gnathotrichus sulcatus Lec., G. retusus Lec., and Trypodendron cavifrons Mann., with a view to the avoidance of attack on green logs in the woods and the establishment of a quick method of destroying the insects in lumber. Work on the project was commenced in 1931.

Location of Work:

Vancouver, B.C., Steelhead, B.C., and various logging operations in the vicinity of Vancouver.

Officers in Charge and Complete Personnel:

Ralph Hopping	- Direction, 1931-38
Geo. R. Hopping	- Supervision of work, 1931-33. Direction, 1938-39.
W. G. Mathers	- Supervison and execution of work, 1934 to date.
H. B. Leech	- Assistant, 1931-33.
K. Graham	- Assistant, 1934 and 1935 in part.

Co-operation with Other Organizations:

The phases of the project dealing with kiln treatment and chemical treatment of lumber were carried out in co-operation with the Dominion Forest Products Laboratory at Vancouver. Work in connection with the determination of the relation of attack to miosture content of the wood has been carried out also in co-operation with the same laboratory.

Progress Report:

The progress made in this project prior to 1939 has been summarized in previous project statements, the work covered including seasonal development and habits of the various species of ambrosia beetles, destruction of the insects in lumber by kiln treatment, effect of air seasoning, experiments with chemical dips, relation of time of felling to attack and relation of moisture content of the sapwood to attack.

This year, 1939, the work on the project has been restricted to a few supplementary observations on flight periods and attacks. No report of serious damage by ambrosia beetles was received during the year. However, in an examination made on May 15, on a logging operation in timber fire-killed in July 1938, near Courtenay, B.C., considerable fresh Trypodendron cavifrons attack was found in recently felled timber and also at the base of standing killed Douglas fir and hemlock. Fresh attacks by the same species were also found on the logs of the repellent studies on Timber Berth "X", near Whonnock, B.C., on July 13. These logs had been cut on April 3 and 5 and this is apparently the first record of attacks by Trypodendron in this district on logs which have been cut for a period less than 4 months. These attacks were undoubtedly due, at least in part, to the scarcity of more desirable host material as a results of the fire which burnt over the area in 1938. The logs of the repellent studies were also attacked heavily during May and June by Gnathotrichus sulcatus, attacks by this species being first recorded on May 9. No records of attack by G. retusus were obtained during the year.

Future Work;

This project is to be discontinued for the duration of the present war emergency.

Project E.30.20-2 - Prevention of Ambrosia Beetle Injury to Felled Timber.

Object of Project:

The aim of this project is to determine the most satisfactory method of preventing attacks by ambrosia beetles on green logs in the coast district of British Columbia. Experiments with repellents as a possible means of preventing attack have been carried on since 1935.

Location of Work:

Logging operations near Vancouver, B.C.

Officers in Charge and Complete Personnel:

Geo. R. Hopping - Direction of Project
W. G. Mathers - Supervision and Execution of Work.

Method Employed:

Solutions have been tested on logs in the field, the materials being applied in the month of May with a bucket pump sprayer, to hemlock logs 10 feet in length and ranging from 8 to 16 inches in diameter. Following the application of the sprays, periodical inspections of the logs are made and all new ambrosia beetle attacks, as indicated by the fresh frass, are recorded at each examination in order to determine the relative effectiveness of each solution.

Progress Report:

Prior to 1939, a total of 67 logs had been used in these experiments. 46 of the logs were treated while the remaining 21 were used as checks. 36 different solutions were tested and these included:

a. Light and dark creosote-kerosene mixtures.
b. Lime sulphur solutions.
c. Bordeaux mixtures.
d. Sulphite waste liquid, from the Powell River Paper Company.
e. Miscible oil.
f. Sodium fluoride emulsion.
g. Colloidal lead arsenate solutions.
h. Quassia solutions.
i. Microsul, a micronized sulphur compound.
j. Bouisol, a colloidal copper compound.

k. Pyridine.
l. Lignasan, a mercury chloride compound used for the protection of lumber from stain.
m. Dowicide, a sodium pentachlorphemate product used for the same purpose as Lignasan.

A number of the solutions were tried only once, tests of a solution being repeated in the following year only when they were warranted by the results obtained.

Of all the solutions tested prior to 1939, creosote-kerosene mixtures consistently showed the most promise. As a result, the work this year consisted of again testing the following creosote-kerosene solutions:

Light	creosote	- kerosene,	1:3.
"	"	"	1:6.
"	"	"	1:10.
Dark	"	"	1:10
"	"	"	1:15.

In addition, however, tests were also made with diesel oil, as a report had been received late in 1938 that a logging company in the State of Washington had used it for a repellent with satisfactory results.

The work this year was again located on Timber Berth "X" near Whonnock, B.C. 18 logs were used (see Photo), the diameters of which were as follows:

Log No.	Diameter inside Bark Butt	Top	Log No.	Diameter inside Bark Butt	Top
1.	12.0"	10.5"	10.	12.0"	11.0"
2.	10.5"	10.0"	11.	11.0"	10.0"
3	10.0"	9.0"	12.	10.0"	9.0"
4.	9.0"	7.5"	13.	9.0"	7.5"
5.	15.0"	13.0"	14.	16.0"	13.0"
6.	13.0"	11.5"	15.	13.0"	12.0"
7.	11.5"	9.5"	16.	12.0"	11.0"
8.	9.5"	8.0"	17.	11.0"	9.5"
9.	14.5"	12.0"	18.	9.5"	7.5"

Logs 5 to 8, 9 to 13, and 14 to 18 were from three hemlocks, respectively, felled on April 3rd, while logs 1 to 4 were from a hemlock felled on April 5th. The trees were cut into the log lengths on the same day they were felled. The moisture content (MC) of the sapwood at the top end of each log was determined from samples taken on the same dates. The determinations, to a depth of one inch and expressed in percentage of dry weight, are recorded in Table III. The number of growth rings showing on the stumps of these trees were between 40 and 42.

Showing logs used in Ambrosia beetle repellent studies - 1939.

Photo by W.G.M.

All the logs were placed in parellel positions on an old skid-road with medium shade. The logs were treated on May 9th. On the same date attacks by Gnathotrichus, ranging from nil up to 23, were found to have already taken place on the logs, but the location of these attacks were recorded prior to the application of the sprays.

A summary of the attacks recorded following treatment is to be found in Table III. However, of the attacks found on May 24 and June 13, approximately 80 per cent were by Gnathotrichus while the balance were by the bark beetle Pseudohylesinus tsugae.

Table III.

Repellent Studies - 1939.

Log No.	MC	Treatment	No. of Fresh Attacks on Logs May 24	June 13	July 12	Totals
1.	162%	L. creosote-kerosene 1:3	5	4	49	58
2.	183%	Diesel oil	24	93	270	387
3.	192%	D. creosote-kerosene 1:15	2	11	77	90
4.	171%	Check	15	19	10	44
5.	207%	Diesel oil	39	54	230	323
6.	207%	D.creosote-kerosene 1:15	5	25	110	140
7.	202%	L.creosote-kerosene 1:10	-	5	55	60
8.	197%	D.creosote-kerosene 1:10	-	4	18	22
9.	194%	Check	20	13	6	39
10.	190%	L.creosote-kerosene 1:10	1	3	19	23
11.	203%	Diesel oil	10	28	65	103
12.	196%	L.creosote-kerosene 1:6	-	1	12	13
13.	181%	Check	-	4	1	5
14.	156%	L.creosote-kerosene 1:6	-	5	50	55
15.	163%	Diesel oil	30	81	95	206
16.	178%	D.creosote-kerosene 1:10	5	26	75	106
17.	202%	Check	4	11	15	30
18.	188%	L.creosote-kerosene 1:3	-	1	22	23
		Totals	160	388	1179	1727

The results showed that diesel oil, under this year's experimental conditions, is ineffective as a repellent for either ambrosia beetles or bark beetles, for within two weeks following treatment, from 10 to 39 fresh attacks had occurred on the diesel oil logs. On the other hand, no more than 5 attacks occurred on any log treated with a creosote-kerosene mixture, in the same period. Moreover, it was evident from this year's experiment that of the creosote-kerosene mixtures, single application of dilutions up to 1:10 will give reasonable protection for a period of only two to three weeks. It was also evident from observations, however, that the creosote mixtures used, were 100 per cent effective in stopping the work of the ambrosia beetles which had attacked the logs prior to treatment, whereas 14 of 25 such attacks on the diesel oil logs were still active on May 24, two weeks after the oil was applied. On the same date, all but 1 of 14 such attacks on the check logs were still active.

The investigations to date have met with practically no success towards finding a satisfactory repellent for ambrosia beetles attacking green coniferous logs in this district. Such a repellent would need to be cheap and, moreover, retain its effectiveness for at least one month for, in the system of logging now used on large operations, logs usuaally remain in the woods for at least 90 days after the trees are felled and bucked, and are liable to attack by ambrosia beetles from April to September.

Future Work:

An interim report on this project will be prepared for, under present conditions, it has been considered advisable to discontinue the investigation of repellents.

E.30.24 - Ellopia somniaria Hulst. - Reconnaissance of Outbreaks.

Because of lack of time and men and also because of the large increase in forest insect survey work, this investigation has been confined to examination of outbreak areas and a small experiment relating to fecundity carried out at Trinity Field Station.

The Blackwater Lakes area in the Big Bend region was examined by G. R. Hopping on July 23rd and it was found that larvae were very difficult to find and the epidemic had completely subsided. The Wilson Lake area was checked in late September, and the total absence of moths and late larvae indicated complete subsidence of the outbreak. A report from rangers regarding the Trout Lake areas indicated that the same conditions prevailed there, so it appears that epidemics of the hemlock looper in the interior of the province are at an end for the time being.

Fecundity Studies

In 1937 egg production from 100 females was studied. Each female was confined separately with two males. For convenience in statistical handling these were divided into ten lots of ten each, with the following results:

Basis 98 females (two lots had 9 females each)

Total eggs laid	5579
Ave. eggs per female ...	56.9
Total eggs hatched	4741
Percent. hatched	84.9

Larvae hatching from the above eggs were reared but unfortunately, appointments came through from Ottawa too late and hatching had commenced before counting took place. Many of the young larvae had been several days without food and were weak to start with. Hence, only 35 females were produced from this material. These were augmented from survey material so that in the fall of 1938 it was possible to mate 47 females with two males each. Of the 47, several females died without laying eggs and infertility seemed to be the cause of failure to hatch in many cases. Consequently only ten or twelve fertile lots of eggs were obtained. The number of eggs laid per female in the fall of 1938 and the subsequent number of eggs hatching in the spring of 1939 are shown in the following table. Hatching took place between June 2nd and 13th with the peak between June 5th and 7th.

Lot Number	Eggs per female	Eggs hatched		Lot Number	Eggs per female	Eggs hatched
1	23	-		25	40	31
2	26	-		26	12	5
3	40	-		27	19	-
4	25	-		28	39	30
5	63	-		29	58	22
6	55	-		30	42	-
7	104	-		31	49	-
8	52	-		32	9	8
9	37	-		33	24	-
10	0	-		34	33	-
11	0	-		35	35	-
12	35	27		36	46	-
13	45	24		37	39	-
14	34	-		38	77	-
15	30	-		39	55	-
16	88	-		40	20	-
17	41	-		41	52	-
18	17	-		42	27	-
19	47	20		43	55	-
20	53	33		44	0	-
21	41	-		45	0	-
22	70	61		46	0	-
23	51	-		47	0	-
24	35	-				

Summary

Total eggs laid 1743
Ave. eggs per female 37.1
Total hatched 261
Percentage hatched 14.9

Future Work

Only 18 females and 20 males were produced from the above material. As many females as possible were mated with the available males and eggs were secured which have been overwintered and will be counted in the spring of 1940. Extreme care will be taken in 1940 to see if this population can be maintained and increased.

The cost for 1939 amounted to $63.00. The cost of doing the small amount of work with the above material in 1940 will be practically nothing as the work will be done along with forest insect survey rearings at Trinity Valley Field Station.

Project E.30.25-2 - Satin Moth, Stilpnotia salicis L., in British Columbia

Object of Project:

The control, distribution and bionomics of the satin moth in British Columbia.

Nature and Importance of project:

The satin moth is a native of Europe and Western Asia. It was first found in British Columbia in July, 1920, in which year it was observed defoliating Lombardy poplars in New Westminster. As the species is a near relative of the destructive gypsy and brown-tail moths, this project was undertaken.

Since its discovery in British Columbia, the satin moth has spread considerably into new localities, having become thoroughly adapted to feeding on native poplars and willows. As a result, the species is now of major economical importance and every precaution is being taken to prevent its spread to the Interior of the province.

Location of Work:

Southern coast district of British Columbia.

Officers in Charge and Complete Personnel:

Prior to 1939: R. Glendenning in charge, assisted by various seasonal assistants.

Officers now concerned:

Geo. R. Hopping - Direction of project.
W.G. Mathers - Supervision and execution of work.

Co-operation with Other Organizations:

As the satin moth was an introduced pest, the Division of Foreign Pest Suppression has been particularly interested in this project and for several years provided assistants for scouting. Moreover, in 1928, Regulation No. 9 (Domestic) Destructive Insect and Pest Act, restricting the movement of the host plants, was placed in effect in an endeavour to prevent the spread of the pest.

Progress Report:

This project was commenced in 1920 and until the spring of 1939, when it was transferred to the Vancouver Forest Insect Laboratory, was under the jurisdiction of the Agassiz Laboratory. The following summary of the work done on the project prior to 1939 is based on reports of R. Glendenning.

During the years 1920-23, the life history of the satin moth was studied intensively in its new environment. At that time its ravages were confined to the introduced species of poplar used as shade trees in the coast cities of British Columbia, and a satisfactory control by spraying was established. Since then the species has altered its food habits and subsequent studies showed a gradual adaptation to feed on native poplars and willows. This change of food habit was accompanied by a great extension of range.

During the seasons of 1929 to 1932, the extent of the infested area was delimited by scouts provided by the Division of Foreign Pest suppression, and during this scouting it was observed that accidental dispersal by means of the moths being carried on boats and trains might be a serious obstacle to preventing its spread.

As the satin moth, when it became established on the native cottonwood, was impossible to control by artificial means, the introduction of parasites was commenced in 1929. In that year and in the following four years, close to 3,000 adults of the tachinid, Compsilura concinnata, received from the Belleville Laboratory, were liberated, but no recoveries of this species have been made to date.

In 1933, close to 7,000 adults of the pteromalid, Eupteromalus nidulans, were liberated and in 1934 an additional 4,900 specimens of the same species and over 500 adults of the braconid, Meteorus versicolor, were also released, but apparently neither of these species became established.

However, in 1933 approximately 700 adults of the braconid, Apanteles solitarius, were liberated on May 31st and within a month cocoons of this species were noticed in the field and in July adults were recovered several miles from the point of liberation. By the following year the natural spread had extended to at least 20 miles and by transferring 1,500 satin moth caterpillars and 60 Apanteles cocoons from the parasitized area to the Lillooet district in the first part of May, 1934, the parasite was successfully established in the latter district.

Since 1934, Apanteles solitarius has been an important factor in almost eliminating the satin moth in many areas and in definitely checking the eastward spread of the pest.

At the present time the satin moth infestation is apparently in a state of equilibrium in the coast district, and as a result, the work in 1939 consisted of maintaining a lookout for any increase in the population of the species and for any spread in its distribution. Infested trees on the campus of the University of British Columbia, Vancouver, and in Victoria, B.C., were examined furing the year out no increase in defoliation over the past few years was observed. The parasite, Apanteles solitarius, is still very much in evidence and is undoubtedly the main factor keeping the satin moth in check in this locality.

Future Work:

The surveillance of 1939 should be continued and as Apanteles solitarius is desired for colonization in eastern Canada, a close watch should be maintained for the occurrence of the parasite in sufficient numbers for the purpose.

Publications:

Glendenning, R.

1924 - The satin moth in British Columbia. Dom. Dept. Agr., Ent. Br., Pamphlet No. 50, n.s. (Revised in 1929 and in 1932).

1929 - Host adaptation in the European satin moth. Proc. Ent. Soc. of B.C., 26:34-38.

McLaine, L. S. & R. Glendenning

1929 - The spread and distribution of the satin moth in British Columbia. 60th Ann. Rept. Ent. Soc. of Ontario:70-73.

Project E.30.32-1 - Elm Scale Control

Object of Project:

To reduce the elm scale, Gossyparia spuria, infestation on boulevard elms in the city of Vancouver to prevent the death of the trees.

Nature and Importance of Project:

This scale was first reported in British Columbia in 1933 and was then well established on some 1,000 boulevard elms in the Shaughnessy district of Vancouver. The less vigorous trees were rapidly being killed and prompt efforts to reduce the scale infestation were necessary.

Location of Work:

City of Vancouver, B.C.

Officers in Charge and Complete Personnel:

Prior to April, 1939: R. Glendenning in Charge.

Officers now concerned:

Geo. R. Hopping - Direction of project.
W. G. Mathers - Supervision and execution of work.
R. H. Longmore - Assistant in scouting.

Co-operation with Other Organizations:

The Parks Board of the city of Vancouver has provided all labour, equipment and material for the spraying operations.

Methods Employed:

The Division of Entomology has been responsible for delimiting the infestation each year and for advising the Vancouver Parks Board on the control programme that should be followed. The actual spray operations have been carried out by the Parks Board, under the supervision of an officer of the Division.

Progress Report:

This project was under the jurisdiction of the Agassiz Laboratory, B.C., from its inception in 1934 to April, 1939, when it was transferred to the Vancouver Forest Insect Laboratory.

The following summary of the work on this project prior to 1939 is from progress reports of R. Glendenning.

First operations were conducted in 1934 and consisted in delimiting the infestation and directing spraying operations by the Parks Board's employees. An 8 per cent oil emulsion was applied and gave good control.

No further spraying was necessary in 1935 or 1936, but the infestation had increased again by spring 1937 and further spraying was necessary in that year and in 1938.

In 1938, 5,000 gallons of 5 per cent Ortho-Kleenup oil emulsion was applied in March, the operation taking seven days. Subsequent examination in May of that year showed very irregular control which was not understood. However, scouting in the autumn of 1938 and spring 1939 showed the infestation to be sufficiently reduced that the Parks Board was advised that no spraying would be necessary in the spring of 1939.

Preliminary scouting in the fall of 1939, however, indicated that spraying would again be necessary in the spring of 1940 (See Photos). A survey of all boulevard elms in the city was then undertaken by W. G. Mathers, assisted in part by R. H. Longmore. These elms are located on approximately 25 miles of streets, for the most part in the Shaughnessy and Point Grey districts. The survey showed the infestation to be very spotty and as we had been advised that the city's finances would permit only a very limited spray programme, if any, the heavy and medium infested areas were listed separately. In submitting the two lists to the Parks Board, it was pointed out that for satisfactory control, all the areas listed should be sprayed, but if sufficient funds were not available, it was very important that at least the heavily infested sections be treated, otherwise many of the trees on such areas would eventually be killed by the scale. It was also recommended that in all cases, healthy vigorous growth should be encouraged. In this connection, the survey showed that a heavy pruning of infested trees is extremely helpful in that not only are large numbers of the scale removed by the pruning, but the resulting new growth is much more vigorous and more resistant to attack.

Showing elm scale infested boulevard elm, heavy infestation. Vancouver, B.C., September, 1939.

Showing elm scale infested boulevard elms, light and medium infestations. Vancouver, B.C., September, 1939.

Photos by W.G.M.

The spraying of the heavily infested areas was carried out by the Parks Board between March 13 and 21. A total of 1600 elms, located on about 100 city blocks, were treated. Approximately 5,000 gallons of 7 per cent Shell Neutrol "A" oil emulsion were applied at an average cost to the Parks Board of about 20 cents per tree. The operation took 6 working days with 4 men, 1 truck and driver. Unfortunately, the spraying was interrupted by rain but ideal conditions prevailed during the last four days of the operation. 1940

Future Work:

The results of the spray work are to be checked this spring and further scouting should be undertaken in the fall of 1940.

Project E.30.37-2 - Identification and Control of Miscellaneous Insects Affecting Forest Products

Object of Project:

This project provides for the investigation of reported insect damage to forest products for the purposes of determining the insect responsible, the nature and extent of damage and the formulating of measures of control or prevention.

Location of Work:

Vancouver, B.C., and surrounding district.

Officers in Charge and Complete Personnel;

Geo. R. Hopping - Direction of project.
W. G. Mathers - Supervision and execution of work.

Co-operation with Other Organizations:

This project is being carried out in co-operation with the Dominion Forest Products Laboratory at Vancouver, through which many of the reports of damage to forest products have been received.

Methods Employed:

Reports of insect damage to forest products are investigated and records made of pertinent data such as, insect responsible, nature and extent of injury and probable source of infestation. When the insect is not known, specimens for identification, are reared when possible, from infested material in the laboratory. In many instances recommendation for control is made. Methods of control are also investigated and in this connection, trial kiln runs for the control of insects in infested material have been made in co-operation with the Forest Products Laboratory.

Moreover, reference collections are being assembled at the laboratory, of insects found attacking forest products. These collections include larval and adult specimens of the insects, samples of their work and also samples of their frass.

Progress Report:

This project was started in 1934 and a summary of the work done prior to 1939 was included in the Annual Report for 1938.

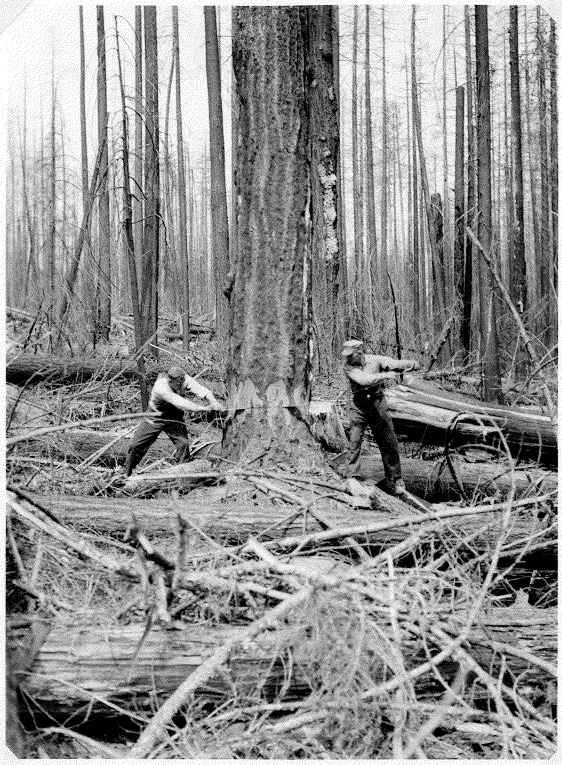
During 1939, 20 reports of insect damage to forest products were received by the Vancouver Laboratory. One of these reports was concerned about Lyctus in imported ash lumber, another about Siricid damage to cedar poles, and a third in regard to an undetermined borer in Australian gumwood, while the balance were about either termites or carpenter ants. Eight requests for information on the control of fleas in sawdust, were received during the year.

Lyctus Injury

A report of Lyctus infesting imported ash at a local ski factory was investigated on August 8th. The damage was confined to only a few boards, ½" x 8" x 12', which were part of a shipment imported from the United States about six months previously and had been stored undisturbed at the factory. Adults of the Lyctus were emerging at the time the boards were examined but the species has not yet been determined.

Siricid Injury to Cedar Poles

In January, 1939, insect injury to cedar poles recently cut from timber fire-killed in July, 1938, was referred to the Vancouver Laboratory for identification. The injury proved to be the work of an undetermined species of Siricid or horntail, which had apparently attacked the timber immediately after the fire. The poles were being purchased by a power company for local use and on January 20th an inspection was made of a number of the poles which had already been delivered to the company's yard. Several heavily infested poles were found but they were almost impossible to detect until the poles were shaved, a practice which is used by the local company. Larvae up to ½ inch in length were present in the infested poles and the galleries penetrated the wood to a depth of 1 inch. The injury would have practically no effect on the strength of the poles, but the objection was raised by the company's inspector that the presence of the larvae might attract woodpeckers. In this regard, occasions have occurred in this district where it was necessary to replace poles in service due to the disturbances caused by woodpeckers working on the poles. As this was our first complaint of Siricid injury, an examination was made on May 15th of the large fire-killed area near Courtenay, B.C., and from which the poles had been received. (See Photos). However, the Siricid attacks had apparently been limited to a relatively small area for on the receipt of the original complaint, the pole cutting operation was moved only a short distance and no further complaints were received, nor did the examination on the area disclose any attacks. Attempts to rear adults from infested material at the laboratory were unsuccessful.



Felling Douglas fir on fire-killed area near Courtenay, B.C. May, 1939.

Cedar poles cut on fire-killed area near Courtenay, B.C. May, 1939.

Photos by W.G.M.

Termites

Attacks by the termite, Zootermopsis angusticollis Hagen, on the older dwellings in the Vancouver district constitute a serious problem. Instances of expenditures of expenditures of from $300 to $500 for replacement work were reported during the year. As has been mentioned before, such damage is usually closely associated with rot and in the majority of cases is due to faulty construction (See Photos). Nine reports of termite damage were received during the year, the following being of particular interest.

In March a report of termites working in close association with rot in the supporting timbers of a large stave pipe at Powell River, B.C. was received from H. W. Eades, Timber Pathologist of the Dominion Forest Products Laboratory, who had just returned from an inspection of the damage. The stave pipe is 12 feet in diameter, about one mile in length and has been in service for 9 years. Thepipe rests in wood cradles on cross beams supported in some cases as high as 20 feet from the ground on upright timbers. The main termite and rot damage occurred in the cradles where considerable moisture had gathered and in several instances the attack extended into the pipe staves which are 3⅜ inches thick. The remedies recommended for the control of the rot should also be effective against the termites.

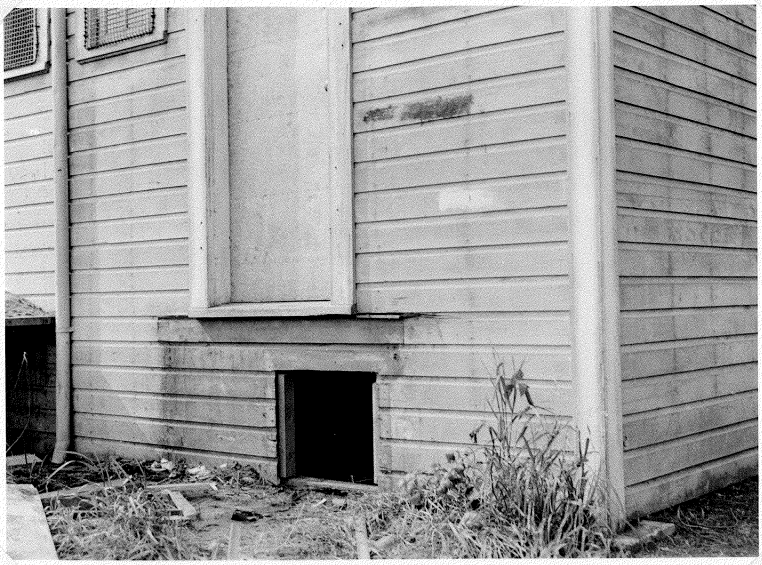
In August termite damage to the foundation timbers of a building in Vancouver was examined. A section of 6" x 6" Douglas fir over 6 feet long riddled by termites had already been replaced. This timber had been in place 11 years and although on concrete, conditions had been very damp due to the lack of sufficient ventilation.

Reported termite damage to the roof of a dwelling near Cloverdale, B.C., was investigated in October. The roof had been leaking at a point where holes had appeared in the shingles, and in the course of reshingling the damaged shingles were found to be directly over two sections of Douglas fir sheathing which were heavily infested with larvae of Buprestis aurulenta, adults of which have since been reared at the laboratory from samples of the infested sheathing. The holes in the shingles had been made by emerging beetles. The infested boards consisted of considerable sapwood with an edging of bark, but as they had been in use for at least 5 years, the presence of the live flathead larvae at this time makes a very interesting record. A large number of dealated adults of the native dampwood termite, Zootermopsis nevadensis were found present in the workings of the larvae. No immature termites were present. The damaged boards were very wet, due to rain leaking through to them and the winged termites had gained entrance to them through the holes in the overlaying shingles.

Showing sample sections of termite damaged foundation timbers removed from buildings in Vancouver, B.C.

Front of store being rebuilt as the result of termite and rot damage to foundation timbers. Vancouver, B.C.

Photos by W.G.M.



Showing type of construction liable to attack by termites. Concrete corner post too low so that sill and siding in contact with ground. Termite work evident in sill at window opening.

Same building as above, showing concrete replacement work undertaken as result of termite attack. Vancouver, B.C.

Photos by W.G.M.

Carpenter Ants

(See Photo)

During 1939, eight reports of carpenter ants infesting studding, flooring or joists of buildings in Vancouver, were received. Such attacks are difficult to avoid, but very satisfactory control of established colonies can be obtained with derris powder. On the suggestion of W. Downes, derris powder was used successfully in October to kill out a colony in the wall of a private dwelling in Vancouver. The ants were apparently active in the wall fully 6 feet from any opening, but by applying the powder with a hand blower into crevices leading into the workings of the ants, complete control was obtained.

Future Work:

In view of the importance of insect damage to forest products, this project should receive additional attention during the present war emergency. The work should include primarily, a general survey of such damage in the Vancouver district. Moreover, as there is a very definite need for information on control and prevention of damage by termites in this district to be available in printed form, a joint publication with the Dominion Forest Products Laboratory on this subject would be considered advisable.

Showing carpenter ant work in section of Douglas fir post.

Photo by W.G.M.

E.30.40 - A Study of the Bionomics and Control of the Douglas Fir Tussock Moth

The Douglas fir tussock moth, Notolophus pseudotsugata McD. occurred in outbreak numbers on at least four small areas in the north Okanagan Valley in 1939 and caused considerable damage to shade trees in the vicinity of farm houses.

Damage occurred in 1938 in the following places:

(1) A.W. Hunter's farm on the east side of the Vernon-Armstrong road, between Armstrong and Larkin. Six Douglas fir shade trees were quite severely defoliated and the tops of one or two may die.

(2) Jack Fowler's farm, 2 miles west of Landsdowne. About 30 Douglas firs grouped around the barn and house were partially defoliated.

(3) John W. Pinniger's farm north-east of Armstrong. Group of about 10 trees around the house and extending over about 40 acres at the base of the hill.

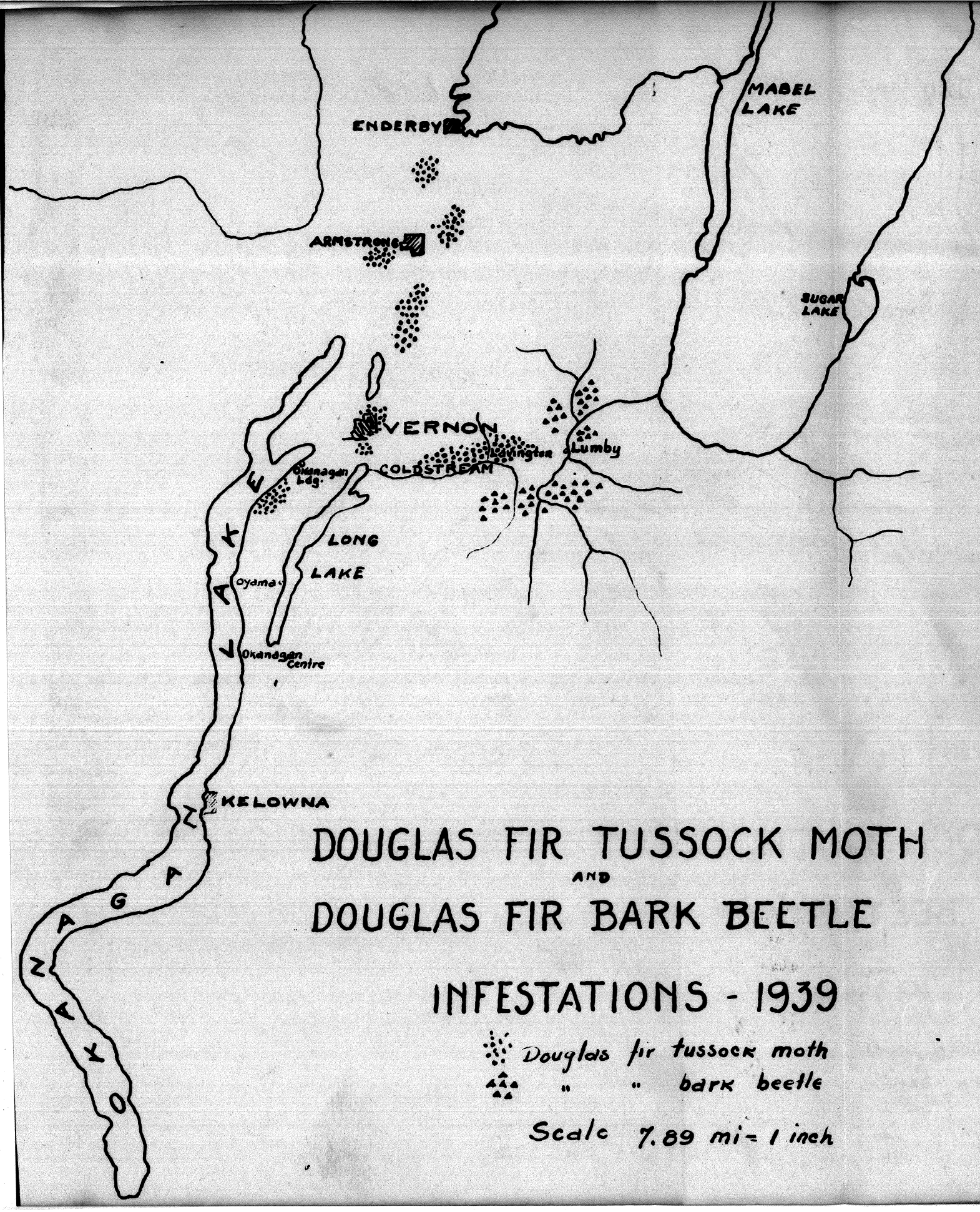
(4) H.W. Galbraith's farm in the Coldstream district. Five Douglas fir trees affected in varying degrees but no complete defoliation.

(5) Ray Noble's farm, three miles west of Armstrong. About twelve trees quite severely defoliated.

(6) City of Vernon. A number of shade trees on Seventh Street were heavily fed upon. Infestation promised to increase in 1939.

(7) Along the north side of Coldstream Valley for a distance of two miles. Greatest defoliation was in the tops of the trees which appeared quite reddish-brown toward the fall of the year.

The Douglas fir on all the larger areas noted above is scattered and of poor quality, growing on the drier, rocky sites.


MABEL LAKE
ENDERBY
ARMSTRONG
SUGAR LAKE
VERNON
Lumby
Okanagan Ldg.
COLDSTREAM
LONG LAKE
Oyama
Okanagan Centre
KELOWNA
OKANAGAN
DOUGLAS FIR TUSSOCK MOTH
AND
DOUGLAS FIR BARK BEETLE
INFESTATIONS - 1939
Douglas fir tussock moth
" " bark beetle
Scale 7.89 mi = 1 inch

The development of the tussock moth in 1940 ~~is~~ will be of considerable interest. It almost disappeared on the farms of Hunter, Fowler, Pinniger, and Galbraith, apparently due to virus disease in 1939. On Ray Noble's place, however, the caterpillars emerged from eggs in great numbers and the larvae were apparently healthy up to the third instar when Mr. Noble sprayed the trees with arsenate of lead. Good control was obtained but it was necessary to top two of the trees due to injury from feeding of the year before.

Four other small outbreaks were discovered in 1939, one on the slopes east of Larkin, one west of Armstrong, one at Cameron's Point on Okanagan Lake, and one in the hills between Vernon and the North Arm of Okanagan Lake. None of these areas was over a few acres in extent.

On all areas the caterpillar population was greatly reduced in 1939 apparently by a virus disease. More intensive studies of this disease are contemplated in 1940, providing sufficient material is available.

Data on the Egg Stage.

In 1939 egg hatching commenced on May 15th in the Vernon district but seemed to be considerably later on the Noble farm near Armstrong. Hatching in the outside insectary commenced on June 5 for the Lavington material and on June 11 for the Armstrongmaterial. It continued into July. Following is a summary of egg data taken previous to 1939.

Armitage Place, near Salmon Arm, B.C., Nov. 9, 1936.

Number of egg masses	30
Total number of eggs	6265
Average eggs per female	208.8
Number of good eggs	5942
Numberof parasitized eggs	323
Percentage parasitism	5.15

Lavington, B.C., Nov. 8, 1938. (tree tops)

Number of egg masses	10
Total number of eggs	1294
Average eggs per female	129.4
Number of good eggs	1178
Number of light eggs	84
Number of parasitized eggs	32
Percentage parasitism	2.5

Lavington, B.C., Nov. 8, 1938 (lower branches)

Number of egg masses	20
Total number of eggs	2690
Average eggs per female	134.5
Number of parasitized eggs	52
Percentage parasitism	2.0

Armstrong, B.C., Nov. 9, 1938 (Pinniger's farm)

Number of egg masses	10
Total number of eggs	1431
Average eggs per female	143.1
Number of good eggs	1412
Number of light eggs	11
Number of parasitized eggs	8
Percentage parasitism	.56

Egg Data - 1939

The following counts were made by treating the egg mass with 10 per cent KOH and counting the good eggs, light eggs, and parasitized eggs as evidenced by the dark colour. The eggs were collected on April 3, 1939 at Lavington, B.C.

Egg mass	Good eggs	Light eggs	Parasitized	Total eggs per female
1	157	1	5	163
2	184	2	6	192
3	146	1	3	150
4	141	1	2	144
5	194	1	7	202
6	202	5	11	218
7	162	3	0	165
8	174	1	3	178
9	204	2	4	210
10	226	7	8	241
11	213	2	5	220
12	185	29	0	214
13	91	0	2	93
14	112	6	2	120
15	179	7	8	194
16	201	1	0	202
17	173	1	5	179
18	151	0	4	155

Egg mass	Good eggs	Light eggs	Parasitized	Total eggs per female
19	192	1	9	202
20	211	3	8	222
21	197	1	1	199
22	137	0	4	141
23	152	1	4	157
24	149	3	5	157
25	205	4	9	218
26	176	0	4	180
27	153	1	5	159
28	172	12	5	189
29	193	1	3	197
30	178	4	8	190
31	237	1	12	250
32	102	0	5	107
33	172	1	11	184
34	203	2	8	213
35	188	3	0	191
36	181	3	4	188
37	147	3	10	160
38	156	2	1	159
39	123	0	4	127
41	124	2	6	132
42	194	3	5	202
43	93	2	9	104
44	123	1	5	129
45	161	0	7	168
46	144	0	4	148
47	174	7	4	185
48	203	0	4	207
49	186	1	0	187
50	181	0	6	187
40	169	6	3	178
Total	8471	138	248	8857

Summary

Number of egg masses	50
Total number of eggs	6265
Average eggs per female	177.14
Number of good eggs	8471
Number of light eggs	138
Number of parasitized eggs ...	248
Percentage parasitism	2.8

Hatching of Eggs

Armitage Place, near Salmon Arm, B.C., Nov. 9, 1936
Hatching took place in spring 1937.

Number of egg masses	10
Number of caterpillars	2092
Average number per egg mass..	209.2

Lavington, B.C.

Eggs collected March and April, 1939
Eggs counted January, 1940.

Egg mass	Eggs laid per female	Eggs hatched	Eggs parasitized	Trichogramma minutum emerged	Telenomus sp. emerged
1	127	72	7	16	0
2	95	89	3	14	0
3	138	92	34	33	0
4	93	82	6	11	0
5	156	141	0	0	0
6	131	78	41	0	32
7	148	134	8	6	00
8	127	98	4	8	0
9	156	148	0	0	0
10	97	50	16	0	8
11	109	97	9	2	0
12	184	171	6	9	0
13	146	123	21	0	15
14	195	179	9	0	5
15	211	185	11	32	0
16	139	125	9	11	0
17	83	36	17	14	0
18	202	197	1	1	0
19	161	134	14	37	0

Egg mass	Eggs laid per female	Eggs hatched	Eggs parasitized	Trichogramma minutum emerged	Telenomus sp. emerged
20	134	121	1	0	0
21	158	44	28	21	0
22	241	201	32	12	0
23	179	176	2	0	0
24	162	140	11	21	0
25	137	130	4	0	0
26	163	144	17	16	0
27	110	56	9	10	0
28	165	152	8	10	3
29	139	102	35	10	7
30	89	33	12	0	11
31	177	46	73	160	14
32	88	67	6	5	0
33	98	96	0	0	0
34	131	115	9	0	4
35	182	176	0	0	0
36	73	17	0	0	0
37	196	165	26	0	7
38	188	166	16	27	0
39	135	110	21	18	0
40	146	52	73	93	3
41	108	105	0	0	0
42	132	114	14	0	5
43	136	133	0	0	0
44	73	56	12	34	0
45	110	106	0	0	0
46	123	39	9	0	4
47	156	137	14	7	10
48	126	124	0	0	0
49	138	113	18	9	0
50	178	170	4	0	3
Total	7069	5524	670	647	131
Average	141.38	110.48	13.4	12.94	2.62

Summary

Number of egg masses 50
Total number of eggs laid 7069
Average number of eggs per female 141.38
Total number of eggs hatched 5524
Average hatch per egg mass 110.48
Total eggs parasitized 670
Total parasite emergence 778
Percentage of parasitism 9.47

Armstrong District

Eggs laid in 1938
Eggs collected March, 1939.

Note: - No Trichogramma emerged from this lot.

Egg mass	Eggs laid per female	No. of Eggs hatched	No. of eggs parasitized	Chalcids emerged.
1	83	43	0	0
2	139	138	0	0
3	159	82	0	0
4	109	85	0	0
5	126	94	23	19
6	193	185	0	0
7	91	59	0	0
8	154	152	0	0
9	73	8	0	0
10	170	167	0	0
11	139	117	2	1
12	123	43	6	6
13	134	126	0	0
14	94	83	0	0
15	165	163	0	0
16	136	131	3	3
17	119	118	0	0
18	121	113	3	1
19	98	90	0	0
20	51	4	8	7
21	97	88	0	0
22	154	149	0	0
23	177	158	0	0
24	133	122	0	0
25	142	129	7	6
26	79	77	1	1
27	94	89	0	0
28	117	91	13	12
29	101	92	0	0
30	95	92	0	0
31	111	25	0	0
32	128	91	7	5
33	122	114	0	0
34	116	89	11	11
35	87	71	6	4
36	125	119	2	2
37	157	116	5	2
38	158	153	0	0

Egg mass	Eggs laid per female	No. of Eggs hatched	No. of eggs parasitized	Chalcids emerged.
39	152	113	15	7
40	189	183	0	0
41	129	112	4	3
42	161	154	0	0
43	82	38	0	0
44	118	109	3	3
45	142	124	0	0
Totals	5643	4699	119	93
Average	125.40	104.42	2.64	2.07

Summary

Number of egg masses	45
Total number of eggs laid	5643
Average No. of eggs per female	125.40
Total eggs hatched	4699
Ave. hatch per egg mass	104.42
Total eggs parasitized	119
Total parasite emergence	93
Percentage parasitism	2.1

It will be noted that no Trichogramma were recovered from the Armstrong material whereas in both the Salmon Arm and Lavington material this chalcid appeared in numbers. The proximity of orchards in the latter two cases may have an influence on this. The chalcid recovered in the Armstrong material was Telenomus sp. Single occupancy is the rule with Telenomus sp. while with Trichogramma multiple occupancy is the rule.

The following table presents supplementary data on the hatching of eggs. These were laid in the fall of 1938 and hatched under field insectary conditions commencing June 5, and extending into July, 1939.

Egg mass number	Eggs hatched	Trichogramma minutum recovered	Egg mass number	Eggs hatched	Trichogramma minutum recovered
1	72	53	26	123	10
2	92	0	27	137	0
3	150	0	28	79	3
4	97	0	29	109	9
5	163	0	30	168	25
6	147	0	31	129	10
7	92	0	32	44	8
8	176	22	33	170	0
9	179	75	34	86	0
10	173	20	35	129	55
11	112	0	36	140	22
12	165	0	37	126	6
13	97	8	38	147	0
14	140	53	39	35	1
15	26	37	40	52	11
16	143	0	41	76	5
17	194	21	42	180	6
18	157	52	43	206	0
19	65	18	44	111	25
20	76	35	45	84	7
21	74	19	46	75	0
22	161	53	47	158	54
23	140	0	48	150	2
24	144	10	49	147	0
25	124	0	50	107	7
			Totals	6127	742
			Average	122.54	14.84

Disease

Following is an account of preliminary investigation of the virus disease of the tussock moth by Kenneth Graham.

Periodically the large populations of tussock moths succumb to a wilt disease which causes widespread destruction of the larvae. This was true in 1931 and again in 1939. The affected caterpillars become soft, their tissues liquefy and become dark, but odorless. Even the most vigorous larvae appear to be susceptible, as observed in rearing experiments.

Microscopic examination reveals the presence, in the infected caterpillars (but not in healthy ones) of innumerable small bodies of more or less uniform size. These might at first be interpreted as bacteria of the micrococcus type, but with more precise illumination, greater resolution and higher magnification (900X with N.A. 1.25 oil imm.) they appear less uniform and less regular, are non-staining, apparently non-cellular, appearing first in the blood cells, later throughout the body fluid. These, apparently, are polyhedral bodies, accompanying virus infection. Further support for this view is lent by preliminary attempts to culture organisms from diseased caterpillars.

When the contents of an infected caterpillar were introduced into sterile potato dextrose agar, the resulting colonies of micro-organisms were few in number, and a bacillus, producing white colonies, was recovered. The scarcity of the colonies suggested that this probably is not the pathogen, and that the true agent may be virus in nature. More detailed experiments would be necessary for a satisfactory determination of the true agent of the disease. Whatever the cause, very valuable information could be obtained, especially since any general knowledge might be applied to other destructive insects which are affected by wilt diseases. If it is a virus, it could lead to a better understanding of the animal-infecting viruses in general.

A series of studies has been planned as follows:--

(1) Detailed study of slide preparations from normal and diseased caterpillars. Examination of blood cells at different stages of the disease--a search for polyhedral bodies. The effect of stains on the smear.

(2) Culture preparations to examine characteristics of micro-organisms obtained from normal and wilted larvae: form of colony, motility, staining, etc. Test the infectivity of the culture by injection and by contaminating the food.

(3) Test the infectivity of filtrates from suspension of diseased larvae; use Berkfeld bacterial filter. If this indicates virus, examine its properties, such as factors inactivating it; this would precede any attempt to purify it. Apply purification methods as used for enzymes and as employed by Stanley and others on plant viruses.

(4) Find length of time that infectivity of agent persists under forest conditions.

(5) Study factors affecting virulence of disease.

(6) Find normal mode of disease transmission in the field.

(7) Possibilities for use as a control measure.

(8) The preliminary step would be a thorough review of literature on the subject.

Cost

The cost of the tussock moth investigation in 1939 was approximately $76.40. The cost for 1940 will be increased to $450.00 providing Mr. Graham remains at the Vernon Laboratory.

Project E.30.41-1 - Sitka Spruce Weevil, Pissodes sitchensis Hopk.

Object of Project:

This project provides for a detailed investigation of the biology of the sitka spruce weevil and also of means of controlling or preventing damage by it. Preliminary work on the project was first undertaken in 1937.

Location of Work:

Vancouver Laboratory and the Provincial Green Timbers Forestry Station near New Westminster, B.C.

Officers in Charge and Complete Personnel:

Geo. R. Hopping - Direction of project.
W. G. Mathers - Supervision of work.
R. H. Longmore - Execution of work.

Co-operation with Other Organizations:

Field investigations have been conducted in the plantations of the Provincial Forest Service at the Green Timbers Forestry Station, the buildings and equipment of which were made available for the studies.

Methods Employed:

The outbreak of the sitka spruce weevil in the sitka spruce plantations at the Green Timbers Forestry Station was first reported in 1937. Preliminary observations were immediately undertaken that year and a more detailed investigation was planned for 1938 but due to delay in the appointment of an assistant, the work could not be started until July. In 1939, however, detailed field studies were conducted on the area from early April to the end of September. The methods employed in these investigations have consisted of:

(a) Field observations, supplemented by observations on caged material, for data on life history and habits.

(b) Dissection of infested leaders at regular intervals throughout the season for population counts and data on seasonal development.

(c) Caging of infested leaders for data on emergence of weevils and parasites.

(d) Caging in spring of year of leaders attacked the previous year, for recovery of parasites.

(e) Random counts of spruce in plantations to determine percentages of infestation.

(f) Laying of sample plots in plantations for data on trend of infestation and relation of site, density, height and vigour of trees to attack.

Moreover, in connection with these studies, daily weather records were taken during the field season, while a hygrothermograph had been in operation continually at the Station. The daily maximum, minimum and mean temperatures and precipitation recorded in the field this year are shown in an appended graph.

Progress Report:

Spring Activity of Overwintering Adults

Spring activity of the overwintering adults apparently commences on the first warm days of spring. This year, adults were observed in the field on March 21 when a maximum temperature of over 65 degrees was recorded, but they were not found to be numerous in the field until after the middle of April. On April 26, fifteen weevils were counted on a single leader. The adults continued to be plentiful throughout the first half of May but the majority of them had disappeared by the 1st of June. However, a few continued to be present in the field during June and one old adult was taken in the field as late as July 5. Adults confined in a rearing jar on June 12 were dead by June 30.

On emerging from hibernation, the weevils frequent the tops of the spruce trees and feed through punctures in the bark of the 1938 leader growth. However, in several instances weevils were found feeding on 1937 growth and in one case they were found feeding on 4 year old growth. Only rarely were weevils found on laterals. Mr. Longmore recorded on April 18 that leaders on which feeding occurred, were readily recognized by the pitch oozing from the feeding punctures glistening in the sun. On May 4 a single weevil was found feeding on an unopened bud.

The weevils are relatively strong flyers. One weevil which took off from the hand on March 21, was kept in sight for close to 100 feet, flying above the tops of the

spruce and about 15 feet from the ground. Other weevils were observed in similar flight and it was also found that the adults are able to fly against a light breeze, but they could not be induced to fly except in the sun and in the shade only when the temperature was close to 70 degrees or higher.

Copulation occurs soon after the weevils emerge from hibernation, two pairs being observed on March 21, the first day overwintering adults were found in flight. The last pair observed in copulation was on June 9.

Egg laying starts in April, in many cases before the spruce buds open, and continued on into June. However, the main egg laying period was from the middle of April to about the end of May. The buds on uninfested trees opened this year in the latter part of April, but of 210 leaders killed this year in the sample plots, the terminal buds of 18 failed to open while the 1939 terminal growth on 125 others amounted to 2 inches or less. Such growth on the remaining killed leaders, with one exception, ranged up to 14 inches in length, while the exception put out 22 inches of new growth before dying. In the dissection of infested leaders, (see Table IV), eggs were found in all leaders examined during May and in an occasional leader during June and in one leader as late as July 8. The eggs were found to be deposited anywhere on the 1938 leader growth although usually towards the tip. Moreover, they may be laid at several points along a single leader. In one leader, 13½ inches long, dissected on May 27, 80 larvae were found, 3 of which were at the tip, 76 between 8 and 10 inches from the tip and a single larva 1 inch lower. A number of other leaders were examined during the season which had been attacked at two separate points from 1 to 9 inches apart and in several cases young to mature larvae were found present in the same leader. The eggs are usually laid singly just under the bark but in several instances two eggs were found in a single egg pocket. On June 8 Mr. Longmore observed a weevil in the process of depositing eggs. The weevil was faced upward and had its ovipositor inserted in the bark, where it remained for about 10 minutes. The ovipositor was then withdrawn and inserted again for a much shorter time. The weevil remained in the same position for over 1 hour, but at the end of 1¼ hours, had turned around about three-quarters of the way. The egg cavity which was found to contain 2 eggs, was left open, but by the following day had closed somewhat due to the healing effect of the tree. As no egg counts were made, the number of eggs laid by a single female was not determined. However, an average larval population of 66.9 was

Table IV

Summary of Data Secured from Dissection of Sitka Spruce Leaders Infested with Pissodes. Green Timbers Forestry Station - 1939

Date	Number of Leaders	Pissodes sitchensis					Miscel.	
		Larvae	Pupae	Adults	Emerg. Holes	Totals	Larvae	Pupae
May 12	2	1	-	-	-	1#	-	-
" 16	2	-	-	-	-	-#	-	-
" 18	2	127	-	-	-	127#	-	-
" 20	2	3	-	-	-	3#	-	-
" 23	2	4	-	-	-	4#	-	-
" 25	2	57	-	-	-	57#	-	-
" 27	2	175	-	-	-	175#	-	-
" 30	2	176	-	-	-	176#	-	-
June 1	2	268	-	-	-	268##	-	-
" 3	2	117	-	-	-	117#	-	-
" 5	2	123	-	-	-	123##	-	-
" 6	2	59	-	-	-	59	-	-
" 7	2	101	-	-	-	101	-	-
" 8	2	175	-	-	-	175	-	-
" 9	2	108	-	-	-	108#	23	-
" 10	2	178	-	-	-	178	-	-
" 12	2	62	-	-	-	62	-	-
" 13	2	236	-	-	-	236	14	-
" 14	2	87	-	-	-	87	-	-
" 15	2	92	-	-	-	92	-	-
" 16	2	46	-	-	-	46	-	-
" 17	2	80	-	-	-	80##	-	-
" 19	2	120	-	-	-	120##	16	-
" 20	2	191	-	-	-	191	1	-
" 21	2	79	-	-	-	79	9	-
" 22	2	77	-	-	-	77	-	-
" 23	2	90	-	-	-	90	25	-
" 24	2	68	-	-	-	68	4	-
" 26	2	140	-	-	-	140	1	-
" 27	2	85	-	-	-	85	57	-
" 28	2	84	1	-	-	85	1	-
" 29	2	31	-	-	-	31##	-	-
" 30	2	62	-	-	-	62	1	-

- Eggs present in both leaders. ## - Eggs present in 1 leader.

Table IV - continued.

Date	Number of Leaders	Pissodes sitchensis					Miscel.	
		Larvae	Pupae	Adults	Emerg. Holes	Totals	Larvae	Pupae
July 3	2	68	-	-	-	68	10	-
" 4	2	57	-	-	-	57	3	-
" 5	2	39	7	-	-	46	14	-
" 6	2	65	-	-	-	65	-	-
" 7	2	58	-	-	-	58	4	-
" 8	2	62	-	-	-	62##	-	-
" 10	2	112	14	-	-	126	27	-
" 12	2	35	-	-	-	35	22	-
" 13	2	32	4	-	-	36	6	-
" 14	2	33	5	-	-	38	7	1
" 15	2	31	5	-	-	36	10	-
" 17	2	2	2	-	-	4	2	-
" 18	2	24	38	1	-	63	14	3
" 20	2	13	9	-	-	22	3	-
" 21	2	5	15	3	-	23	9	6
" 22	2	13	18	2	-	33	29	1
" 24	2	8	15	2	-	25	22	1
" 25	2	41	37	1	-	79	14	-
" 26	2	35	27	-	-	62	-	-
" 27	2	-	25	-	-	25	-	-
" 28	2	14	2	1	-	17	9	-
Aug. 1	2	17	24	8	-	49	18	-
" 2	2	7	2	-	-	9	7	-
" 3	2	2	2	2	-	6	32	-
" 4	2	-	-	2	2	4	1	-
" 5	2	10	6	-	-	16	6	-
" 7	2	1	10	9	4	24	8	-
" 8	2	1	3	14	5	23	14	-
" 9	2	6	13	4	-	23	6	-
" 10	2	10	-	-	-	10	5	-
" 11	2	2	8	14	-	24	7	-
" 12	2	-	3	3	6	12	17	-
" 14	1	-	-	-	-	-	37	-
" 15	1	9###	3	-	4	16	39	-
" 16	1	-	-	-	9	9	6	-
" 17	1	-	-	5	6	11	57	-
" 18	1	-	4	4	1	9	4	1
" 19	1	-	-	1	9	10	2	1
" 21	1	-	-	5	6	11	2	-
" 22	1	-	-	-	4	4	-	-
" 23	1	-	-	-	2	2	12	-
" 25	1	-	-	-	18	18	2	-
" 26	1	1####	-	2	7	10	1	-
Sept. 1	2	-	-	-	-	-	-	-
" 5	2	-	-	-	11	11	8	-
" 7	2	-	-	-	18	18	7	-
" 12	2	-	-	-	5	5	11	-
" 14	1	-	-	-	10	10	1	-
Totals	150	4115	302	83	127	4627	667	14

- 8 dead. #### - dead

found in the 24 leaders dissected between June 1 and 15 inclusive, and June 13 a total Pissodes population of 164, all larvae, was found in a single leader. However, as has been mentioned above, egg laying frequently takes place at different points on the same leader and judging from the number of weevils that may be found on a single leader in the spring, more than one female may deposit eggs in the same leader. Sex determinations of the weevils taken from 10 individual leaders between May 18 and 23 gave the following results:

Leader No.	Males	Females	Totals
1.	2	2	4
2.	4	1	5
3.	2	3	5
4.	1	2	3
5.	2	1	3
6.	1	2	3
7.	1	2	3
8.	1	2	3
9.	2	2	4
10.	2	1	3
	18	18	

Development of New Brood

Data on the development of the new brood was obtained this year mainly from the dissection of 150 infested leaders, (see Table IV). No data were obtained of the incubation period of the eggs other than that eggs found on June 2 hatched on June 9. However, the dissections indicated an incubation period of at least two weeks in the early part of the season. In two leaders dissected on May 12 only one egg had hatched while on May 16, no unhatched eggs were to be found in the two leaders examined. However, on May 18, 126 larvae in addition to some eggs were present in a single leader.

Mature larvae were first encountered on June 8, four of which had already formed pupal cells in the pith of the stem, but the first pupa was not recorded until June 28, almost 3 weeks later, and pupae were not found to outnumber the larvae in a single leader until July 17. One live larva was found in a leader as late as August 15 and the last pupa was recorded on August 18. The first adult was not encountered in the dissections until July 18, almost 3 weeks from the date of the first pupa, and the first emergence hole not until August 4, while the last adult found in the dissected leaders was recorded on August 26.

The studies this year indicated that larvae require about 6 weeks to reach maturity and that the pupal period lasts for about 2 weeks. The adults apparently remain in the pupal cells for periods up to 2 weeks before emerging.

Measurements were made by Mr. Longmore of the head capsules of about 1,000 larvae recovered from the dissections, in an attempt to determine the number of instars and the length of the different stadia. However, the number of instars could not be determined definitely although 6 were indicated. There was a great deal of overlapping in the measurements, from which it would seem that there must be considerable difference in the size of the male and female larvae of the same instar.

Emergence of New Adults

Emergence data was obtained this year mainly from 150 infested leaders removed from trees in the field and placed in three compartments of a cheesecloth cage under field conditions. 50 of the leaders were taken from a pure spruce plantation, No. 80, and placed in Cage "a" on July 14, another 50 from a spruce and Douglas fir plantation, No. 69, were placed in Cage "b" on July 26, while the remainder were from the spruce and Douglas fir Plantation No. 96 and caged in Cage "c" on August 10. The total emergence of weevils from these cages has been summarized in Table V and is also shown in the accompanying graph.

The emergence of the new adults extended from July 22 to the end of September but the main emergence period was from August 7 to September 21 with a peak emergence of 95 on August 21. The large numbers of adults recorded for September 7 and 8 is due to the fact that 56 and 10 were obtained on the 2 days from siftings of the needles which had dropped to the floor of the cages.

The sex ratio was approximately 1:1 and with practically no difference in the time of emergence of the two sexes.

The emergence this year was consistently later than that from similarly caged material in 1938. The first emergence was 11 days later while the last emergence was about 12 days later. However, although the peak emergence this year was only 6 days later than in 1938, only about 76 per cent of this year's total emergence had occurred by the end of September whereas in 1938 approximately 95 per cent had emerged by the same date. As mentioned in the report for 1938, a noticeable increase in emergence followed closely after rains. In this regard, rain occurred on several days in July of last year,

Table V

Showing Emergence of Pissodes from Caged Infested Sitka Spruce Leaders

Green Timbers Forestry Station - 1939.

Date	Cage a.		Cage b.		Cage c.		Totals	
	Males	Females	Males	Females	Males	Females	Males	Females
July 22	1	-	-				1	-
" 23	-	-					-	-
" 24	1	-					1	-
" 25	-	-					-	-
" 26	-	-	-	-			-	-
" 27	-	1	-	-			-	1
" 28	-	-	1	-			1	-
" 29	-	-	-	-			-	-
" 30	1	-	-	-			1	-
" 31	-	-	-	1			-	1
Aug. 1	-	-	-	-			-	-
" 2	1	3	-	-			1	3
" 3	-	1	1	-			1	1
" 4	1	1	-	1			1	2
" 5	1	1	-	-			1	1
" 6	1	-	-	-			1	-
" 7	2	1	3	4			5	5
" 8	5	5	5	5			10	10
" 9	4	5	3	1			7	6
" 10	9	8	9	5	-	-	18	13
" 11	4	3	3	2	1	1	8	6
" 12	4	1	1	1	-	-	5	2
" 13	1	2	4	2	-	-	5	4
" 14	6	6	11	15	-	-	17	21
" 15	14	10	14	8	-	1	28	19
" 16	3	6	7	5	-	1	10	12
" 17	6	5	13	7	1	-	20	12
" 18	3	6	9	9	1	5	13	20
" 19	1	1	4	5	3	1	8	7
" 20	9	3	11	10	-	1	20	14
" 21	11	10	26	21	13	14	50	45
" 22	8	10	7	11	6	2	21	23
" 23	14	14	10	22	5	4	29	40
" 24	3	5	1	3	1	1	5	9
" 25	13	7	19	12	6	4	38	23

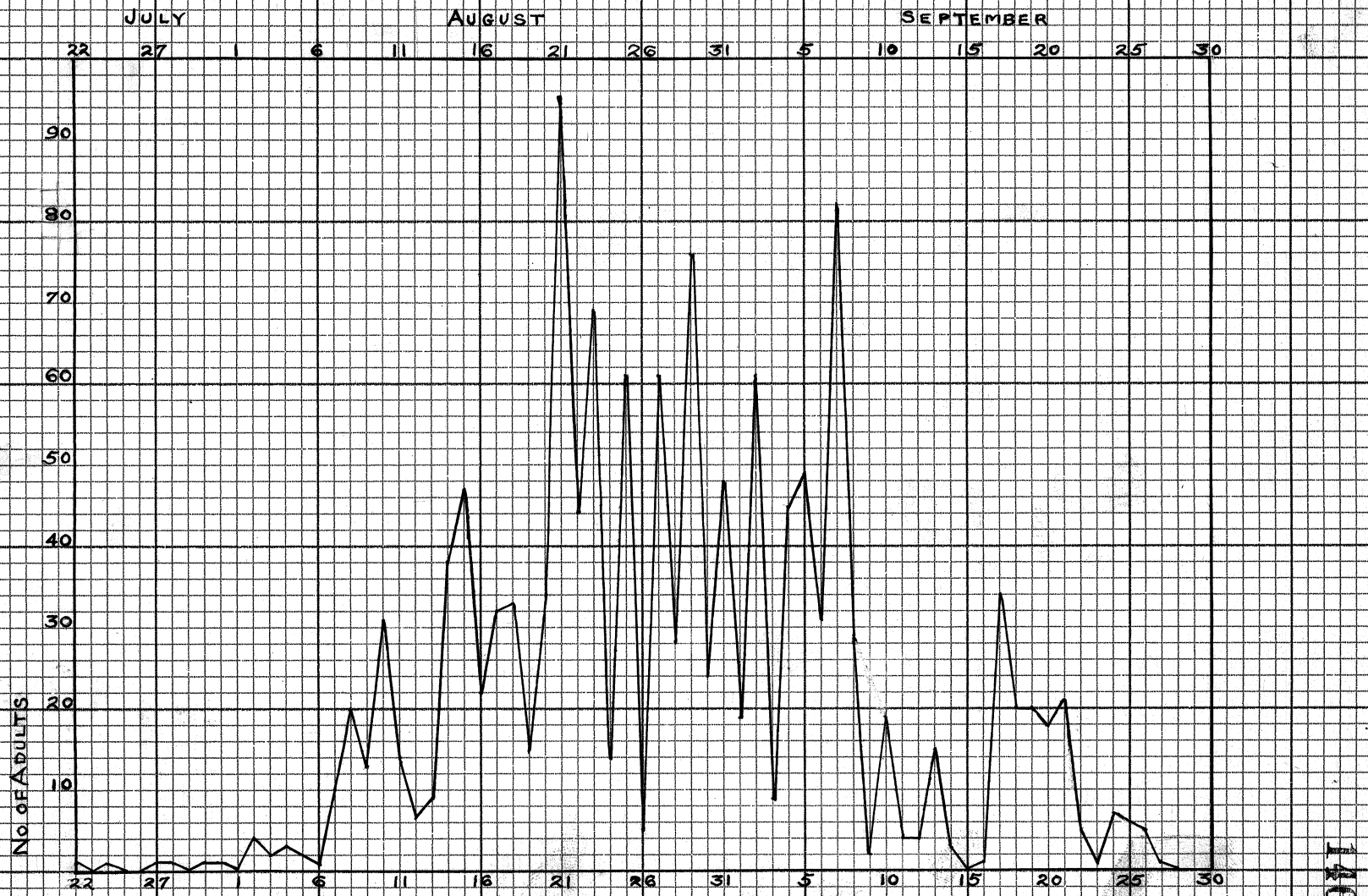
Table V (continued)

Date	Cage a. Males	Cage a. Females	Cage b. Males	Cage b. Females	Cage c. Males	Cage c. Females	Totals Males	Totals Females
Aug. 26	2	-	1	-	2	-	5	-
" 27	13	9	16	15	5	3	34	27
" 28	7	8	6	1	4	2	17	11
" 29	6	14	12	12	12	20	30	46
" 30	4	2	4	-	8	6	16	8
" 31	6	4	6	8	8	16	20	28
Sept. 1	5	1	1	2	6	4	12	7
" 2	8	11	19	8	6	9	33	28
" 3	3	3	1	-	1	1	5	4
" 4	9	11	13	9	2	1	24	21
" 5	14	12	6	10	3	4	23	26
" 6	4	2	3	6	6	10	13	18
" 7*	17	13	21	24	2	5	40	42
" 8*	2	4	1	5	7	10	10	19
" 9	-	-	-	-	1	1	1	1
" 10	2	3	3	5	4	2	9	10
" 11	-	-	1	3	-	-	1	3
" 12	-	-	-	1	1	2	1	3
" 13	1	2	2	6	4	-	7	8
" 14	1	-	1	-	-	1	2	1
" 15	-	-	-	-	-	-	-	-
" 16	-	-	-	1	-	-	-	1
" 17	8	7	6	10	1	2	15	19
" 18	4	2	4	8	2	-	10	10
" 19	1	5	5	4	1	4	7	13
" 20	5	2	4	3	2	2	11	7
" 21	2	4	5	4	3	3	10	11
" 22	-	1	2	-	-	2	2	3
" 23	-	-	1	-	-	-	1	-
" 24	1	1	-	3	1	1	2	5
" 25	1	-	-	5	-	-	1	5
" 26	1	-	1	2	1	-	3	2
" 27	-	-	1	-	-	-	1	-
Oct. 6	2	1	3	2	3	3	8	6
Totals	256	237	311	307	133	149	700	693

* Cages a & b cleaned on Sept 7
& c cleaned on Sept 8

Showing Emergence of Pissodes Sitchensis

Green Timbers Forestry Station B.C. 1939.



while this year no rain fell at the Station from July 21 to August 24 inclusive, (see appended Weather Graph), However, considerable rain did occur this year at the end of August and the 1st part of September, which possibly explains the heavy late emergence this year. No explanation was recorded for the flucutations in emergence during August, particularly the low emergences shown for August 24 and 26, but they may have been largely due to changes in the time of the day that the collections were made.

Activities of New Adults

Although an adult emerged from the caged material this year as early as July 22 and emergence holes were encountered in the dissections on August 4, no new adults were recorded in the field until August 28, nor were they to be found in any numbers throughout September.

On August 26 a 5 foot spruce was enclosed with a cloth cage in the field and by September 1 a total of 100 new adults recovered from the emergence cages, were liberated on this caged tree. These adults fed through the bark of the new terminal growth and a number were found to be still active in the cage on October 6. However, no pairs were observed in copulation.

Pissodes Mortality

The dissection made this year of infested leaders for population counts showed that a heavy mortality occurred as the season advanced. For example:

Average Pissodes population of 24 leaders dissected June 1-15 inclusive	- 66.9
Average Pissodes population of 22 leaders dissected July 1-15 inclusive	- 28.5
Average Pissodes population of 23 leaders dissected August 1-15 incl.	- 9.0

This latter figure, which includes exit holes present, corresponds closely with the average of 9.3 weevils recovered this year from the 150 caged infested leaders.

Competition among the larvae for food is undoubtedly the most important factor responsible for the reduction in population. Parasites are also a factor of importance and these are discussed below.

There has also been a marked reduction in the average number of weevils recovered from caged infested leaders during the past 3 years, as shown by the following figures:

Year	No. of Leaders	Total Emergences		Ave. No. Pissodes per Leader
		Pissodes	Miscellaneous	
1937	61	1092	15	17.9
1938	150	2014	100	13.4
1939	150	1393	85	9.3

The factors responsible for this reduction have not been determined definitely. There was no increase in the average number of parasite larvae recovered in the dissections this year over those recovered from the 1938 dissections. However, Mr. Longmore recorded that a number of the leaders dissected during the latter part of the season, that is after July 25, showed heavy attack by birds, and that in such leaders there were many pupal cells with no Pissodes specimens present. For example, in one leader dissected on August 26, 83 pupal cells were present but only 15 Pissodes larvae and 7 Pissodes pupae, with no weevils or parasite larvae, were to be found. Moreover, the average size of the leaders caged this year for emergence was undoubtedly smaller than that of the leaders caged in 1938; this was particularly true of the last 50 leaders caged each year.

Parasites

In the latter part of April of this year, 134 spruce leaders attacked by Pissodes in 1938 were caged at the Station for the recovery of parasites which overwinter in the leaders. Emergence commenced on April 27 and the following were recovered by July 7, the date of the last emergence:

Hymenoptera

Rhopalicus pulchripennis	- 41 adults	
Eurytoma sp.	- 90 "	
Eurytoma pissodes	- 12 "	
Eupelmella sp.	- 3 "	
Miscellaneous	- 18 "	164

Diptera

Lonchaea watsoni	- 38 adults	
Cnemodon sp.	- 1 "	
Miscellaneous	- 3 "	42

Total 206

The total emergence averaged only about 1.5 specimens per leader whereas winter dissections of 45 leaders killed in 1938 showed an average of approximately 2 miscellaneous larvae per leader. The emergence dates of the above R. pulchripennis, Eurytoma sp., E. pissodes and L. watsoni are shown in Table VI.

Table VI

Showing Spring Emergence of Principal

Pissodes Parasites from Infested Spruce Leaders

Green Timbers Forestry Station - 1939

Date	R.pulchripennis		Eurytoma sp.		E. pissodes		L. watsoni
	Males	Females	Males	Females	Males	Females	
May 3	-	-	-	1	-	-	4
" 4	-	-	-	-	-	-	3
" 5	-	-	4	2	-	-	7
" 6-7	-	-	-	-	-	-	-
" 8	-	-	1	3	-	-	5
" 9	-	-	3	1	-	-	4
" 10	-	-	2	3	-	-	1
" 11	-	-	-	-	-	-	-
" 12	-	-	10	10	-	-	7
" 13	-	-	1	2	-	-	1
" 14	-	-	-	8	-	-	2
" 15	-	-	6	7	-	-	2
" 16	-	-	2	1	-	-	-
" 17	-	-	1	4	-	-	2
" 18	-	-	-	2	-	-	-
" 19	-	-	-	2	-	-	-
" 20	-	-	-	-	-	-	-
" 21	-	-	-	1	-	-	-
" 22	-	-	-	-	-	-	-
" 23	-	-	-	6	-	-	6
" 24	-	-	-	1	-	-	-
" 25	-	-	-	-	-	-	-
" 26	4	2	-	2	-	-	-
" 27	-	3	-	-	-	-	-
" 28	-	-	-	1	-	-	-
" 29-31	-	-	-	-	-	-	-
June 1	-	2	-	-	-	-	-
" 2	2	-	-	-	-	-	-

Date	R.pulchripennis Males	R.pulchripennis Females	Eurytoma sp. Males	Eurytoma sp. Females	E. pissodes Males	E. pissodes Females	L. watsoni
June 3-4	-	-	-	-	-	-	-
" 5	3	-	1	1	-	-	-
" 6	-	-	-	-	-	-	-
" 7	1	-	-	-	-	-	-
" 8	1	-	-	-	-	-	-
" 9	3	2	-	-	-	-	-
" 10	-	-	-	-	-	-	-
" 11	-	2	-	-	-	-	-
" 12	-	3	-	1	-	-	-
" 13	-	-	-	-	-	-	-
" 14	1	2	-	-	1	-	-
" 15-19	-	-	-	-	-	-	-
" 20	-	7	-	-	1	-	-
" 21	-	1	-	-	-	-	-
" 22	-	-	-	-	2	-	-
" 23-26	-	-	-	-	-	-	-
" 27	-	2	-	-	-	2	-
" 28	-	-	-	-	1	1	-
" 29	-	-	-	-	-	1	-
" 30	-	-	-	-	-	-	-
July 1-4	-	-	-	-	-	-	-
" 5	-	-	-	-	1	-	-
" 6	-	-	-	-	-	1	-
" 7	-	-	-	-	-	1	-
Totals	15	26	31	59	6	6	38

The 3 Eupelmella sp. adults emerged on May 22 and 23 while the Cnemodon specimen was recovered on May 7. The miscellaneous adults consisted of a number of different species, the status of which has not been determined.

Of the miscellaneous material which emerged in the summers of 1938 and 1939 from the infested spruce leaders caged for the recovery of Pissodes adults, the following parasitic adults have been determined:

Hymenoptera	1938	1939
Rhopalicus pulchripennis	29	50
Eurytoma sp.	11	13
Calliephieltes comstockii	11	-
Microbracon pini	5	4
Coeloides sp.	-	1
Phygadeuonini	2	-

	1938	1939
Diptera		
Cnemodon sp.	1	5
Totals	59	73

Although there was a slight reduction in the average number of miscellaneous adults recovered per leader in 1939 as compared with 1938, they amounted to 5.75 per cent of the total emergence in 1939 as compared with 4.73 per cent in 1938. The emergence dates for the above R. pulchripennis and Eurytoma sp. are given in Tables VII and VIII. The C. comstockii adults were recovered in 1938 between August 4 and 10 inclusive, while the emergence of the M. pini adults was from August 10 to 29 inclusive in 1938 and from August 3 to 15 in 1939. The 1 Coeloides specimen was recovered on August 14, and the 2 Phygadeuonini adults on August 31 and September 8. The Cnemodon taken in 1938 emerged on August 4 and the other 5 specimens of the same species were taken in 1939 between August 1 and 13 inclusive.

In the dissection of infested leaders this year, a total of 681 miscellaneous larvae and pupae were encountered, and for the 50 leaders dissected between June 23 and July 25 inclusive, an average of 5.94 miscellaneous larvae per leader or about 17 per cent of the total specimens in the 50 leaders, was found. In the dissection of 50 leaders in 1938 an average of 6.38 miscellaneous specimens per leader or about 14 per cent of the total specimens, was encountered. Although the miscellaneous larvae have not been identified, the majority were either parasitic or predacious on Pissodes.

Of the parasites which have been identified to date R. pulchripennis, E. pissodes and M. pini have been listed as important parasites of the white pine weevil, Pissodes strobi, in the East. From the emergence dates if would seem that R. pulchripennis and Eurytoma sp. have two generations a year, although the latter may represent more than one species. On June 5, a Lonchaea adult was observed ovipositing on a spruce leader in the field by Mr. Longmore. On dissecting the leader the parasite egg was found just under the outer bark and along side of a newly hatched Pissodes larva.

Extent and Trend of Infestation.

The present outbreak has been confined to the plantations at the Green Timbers Forestry Station, although this year two sitka spruce in the forest belt at the University of British Columbia were found, for the first time, to have been attacked. One tree, 20 feet in height showed 1938 attack while the other, 9 feet high, was attacked this year.

Table VII

Showing Summer Emergence of Principal Pissodes Parasites from Infested Spruce Leaders Green Timbers Forestry Station - 1938

Date	R. pulchripennis Males	R. pulchripennis Females	Eurytoma sp. Males	Eurytoma sp. Females
July 25	-	-	-	-
" 26	-	1	-	-
" 27-28	-	-	-	-
" 29	3	8	-	1
" 30	-	-	-	2
" 31	-	2	-	-
Aug. 1	1	-	-	2
" 2	-	-	-	-
" 3	-	-	-	1
" 4	-	1	-	-
" 5-6	-	-	-	-
" 7	-	4	-	-
" 8-14	-	-	-	-
" 15	-	-	-	1
"16-18	-	-	-	-
" 19	-	2	-	-
" 20	-	-	-	-
" 21	-	1	-	-
" 22	1	-	-	-
" 23-28	-	-	-	-
" 29	-	3	-	-
" 30	-	-	-	-
" 31	-	2	-	3
Sept.1-5	-	-	-	-
" 6	-	-	-	1
Totals	5	24	-	11

Table VIII

Showing Summer Emergence of Principal

Pissodes Parasites from Infested Spruce Leaders

Green Timbers Forestry Station - 1939

Date	R. pulchripennis		Eurytoma sp.	
	Males	Females	Males	Females
July 26	-	-	-	-
" 27	-	1	-	-
" 28-31	-	-	-	-
Aug. 1	-	5	-	-
" 2	3	3	-	-
" 3	-	2	-	1
" 4	3	1	-	1
" 5-6	-	-	-	-
" 7	1	5	-	1
" 8	-	3	-	-
" 9	1	1	-	1
" 10	-	2	-	1
" 11	-	1	-	-
" 12	-	1	-	-
" 13	-	1	1	-
" 14	-	1	-	-
" 15	-	4	1	1
" 16	-	1	-	1
" 17	-	4	-	-
" 18	3	1	-	-
" 19	-	-	-	-
" 20	-	-	-	1
" 21	-	-	1	1
" 22	-	-	-	-
" 23	-	1	-	1
" 24-27	-	-	-	-
" 28	-	1	-	-
Totals	11	39	3	10

The infestation at the Forestry Station extends throughout the spruce plantations, consisting of 14 acres of pure spruce and about 126 acres of spruce mixed with Douglas fir. The ages of the trees range from 10 to 12 years. Percentages of infestation in the various spruce plantations were determined this year from random counts of 100 trees in each plantation and the results of these counts are shown in Table IX. As shown by these counts, the percentages of infestation in the pure spruce plantations ranged from 5 to 75 per cent with an average of about 48 per cent and in the mixed planatations from 55 to 92 per cent with an average of about 72 per cent. The lower degree of infestation in the pure spruce plantations is due to the smaller size of the trees in such plantations, those in Plantation No. 75 being exceptionally small and stunted. As shown by the counts this year, an average of 69.0 per cent of all spruce on the area have been attacked to date, an increase of 14.2 over the total up to the end of 1938. However, the increase does not represent the total 1939 attack as a number of trees were re-attacked this year and many of these, due to their multiple tops, were attacked more than once.

In the fall of 1938 one half acre of the pure spruce plantation No. 68 and three-quarter acre of the mixed plantation No. 84 were marked off into one-eighth acre sample plots. From these plots the following records of attacks have been obtained, the figures in brackets denoting actual number of leaders attacked:

	Pure Stand		Mixed Stand	
	No.	Percent.	No.	Percent.
Total No. of Spruce	514	100.0%	359	100.0%
Total Attacks to Date	250(314)	48.6%	313(479)	87.2%
Attacks Prior to 1938	74 (78)	14.4%	91 (93)	25.3%
1938 Attacks				
Re-infested	8 (10)		27 (36)	
New	119(122)		204 (208)	
Totals	127(132)	24.7%	231 (244)	64.3%
1939 Attacks				
Re-infested	39 (47)		91(124)	
New	57 (57)		18 (18)	
Totals	96(104)	18.7%	109(142)	30.4%

Cont. p 156.

Table IX

Showing Percentage of Spruce Injured by Pissodes as Determined by Sample Counts.#

Green Timbers Forestry Station - 1939.

Plant. Number	Attacked Prev.to'39	Attacked - 1939 Re-infest.	New	Total	Attacked to Date	Remarks
68	44 (53)	8	19	27 (30)	63	Pure spruce
69	40 (40)	5	34	39 (40)	74	Spruce & D. fir
72	54 (54)	8	22	30 (32)	76	" & "
73	54 (58)	16	13	29 (31)	67	" & "
75	1 (1)	-	4	4 (4)	5	Pure spruce
77	30 (30)	8	27	35 (36)	57	Spruce & D. fir
79	48 (52)	14	12	26 (33)	60	" & "
80	73 (80)	21	2	23 (26)	75	Pure Spruce
85	85 (99)	38	7	45 (61)	92	Spruce & D. fir
92	87 (104)	42	4	46 (64)	91	" & "
96	80 (86)	24	7	31 (42)	87	" & "
99	53 (55)	15	21	36 (43)	74	" & "
100	34 (34)	4	24	28 (29)	58	" & "
102	26 (26)	3	29	32 (32)	55	" & "
A1##	85 (99)	19	4	23 (30)	89)	100 spruce
A2##	91 (103)	42	4	46 (59)	95)	each
B ###	30 (30)	3	22	25 (27)	52)	
C ###	51 (51)	15	10	25 (30)	61)	
D ###	76 (77)	30	4	34 (42)	80)	
Total	52.8%			29.9%	67.5%	

Figures in brackets - no. of leaders attacked

\# -Count in each plantation consisted of 100 spruce so that above figures also represent percentage of trees counted.

-Nursery shelter belt.

-Roadside counts:

B - Between Plantations Nos. 67-72 and Nos. 73-79
C - " " Nos. 82-85 and Nos. 93-102
D - " " Nos. 95-103 and Nos. 104-106.

Summarizing these figures we find:

	No. of trees attacked	No. of leaders attacked
Prior to 1938	165	171
1938 only	358	376
1939 only	205	246
(1940 "	356	452) - as per letter from Hubble - Mar 6/40
1941 "	272	332

The increase in the number of leaders attacked in comparison with the number of trees is due to the fact that weeviling frequently results in the production of multiple tops, thus making more leaders available for attack in the following years. The tendance to produce multiple tops is shown by the following figures, based on 563 sample plot trees which have been attacked:

Trees with 1 leader - 40.0%
Trees with 2 leaders - 35.3%
Trees with 3 leaders - 13.3%
Trees with 4 or more leaders - 11.4%

From the foregoing records of attacks in the sample plots, it is evident that 1938 was the peak year of the infestation. The percentage of trees attacked in 1939 was considerable less than in 1938 and there was also a marked reduction in the total number of leaders attacked. Moreover, as has been mentioned previously, the average number of weevils recovered from caged infested leaders in 1939 was 9.3, a reduction of 4.1 from the average number recovered from the same number of caged leaders in 1938.

Relation of Tree Factors to Attack

The height of the trees is one of the most important factors governing attack by the sitka spruce weevil. As shown in Table X, based on attacks which occurred in 1939 on trees in the sample plots, the percentage of attack increases directly with the height of the trees. Moreover, it is evident from this Table that the majority of the trees have not yet reached the most susceptible height to attack and that this factor is responsible mainly for the lower percentage of trees attacked in the pure stand in comparision with those in the mixed stand.

However, height factor is closely related to the degree of shade, in that the weevils have shown a distinct preference for exposed tops. In this regard, the effectiveness of shade from deciduous growth, such as vine maple and willow which has come in naturally throughout the plantations, is minimized by the fact that the weevils have been found to attack in the spring before

such foliage appears. Instances of weeviled spruce completely enclosed in clumps of vine maple were observed. The shade factor is to be investigated further and in this connection sample plantings of spruce with poplar hybrids and of spruce in open areas in pole-size second growth Douglas fir and hemlock were made in the spring of 1939 at the Green Timbers Forestry Station by the Provincial Forest Service and similar plantings of spruce under second growth alder were made at the Station early in 1940.

Preliminary data have also been obtained from the sample plot trees on length and diameter of leaders but analysis of such data will not be completed until additional measurements are made following the weevil attacks in 1940.

Future Work:

Future work on this project will be limited mainly to the recording and analyses of sample plot data.

Table X

Showing Relation of Height of Trees

to Attack by Pissodes.

Green Timbers Forestry Station - 1939

Height Classes in Inches	Pure Stand			Mixed Stand		
	Total No. of spruce	Attacked-1939 No.	Percent.	Total No. of spruce	Attacked-1939 No.	Percent.
0- 12	19	-	0.0%	-	-	-
13- 24	68	2	2.9%	3	1	33.3%
25- 36	119	12	10.1%	20	3	15.0%
37- 48	128	26	20.3%	60	7	11.7%
49- 60	116	29	25.0%	90	23	25.6%
61- 72	47	20	42.5%	94	20	21.3%
73- 84	13	4	30.8%	55	27	49.1%
85- 96	4	3	75.0%	27	19	70.4%
97-108	-	-	-	8	7	87.5%
109-120	-	-	-	2	2	100.0%
Totals	514	96	18.7%	359	109	30.4%

Project E.30.42-1 - Lecanium Scale, Eulecanium coryli L.

Object of Project:

The control and bionomics of the Lecanium scale in the Vancouver district.

Nature and Importance of Project:

This scale of European origin, was apparently first introduced into British Columbia about 1903, but did not attract attention as a serious pest until 1923, In the fall of that year many miles of roadside maple trees in Stanley Park, and numerous boulevard trees on the streets of Vancouver, were found to be heavily infested.

In order to save the ornamental trees from destruction and to obviate sticky exudation from the scales, which fell from the trees, this project was undertaken by R. Glendenning, in charge of the Dominion Entomological Laboratory at Agassiz, B.C., at the request of the Vancouver Parks Board.

Location of Work:

Vancouver, B.C., and vicinity.

Officers in Charge and Complete Personnel:

Prior to 1939: R. Glendenning in charge.

Officers now concerned:

Geo. R. Hopping - Direction of project
W. G. Mathers - Supervision and execution of work.

Co-operation with Other Organizations:

The Parks Board of the city of Vancouver provided all labour, equipment and material for spraying operations.

Division of Foreign Pest Suppression for several years provided assistants for delimiting the infested area.

Progress Report:

This project was commenced in 1924 and was under the jurisdiction of the Agassiz Laboratory, B.C., until the spring of 1939 at which time it was transferred to the Vancouver Forest Insect Laboratory, under the supervision of the Vernon Laboratory.

The following summary of the work done on this project prior to 1939 is based on reports of R. Glendenning.

With the start of the project in 1924, a detailed life history study was not attempted but the main facts were ascertained and the hosts and distribution determined. Tests with oil sprays were made with good results and on the recommendation of Mr. Glendenning, a suitable high power spray outfit was purchased in 1925 by the Vancouver Parks Board.

From 1925 to 1930 many miles of roadside trees in Stanley Park and boulevard trees on the streets of Vancouver were sprayed each spring with an oil emulsion with satisfactory kill. However, the annual cost for this work alone was approximately $1,000.00 and the sprayed trees rapidly became re-infested from the adjacent native vegetation which it was impossible to treat. The scale continued to spread on vegetation outside the control areas.

In 1927, the Dominion Entomologist made request to the Imperial Institute of Entomology for parasites of this scale, and in 1928 and 1929 approximately 1,000 adults of the encyrtid, Blastothrix sericea (Dalm) were received from England and liberated.

In 1930, observations showed the parasite to be thoroughly established and further artificial dispersal was performed in 1931 by transferring twigs from scale-infested trees showing heavy parasitism, to various widely separated pointsover the scale infestation.

As a result of this colonization the entire main area of infestation, some twenty miles long by five miles wide, was found to be well parasitized and the spread and increase of the parasite was so rapid that spray control was abandoned in 1932.

From 1930 to 1933, the Division of Foreign Pests Suppression scouted the scale infestation each autumn to record the spread and degree of infestation. In 1930, the average number of scales per foot of twig on marked trees was 35, with a maximum of 80, while in 1932 the maximum on any of the marked trees was 2 per foot and the greater number of trees were quite free from any scale. The percentage of parasitism, determined from the number of scales showing emergence holes, was recorded each year, the average percentage being 25 in 1930, 60 in 1931, and 99 in 1932.

Scouting performed in 1933 and 1934 failed to reveal the scale in sufficient number to collect; it being desired to procure some of the parasites to colonize in Nova Scotia.

As the Lecanium scale has been exceptionally scarce in the Vancouver district for the past several years, the work in 1939 was confined to the investigation of any reported occurrences of the species. Two such reports were received during the year, both from West Vancouver. The hosts were a rose bush and a pear tree and in both instances the infestation was comparatively light. However, the scale was also noticed in September on an ornamental plum on the campus of the University of British Columbia and sample counts made at that time showed attacks up to 27 scales per foot of twig, but with an average parasitism, as indicated by exit holes, of 85 percent. The parasite was undoubtedly Blastothrix sericea.

Future Work:

As indications point to an increase in the scale in the Vancouver district, the investigation of the reported occurrence of the species should be continued.

Publications:

Glendenning, R.

1925 - The Lecanium scale outbreak in Vancouver, B.C. Proc. Ent. Soc. of B.C., 22:21-26.

1931 - The Lecanium scale, an insect affecting fruit and shade trees on the Pacific coast. Dom. Dept. Agr., Ent. Br., Circular No. 77.

1933 - A successful parasite introduction into British Columbia. Canadian Entomologist, 65:169-171.

1933 - On the control of Eulecanium coryli (L) in British Columbia by the parasite Blastothrix sericea (Dalm). Proc. 5th Pacific Sci. Congress, 5:3543-3545.

DESCRIPTIONS OF PHENOLOGICAL STATIONS NUMBERS 1-12

The phenological stations are situated in close proximity to each other upon an area which is quite uniform in all characteristics of soil, slope, exposure, and type of forest. It is considered, therefore, that one description will suffice for all the stations.

Position:

50° 17' N. latitude, 119° W. longitude, altitude 2125'.

Forest Entomological Field Station, Trinity Valley, B.C., Township 2, S. W. ¼ of N.E. ¼ Section 13, Osoyoos Division, Yale District.

Slope and Exposure:

The slope of this area is almost nil; consequently it or the exposure does not warrant further description. Slope and exposure - o

Type of Forest:

According to pioneers living in the country, this area was swept by a large fire about the year 1898. Old fire scars on mature trees still bear the evidence. Prior to June 1929 the area had been selectively logged for spruce, fir and particularly cedar. In that year the site was taken over for all times by the Dominion Entomological Branch. Recently, the forest has been thinned, and old logs and debris have been removed and burned. The site of these stations now consists of a mixed stand of evergreens, and a variety of deciduous trees and shrubs, together with many of the flowering plants.

The approximate percentage of each evergreen represented is:

Pseudotsuga taxifolia	- 30%	
Picea engelmanni	- 20%	
Larix occidentalis	- 20%	- mostly mature
Pinus monticola	- 10%	
Thuja plicata	- 10%	- mostly young
Tsuga heterophylla	- 5%	- mostly young
Pinus contorta)		
Abies lasiocarpa)	- 5%	
Juniperus communis)		
Taxus brevifolia)		

A few hundred yards from the field station can be found western yellow pine, Pinus ponderosa. The area can, therefore, be considered as part of a transitional region, especially for western yellow pine and western white pine.

Some of the more important deciduous trees and shrubs represented are:

Acer glabrum	Populus trichocarpa
Alnus ~~rubra~~ tenuifolia	Pyrus sitchensis
Alnus sitchensis	Ribes lacustre
Amelanchier alnifolia	Rosa gymnocarpa
Betula ~~occidentalis?~~ papyrifera	Rosa melina
Ceanothus sanguineus	Salix Scouleriana?
Corylus californica	Shepherdia canadensis
Lonicera ciliosa	Spiraea lucida
Lonicera involucratum	Vaccinium sp.
Lonicera utahensis	

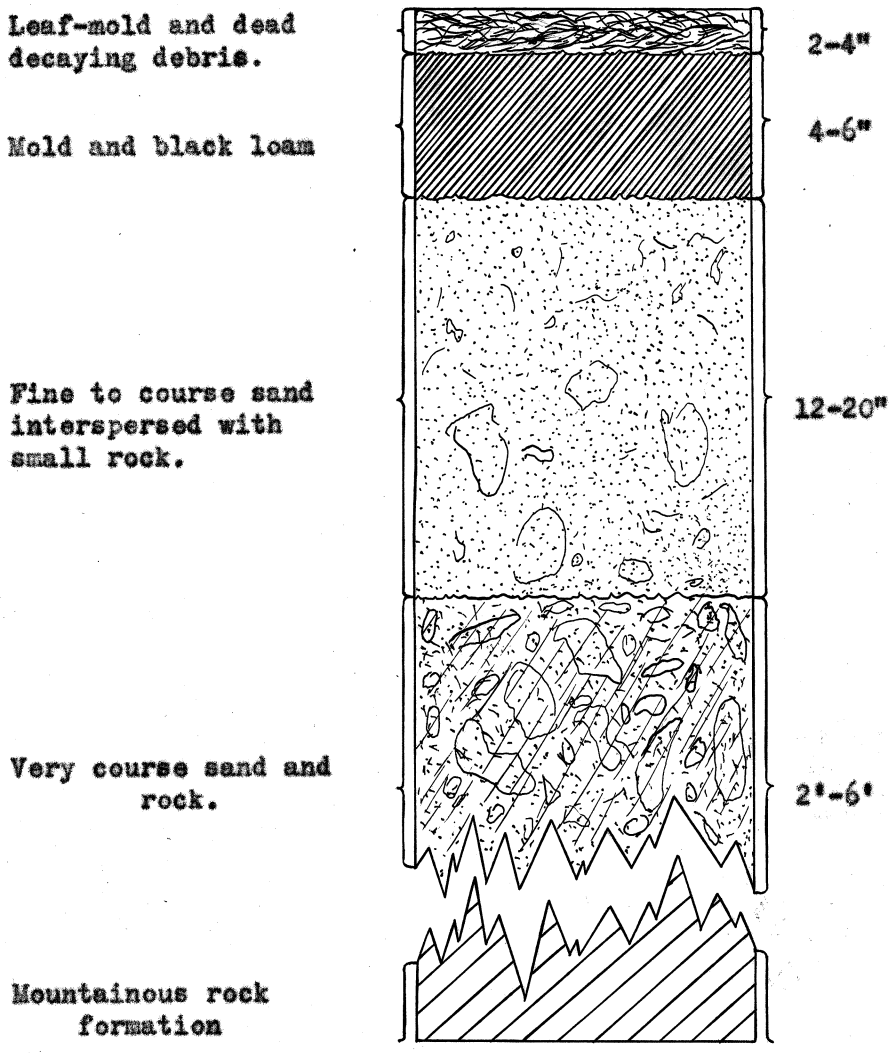
The following species represent the most prevalent of the flowering plants:

Aralia nudicaulis	Lilium parviflorum
Calypso bulbosa	Peramium decipiens
Clintonia uniflora	Rubus parviflorus
Cornus canadensis	Smilacena racemosa
Disporum trachycarpum	Streptopus amplexifolius
	Viola glabella

Soil:

The phenological stations are situated upon a typical forest soil. The forest floor consists of a layer of leaf mold and dead decaying debris, a layer from 2 to 4" in depth. Below this is a definite stratum of mold and black loam ranging from 4" to 6" in thickness. Following is a 12" to 20" stratum of fine sand interspersed with small rocks. Beneath this again is a 2' to 6' layer of very course sand and rock. Mountainous rock formations is the final base for the above over the area.

PROFILE OF SOIL



PHENOLOGICAL OBSERVATIONS

Laboratory: Trinity Valley Field Station, Vernon, B. C.

Year: 1939
Observers: K. Graham, C.V.G. Morgan

Sta.	Species	Observations	Date	Remarks
1	Picea engelmanni	First bud-scales shed	May 8	
		First staminate flowers shedding pollen	May 15	
		Terminal growth completed	July 12	Second week of July
2	Pinus contorta	First bud-scales shed	Apr. 22	On leaders
		First staminate flowers shedding pollen	May 26	On leaders
		Terminal growth completed	Aug. 2	First week of Aug.
		Old needles falling	Sept 20	
3	Abies lasiocarpa	First bud-scales shed	Apr. 28	
		First staminate flowers shedding pollen		Data not available
		Terminal growth completed	July 6	First week of July
4	Larix occidentalis	First staminate flowers shedding pollen	Apr. 19	
		Needles separated in bud	Apr. 22	Leaders later, esp. on smaller trees.
		Terminal growth completed	July 25	Fourth week of July
		Foliage turned on young trees (10')	Sept 22	
		Foliage turned on older trees (30-75')	Oct. 1	
5	Pyrus sitchensis	First flower open	May 21	
		First fruit ripe	Sept. 4	
		Foliage turned	" 16	50% turned
		50% leaves dropped	Oct. 2	
		Tree leafless	" 25	

Sta.	Species	Observations	Date	Remarks
9	Clintonia uniflora Kunth	First flower open	June 6	
		First fruit ripe	Aug. 7	
10	Cornus canadensis	First floret open	May 6	
		First fruit ripe	July 29	
12	Epilobium angustifolium	First flower open	July 12	
		Flowers common in region	July 18	
	Prunus demissa	First flower open	May 18	Note taken several miles from station on exposed southern slope. Only one plant occurs at station. This was cut to the ground in 1937.
	Acer glabrum	First flower open	Apr. 29	
		First leaf fully expanded	May 17	
		90% of leaves dropped	Oct. 2	
		Tree leafless	Oct. 12	
	Populus trichocarpa	First flower shedding pollen	May 3	
		First leaf fully expanded	May 11	
		Foliage turned	Oct. 6	
		Tree leafless	Oct. 20	
	Pinus monticola	First bud scales shed	May 1	
		First staminate flowers shedding pollen		Data not available this year.
		Terminal growth completed	Aug.7-10	
		Old needles falling	Sept.11	

Sta.	Species	Observations	Date	Remarks
	Pseudotsuga taxifolia	First bud scales shed	Apr. 30	
		First staminate flowers shedding pollen	May 6	
		Terminal growth completed	July 18	Third week of July
	Amelanchier alnifolia	First flower open	May 10	N.B.:-a very good indicator.
		First fruit ripe	Aug. 7	
	Ribes lacustre	First flower open	May 11	
		Flowers common in region	May 21	
	Rosa melina	First flower open	May 24	N.B.:-a very good indicator.
	Cornus stolonifera	First flower open	June 12	
		First fruit ripe	Aug. 8	
	Lonicera utahensis	First leaves separated in bud	Apr. 20	
		First flowers open	Apr. 28	
		First fruit ripe		
	Lonicera involucratum	First flower open	May 24	
	Lonicera ciliosa	First flower open	June 16	
	Ceanothus sanguineus	First flower open	May 26	
	Shepherdia canadansis	First flower open	Apr.24	
		First leaves divided	May 2	
		First fruit ripe	June 14	
		Leaves turning	Oct. 2	10% of leaves fallen
		Tree leafless	Oct. 16	

Sta.	Species	Observations	Date	Remarks
	Disporum trachy - carpum	First floret open	May 7	In open areas and
		Flowers common in region	May 10	on south exposure.
	Viola glabella	First floret open	May 4	Open, south-west
		Flowers common in region	May 8	slope.
	Calypso bulbosa	First floret open	May 21	In shaded areas.
		Flowers common in region	May 26	
	Aralia nudicaulis	First floret open	May 24	In shaded areas.
		First fruit ripe	July 27	
	Smilacena racemosa	First floret open	May 12	
		Flowers common in region	May 22	
		First fruit ripe	Aug. 9	
	Solidago canadensis	First flower open	July 27	No specimens occur
		Flowers common in region	Aug. 13	at field station.
	Castilleja sp?	First flower open	May 11	On well exposed
		Flowers common in region	May 23	southern slopes.
	Lilium parviflorum	First flower open	June 19	
	Vaccinium sp.	First buds beginning to expand	Apr. 19	
		Leaves unfolded, about 2 cm. long	May 3	
		First flower open	May 12	
	Alnus rubra	First flower shedding pollen	Apr. 22	

Sta.	Species	Observations	Date	Remarks
	Alnus sitchensis	First flower shedding pollen	Apr. 28	
	Pachystima myrsinites	First flower open	May 1	
		First leaves about 5 mm. long	May 15	
	Corylus californica	First flower shedding pollen	April 19	
	Betula occidentalis?	First flower shedding pollen	May 2	
	Salix Scouleriana?	First flower shedding pollen	April 21	
	Thuja plicata	Old foliage browning	Aug. 30	
	Chermes cooleyi	Beginning to migrate to white pine	July 18	

Miscellaneous Notes:-

(1) Aberdeen Mt., B.C. ("Silver-Star"); at an altitude of 5,500'; July 23, 1939; approx. 7 miles (N. 53°W.) from Trinity Valley Field Station; south-west exposure; by K. Graham, C.V.G. Morgan.

Clintonia uniflora - in full bloom
Lilium parviflorum - in full bloom
Lupin sp. ? (with glabrous leaves) - in full bloom
Moneses uniflora - in full bloom
Pyrola sp.? - in full bloom
Pyrus sitchensis - in full bloom
Rhododendron albiflorum - almost in full bloom

(2) Park Mountain, B.C.; August 6, 1939; approx. 23.5 miles (N.40°E.) from Trinity Valley Field Station; south exposure; by K. Graham, C.V.G. Morgan.

Actaea sp? (at 3,300')	- fruit ripe
Cassiope sp.? (at 6,000')	- flowers just over
Delphinium Menziesii (at 6,000')	- in full bloom
Eriogonum heracleoides (at 6,000')	- in full bloom
Heracleum lanatum (at 5,000')	- in full bloom
Lilium parviflorium (at 6,000')	- in full bloom
Lupin sp.? (at 6,000')	- in full bloom
Phyllodoce empetriformis (at 6,000')	- in full bloom
Phyllodoce glandulosa (at 6,000')	- in full bloom
Picea engelmanni (at 5,000')	- staminate flowers shedding pollen
Pinus monticola (at 5,000')	- staminate flowers shedding pollen
Pyrus sitchensis (at 4,500')	- flowers over, berries green
Rubus parviflorus (at 5,000')	- in full bloom
Sedum stenopetalum (at 5,000')	- in full bloom

Disappearance of winter snow in open	- April 23
" " " " " forest	- April 27
Last spring frost	- June 2
First fall frost	- Sept. 14 7
" snow to fly in air	- Oct. 18
" " " whiten ground	- Oct. 24

Rocky mountain maple - Acer glabrum
Trinity Valley, B. C.

First flower open - April 29, 1939.

Black cottonwood, Populus trichocarpa
Trinity Valley, B.C.

First flowers shedding pollen - May 3, 1939.

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Western larch - Larix occidentalis
Station 4 - Trinity Valley,B.C.
Needles separated in bud April 22, 1939.

Mountain ash - Pyrus sitchensis
Station 5 - Trinity Valley, B.C.
First flowers open May 21, 1939.

Alpine fir - Abies lasiocarpa
Station 3 - Trinity Valley, B.C.

First bud scales shed April 28, 1939.

Engelman spruce - Picea engelmanni
Station 1 - Trinity Valley, B.C.

First bud scales shed May 8, 1939.

Douglas fir - Pseudotsuga taxifolia
Trinity Valley, B.C.

First staminate flowers shedding pollen
May 6, 1939.

Lonicera utahensis
Trinity Valley, B. C.

First flower open
April 28, 1939

Phenological Observations - 1939

Vancouver Sub-laboratory

The phenological observations recorded at the Vancouver Laboratory this year were based on the instructions contained in the memorandum received in the spring, in connection with the standardizing of such records throughout Canada. Two observations stations were used, one at the University of British Columbia and the other at the Green Timbers Forestry Station where observations were limited to the period between the early part of April and the end of September.

Station No. 1 - Arboretum of the University of British Columbia, Vancouver, B C.

The University is situated on the promontory which forms the western extremity of the Point Grey peninsula. On three sides is bounded by the Gulf of Georgia. Latitude - 49° 16' 7"N., Longitude - 123° 15' 8" W.

The Arboretum is located on the western side of the campus and protected on the west by a forest belt about 200 yards wide. Soil - glaciated loamy sand with boulders 2 feet below the surface. Trees open grown, see accompanying photos. Elevation, about 150 feet.

Station No. 2 - Green Timbers Forestry Station of the Provincial Forest Service, situated south of the Fraser River on the Pacific Highway and 6 miles south of New Westminster, B.C., by road. Site of forest nursery and plantations. Latitude - 49° 10' 17" N., Longitude - 122° 48' 31" W. Upland with elevation of 300 feet. Topography, rolling. Soil, sandy loam with depth of surface soil 16-30 inches. Logged over area with present natural growth consisting of willow and vine maple up to 20 feet in height. Observations on planted trees, open grown.

A summary of the observations recorded in 1939 is appended. Observations at Sta. No. 1 were recorded by W. G. Mathers, and at Sta. No. 2 by R. H. Longmore while conducting field investigations at the Forestry Station. Flowers were not available for observation in a number of cases this year.

In connection with the observations, as has been followed in past years, the formation of next year's bud on the end of the terminal growth was used at Sta. No. 1 as the indication that the terminal growth was completed. However, in

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case an elongation of the shoot occurs after the bud is formed, actual measurements of shoots under observation in 1940 will be recorded. Moreover, difficulty was encountered in determining the time of the shedding of the first bud-scales on several of the coniferous trees as the scales were found to persist for some time after the new growth first appeared.

The climate on the southern coast of British Columbia is so much milder than elsewhere in Canada that several of the general observations do not apply to this district; there is no winter freeze up and in some years, very little snow. Moreover the weather is often so mild in the fall that there is no definite turning of the foliage but instead a gradual fading with dropping commencing before all foliage has turned.

SUMMARY OF PHENOLOGICAL OBSERVATIONS

VANCOUVER LABORATORY - 1939.

Species	Observations	Date Sta. 1	Date Sta. 2
	Coniferous Trees		
Abies grandis	1st bud-scales shed	Apr. 27	May 4
	Terminal growth completed	June 12	July 12
Abies lasiocarpa	Buds swelling	Apr. 19	-
	1st bud-scales shed	Apr. 23	-
	Terminal growth completed	May 26	-
Larix occidentalis	Buds opening	Mar. 29	- -
	Needles brush-shaped	Apr. 6	-
	1st staminate flowers shedding pollen	Apr. 6	-
	Needles (fully) separated in bud	Apr. 19	-
	Terminal growth completed (& needles mature and fully expanded)	July 6	-
	Foliage turned	Oct. 23	-
	Tree leafless	Nov. 18	-
Picea engelmanni	1st bud-scales shed	Apr. 27	-
	75% buds open	May 8	-
	Terminal growth completed	June 5	-
Picea sitchensis	Buds swelling	Apr. 19	
	1st bud-scales shed	Apr. 25	Apr. 21
	All buds open	May 8	-
	Terminal growth completed	June 5	July 5
Pinus contorta	Candles developed and tip of needles showing	Apr. 27	-
	1st bud-scales shed	-	May 4
	Terminal growth completed	May 20	June 9
	Needles mature	July 24	-
Pseudotsuga taxifolia	Buds swelling	May 5	-
	1st bud-scales shed	May 10	May 2
	Terminal growth completed	June 8	July 5

Species	Observations	Date Sta. 1	Date Sta. 2
	Broad-leaved Trees.		
Acer circinatum	Buds open	Apr. 19	-
	1st flower open	Apr. 27	Apr. 26
	1st leaf fully expanded	May 6	May 8
	Tree leafless	Oct. 23	-
Acer glabrum	Flowers green	Apr. 19	-
	Seed forming	Apr. 27	-
	1st leaf fully expanded	Apr. 27	-
	Tree leafless	Nov. 8	-
Acer macrophyllum	Flowers open	Apr. 19	-
	Flowers dropping	Apr. 27	-
	1st leaf fully expanded	May 8	-
	Tree leafless	Nov. 18	-
Populus tremuloides	1st flower shedding pollen	-	Apr. 11
	Buds opening	Apr. 19	-
	1st leaf fully expanded	May 8	May 6
	Tree leafless	Nov. 18	-
Prunus demissa	1st flower open	Apr. 25	-
	1st fruit ripe	Sep. 7	-
	Tree leafless	Oct. 23	-
	(Petals dropping	May 27)	
Prunus emarginata	1st flower open	-	May 1
	1st fruit ripe	-	Aug. 10
Pyrus sitchensis	1st flower open	May 8	May 10
	1st fruit ripe	July 24	Aug. 12
	Tree leafless	Nov. 8	-
	Herbaceous Plants		
Cornus canadensis	First flowst open	-	May 9
	1st fruit ripe	-	Aug. 4
Epilobium angustifolium	1st flower open.	June 17	June 14
	Flowers common in region	July 6	June 19
Lilium parviflorum	1st flower open	-	June 14
	Flowers common in region	-	June 18
Solidago canadensis	1st flower open	July 28	July 12
	Flowers common in region	Aug. 15	July 18

General Observations	Date Sta. 1	Sta. 2
Last snow to fly in air	Feb. 24	-
Last snow to whiten ground	Feb. 24	-
Last spring frost	Mar. 29	May 10
First fall frost	Oct. 24	Oct. 24
First snow to fly in air	Dec. 24	-
First snow to whiten ground	Jan. 11)40	-

Abies lasiocarpa (foreground) used for Phenological Observations, 1939. Station No. 1, Vancouver Laboratory. Arboretum of the University of British Columbia.

Pinus contorta (two large trees) used for Phenological Observations, 1939. Sta. No. 1, Vancouver Laboratory. Arboretum of the University of British Columbia.

Photos by W.G.M.

a. b. c. d. e. f. g.

Coniferous trees used for Phenological Observations, 1939. Sta. No. 1, Vancouver Laboratory.

a. Larix occidentalis
b. Tsuga heterophylla (not used)
c. Picea englemanni
d. P. sitchensis
e. Pseudotsuga taxifolia
f. Abies grandis
g. Thuja plicata (not used).

Arboretum of the University of British Columbia.

Photo by W.G.M.

Acer glabrum (centre) and A. macrophyllum (background) used for Phenological Observations, 1939. Sta. No. 1, Vancouver Laboratory. Arboretum of the University of British Columbia.

Prunus demissa (left foreground) and Populus tremuloides used for Phenological Observations, 1939. Sta. No. 1, Vancouver Laboratory. Arboretum of the University of British Columbia.

Photos by W.G.M.

TEMPERATURE RECORDS

for

TRINITY VALLEY, B.C.

1 9 3 9
(April to October)

~~(See hygrothermograph records)~~

		Inside Insectary			Outside Insectary		
		Min.	Max.	8 A.M.	Min.	Max.	8 A.M.
April	17		59			61	
	18	31	51	36	30	52	35
	19	27	60	30	26	62.5	28
	20	28.5	67	35	27	70	38
	21	30	67	37	29	70.5	40
	22	32	53	43	30	54.5	44
	23	30	62	40	29	64.5	42
	24	34	54	39	33	56.5	41
	25	38	47.5	41	37	48	41.5
	26	33	64	40	32	66	42
	27	36	70	42.5	35	73	46
	28	36.5	79	44.5	35.5	81.5	48
	29	31	61	56	30	62	57
	30	28.5	65.5	41	27	67.5	43
May	1	31	69.5	50	29.5	71.5	51
	2	39	70	47	37	73	49
	3	41	65	47	39	66.5	48
	4	38	46	42	36	47	42.5
	5	36	56	40	35	58	40.5
	6	33	60.5	40	31.5	62	40.5
	7	40	59.5	46	39	62	47
	8	32	60	48	31	62.5	49.5
	9	27.5	58.5	37	26	59	40
	10	27	65	38	25	67	41
	11	29	69.5	38	27.5	71.5	41
	12	31	75	44	29.5	77.5	46

Temperature Records (Continued)

		Inside Insectary			Outside Insectary		
		Min.	Max.	8 A.M.	Min.	Max.	8 A.M.
May	13	37	80	49	35.5	82	51
	14	42	83.5	52	40	87	54
	15	42	84.5	52.5	40	87.5	56.5
	16	46	68	57	44	70	57.5
	17	41.5	63.5	52	40	66	53
	18	36	53	44.5	34	54	45
	19	35	58	44	33	60	45
	20	30.5	61.5	43	29	64	44
	21	32	61	48	30	63	49
	22	45.5	55	49	46	55.5	48.5
	23	44	56.5	46	43	58.5	47
	24	36.5	70	45	36	72	46.5
	25	40	58	50	39	59	51.5
	26	48	68	52	47	70	52.5
	27	39.5	58	50	38	60	52.5
	28	46	62	52	44.5	63	54
	29	38	67.5	49	37	70	51
	30	35	60.5	44.5	33.5	61.5	45
	31	31	52.5	41	29	55	42
June	1	30	59	41	28	61	43
	2	31.5	66.5	43	30.5	68	46
	3	38	54	48	36	55	50
	4	43	56	46	42	58	48
	5	44	58	45	43	60	46
	6	43	59	49	42	61.5	49.5
	7	45	57	49	43.5	59	48.5
	8	40	62	48.5	38.5	64.5	50
	9	40	59	50	38.5	61.5	52
	10	43.5	67	52	42.5	69	52
	11	38	58	51	36.5	61	52
	12	42	67	49	40	68.5	50
	13	41	58	50	40	59	50.5
	14	38	69.5	48	37	70	48.5
	15	48	68	51.5	46	70	51.5
	16	46	53	48	45.5	53.5	47.5
	17	48.5	58.5	50	47.5	60	50
	18	46	61	51	45	63	51
	19	42.5	62.5	51	41	64.5	51
	20	50	66	53	49	68.5	53.5
	21	43	69	52	41	72	53.5
	22	47	72.5	54.5	45	74	56
	23	49	62.5	53	47	64	53
	24	48	56	50	47	58	49.5
	25	45	60	51	44	62	50

Temperature Records (Continued)

	Inside Insectary			Outside Insectary		
	Min.	Max.	8 A.M.	Min.	Max.	8 A.M.
June 26	38	69.5	48.5	37	71.5	50
27	43.5	70	53	41.5	72	54.5
28	44	83	53	42	85.5	57
29	49	92	59	47	93	62
30	56	76	61	55	79	62
July 1	45	72.5	55	43	74	55
2	48	67.5	54	46	70	55
3	53	58.5	55	52	57.5	55
4	53	66.5	57	52	68	56.5
5	49	68	54.5	47	69	56
6	52	67.5	56	52	69	57
7	43.5	69	54.5	42	71	54
8	40	78	50	38.5	81	52
9	45	85	60.5	43	88	62
10	49	70	58	47	72.5	60.5
11	46	78.5	57	44	80	57
12	39.5	78	47.5	36.5	80	51
13	42	73.5	51.5	40	76.5	54.5
14	46.5	76	53.5	45	78.5	54
15	41.5	74	56.5	40	78	58
16	39	63	50	37.5	64.5	51
17	38.5	72.5	47.5	37	74.5	49
18	45	72	55	43.5	74.5	57
19	47.5	68	53	46	71	53
20	49	64.5	53.5	48	66	54.5
21	42.5	73.5	51	40.5	76	54
22	46	78	54.5	44	80.5	57
23	55	79.5	57	54	84	60.5
24	57	82	62.5	55.5	84	63
25	51	87.5	59	49	90	62
26	53.5	89	60 5	51.5	93	62.5
27	53	93.5	61	51.5	98	64
28	56	89.5	64	54.5	91	67
29	51.5	87	59	49	89.5	61.5
30	51.5	88.5	58.5	49	91	61
31	44.5	67	57.5	42	70	58
Aug. 1	38.5	78	47	36.5	77	50
2	45	82	52.5	43	85	55
3	49	88.5	57	47	92	60
4	50	87	58	48	90.5	61.5
5	50	72	57	48	73.5	57
6	36.5	66	48	35.5	68.5	50

Temperature Records (Continued)

	Inside Insectary			Outside Insectary		
	Min.	Max.	8 A.M.	Min.	Max.	8 A.M.
Aug. 7	34.5	71.5	45	33	74	48
8	39.5	81	48	37.5	84	51
9	46	85	54	44	87.5	57
10	47	87.5	56	45	90.5	59
11	50	86	57.5	48.5	89	60
12	47	78	59	45	79.5	61.5
13	43	81.5	50.5	41	83	52
14	43	85.5	50.5	41	88	52.5
15	44.5	75.5	53	43	78	56
16	40.5	84	49	38.5	86.5	53
17	44.5	74.5	51.5	43	77	53.5
18	35.5	74.5	44	33	77	46
19	35	77	44	33.5	79	47
20	40.5	82.5	48	38.5	86	50
21	40	79.5	45.5	38	82.5	48
22	42	85	49	40	88.5	51.5
23	45	84	50.5	43	86	52
24	50.5	83.5	56.5	50.5	86	57.5
25	48	59.5	53	46	59.5	55
26	44	73.5	50	42	75.5	52
27	44	79	50	43.5	81.5	52
28	47.5	75	52	46	75.5	53.5
29	42	71	47	40	72	47
30	38	75	45	36	77.5	47
31	48	70	52	46	73.5	53
Sept. 1	50	65.5	53	48.5	68	53.5
2	49	62	54	48	63.5	55
3	51.5	72	56	50	74	57
4	52	66	54.5	51	68.5	56
5	51.5	53	53	50.5	55	52
6	35	58	39	33	59.5	40
7	32.5	67	37	31	69	38
8	43	66.5	50.5	42.5	70	51
9	33	68	37	31	71	39
10	38	60		38	62	
11	46	56	50	46	58	50
12	41	54	44	39	55.5	44
13	34	60.5	41	32	64	41
14	32	58.5	35	30	60	36
15	45	55.5	49	45	57	49
16	42	69	46	41	73	47
17	41.5	63	48.5	42	65	50

Temperature Records (Continued)

		Inside Insectary			Outside Insectary		
		Min.	Max.	8 A.M.	Min.	Max.	8 A.M.
Sept.	18	34	63.5	44.5	32	66	45
	19	33	66.5	36	30.5	70.5	38.5
	20	37	71.5	39.5	35	75.5	40
	21	48	68	54.5	47	71	55
	22	43	71.5	45.5	41	75.5	46
	23	42	71	44.5	40	76	45.5
	24	40	66	43	38	69	43.5
	25	35	63	37.5	32.5	66.5	38.5
	26	39	70	42.5	36.5	73	43
	27	39.5	60	51.5	38	62	50.5
	28	33	57.5	37	31	60	37
	29	39.5	63.5	43	37	65.5	43.5
	30	35	63	38	33	66	39.5
Oct.	1	39.5	55.5	45.5	38.5	58	46.5
	2	34.5	56	37	32.5	59.5	36.5
	3	29.5	53.5	32.5	27.5	56	32.5
	4	37	46.5	42.5	35	47.5	43
	5	35	47.5	38	33	49	38
	6	29	46.5	36	28	48	36
	7	29	40.5	32.5	28	41.5	32.5
	8	30.5	52.5	32.5	28.5	55	34
	9	37.5	54.5	41.5	36.5	56.5	42
	10	36	52.5	39	34	57	40.5
	11	36.5	57	41	34.5	59.5	42
	12	34	56	35.5	32	59.5	37
	13	32.5	57.5	33.5	31	61.5	34.5
	14	37.5	56.5	38.5	36	58	39
	15	32.5	50	33	29	51.5	33
	16	30.5	48	33.5	28	51.5	34
	17	31.5	54.5	37	30	56	37.5
	18	29	37.5	31	27	39	30.5
	19	35.5	55	37	34	56.5	39
	20	39	49	42	39.5	50.5	41.5
	21	45.5	63	50.5	44.5	65.5	51.5
	22	48	52.5	49	47	53.5	49
	23	37	48	45.5	36	48.5	45
	24	29.5	30.5	30	28	31	29
	25	28.5	31.5	29	26	33.5	28
	26	30.5	35	33.5	28	35	32
	27	33		34	29.5		33

RAINFALL RECORDS

for

TRINITY VALLEY, B.C.

1939
(April to October)

(See ~~hygrothermograph records~~)

		Rainfall in inches	
April	24* - 25*	.06	- fell during early A.M. of April 25.
May	1 - 2		- few drops of rain at 5:15 P.M. of May 1.
	2 - 3	.12	- fell after 3:30 P.M. of May 2.
	3 - 4	.395	- fell during A.M. of May 4.
	4 - 5	.33	- showers throughout May 4 until early A.M. of May 5.
	5 - 6	.005	- fell during early A.M. of May 6.
	6 - 7	.11	- fell in evening of May 6.
	15 - 16	.035	- fell in early A.M. of May 16
	16 - 17	.055	- showers throughout A.M. of May 17.
	17 - 18	.01	- showers throughout period.
	18 - 19	.07	- showers throughout period.
	21 - 22	.40	- fell in P.M. of May 21 & A.M. of May 22.
	22 - 23	.1	- fell mostly in A.M. of May 22.
	23 - 24	.095	- fell in A.M. of May 23.
	25 - 26	.43	- fell in P.M. of May 25.
	27 - 28	.09	- fell in P.M. of May 27 & A.M. of May 28.
June	3 - 5	.85	- fell from afternoon of June 3 to A.M. of June 5.
	5 - 6	.11	- fell during period.
	6 - 7	.105	- fell in P.M. of June 6 & A.M. of June 7.
	7 - 8	.005	- fell in A.M. of June 7.
	9 - 10	.17	- fell throughout period.
	10 - 11	.03	- fell in early P.M. of June 10.
	11 - 12	.16	- fell in P.M. of June 11.
	12 - 13	.2	- fell in early A.M. of June 13.
	13 - 14	.22	- fell during A.M. of June 13.
	14 - 15	.04	- fell during P.M. of June 14 & A.M. of June 15.

* - (9 A.M. to 9 A.M.)

Rainfall Records (Continued)

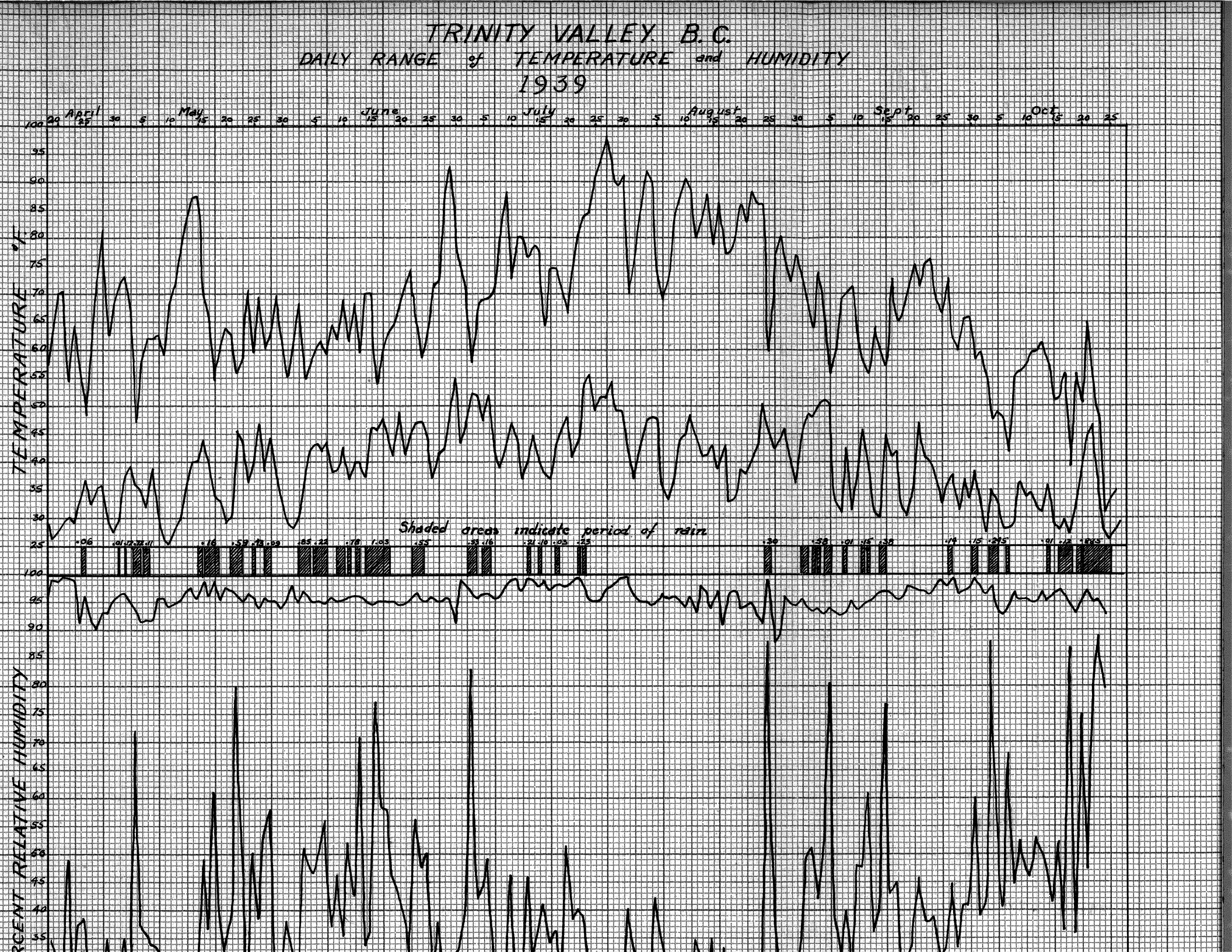
	Rainfall in inches	
June 15 - 16	.575	- fell during P.M. of June 15 & A.M. of June 16.
16 - 17	.075	- fell during A.M. & P.M. of June 16.
17.- 18	.21	- fell during A.M. & P.M. of June 17.
18 - 19	.075	- fell during A.M. & P.M. of June 18.
19 - 20	.06	- fell during A.M. & P.M. of June 19 (scattered showers)
22 - 23	.025	- fell during A.M. of June 23.
23 - 24	.37	- fell during P.M. of June 23 & early A.M. of June 24.
24 - 25	.15	- fell during A.M. & P.M. of June 24.
July 2 - 3	.205	- fell in A.M. of July 3,
3 - 4	.32	- fell in showers throughout period.
4 - 5	.005	- fell mostly in A.M. of July 4.
5 - 6	.09	- fell mostly after 6 P.M. of July 5.
6 - 7	.07	- fell in showers throughout day of July 6.
13 - 14	.21	- heavy rain showers & hail at 4:00 P.M. of July 13.
15 - 16	.1	- fell mostly after 5 P.M. of July 15, 1939.
18 - 19	.03	- fell after 7:00 P.M. of July 18.
22 - 23	.12	- fell after 8:30 P.M. of July 22 (for about 2 hours).
23 - 24	.115	- fell after 9:00 P.M. of July 23 (for about 3 hours).
Aug. 24 - 25	.15	- fell between 8:15 A.M. & 9:00 A.M. of Aug. 25.
25 - 26	.15	- fell A.M. & P.M. Aug. 25.
31 - Sept.1	.025	- fell in P.M. of Aug. 31.
Sept. 1 - 2	.28	- fell in A.M. & early P.M. Sept. 1.
2 - 3	.035	- fell in late P.M. of Sept. 2.
3 - 4	.01	- fell in P.M. of Sept. 3.
4 - 5	.03	- fell early A.M. of Sept. 5.
5 - 6	.205	- fell mostly between 12 (noon) & 3:00 P.M. of Sept. 5.
7 - 8	.01	- fell mostly in A.M. of Sept. 8.
10 - 11	.01	- fell as a shower early P.M. of Sept. 11.
12 - 13	.14	- fell early P.M. of Sept. 12.
14 - 15	.29	- fell between 7 P.M. Sept. 14 & early A.M. Sept. 15.
15 - 16	.085	- fell in P.M. of Sept. 15.
26 - 27	.14	- fell between 12:00 (midnight) & 9 A.M. of Sept. 27.
30 - Oct. 1	.115	- fell between 3 A.M. & 7 A.M. of Oct. 1.
Oct. 1 - 2	.04	- fell between 1:00 P.M. & 1:30 P.M. of Oct. 1.
3 - 4	.02	- fell in early morning until 9:00A.M. of Oct. 4.
4 - 5	.215	- fell in showers throughout period.
5 - 6	.005	- fell between 10:00 A.M. & 12:00 (noon) of Oct. 5.
7 - 8	.005	- fell between 11:00 A.M. & 12:00 (noon) of Oct. 7.
14 - 15	.01	- fell in afternoon of Oct. 14.

	Rainfall in inches	
Oct. 16 - 17	.09	- fell between 3:00 P.M. of Oct. 16 & 9:00 A.M. of Oct. 17.
17 - 18	.02	- fell between 9:00 A.M. & 10:00 A.M. of Oct. 17; and A.M. of Oct. 18.
18 - 19	.01	- fell in showers throughout Oct. 18.
19 - 20	.01	- fell in early A.M. of Oct. 20.
20 - 21	.01	- fell between 10:30 A.M. & 12:00 noon of Oct. 20 & early A.M. of Oct. 21.
21 - 22	.02	- scattered showers after 12:00 (noon) of Oct. 21; and A.M. of Oct. 22.
22 - 23	.17	- fell between 3:00 P.M. of Oct. 22 & Oct. 23 (to 9 A.M.)
23 - 24	.285	- fell - rain throughout period. Snow fell in early A.M. of Oct. 24 until 9 A.M. of Oct. 24 - about 3 inches snow.
24 - 25	.060	- fell throughout period as snow; equals about 1 inche of snow.
25 - 26	.33	- fell between 8:00 P.M. of Oct. 25 & 9:00 A.M. of Oct. 26 as snow; equals about 4.8 inches snow.

TRINITY VALLEY B.C.

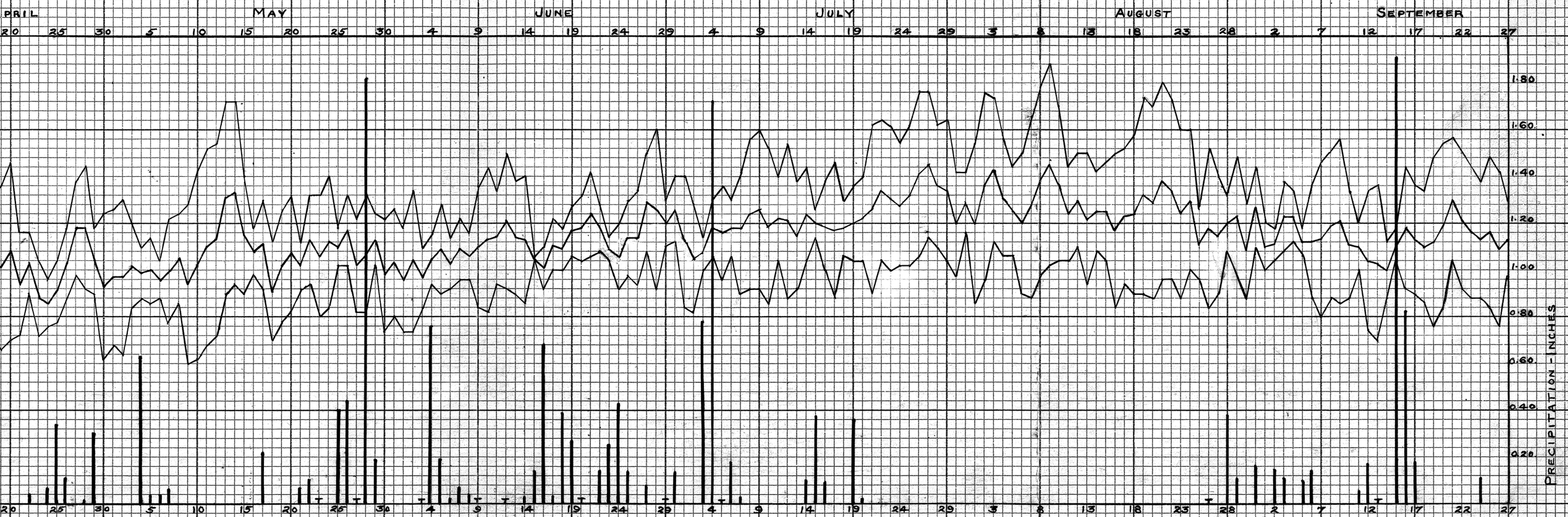
DAILY RANGE of TEMPERATURE and HUMIDITY

1939



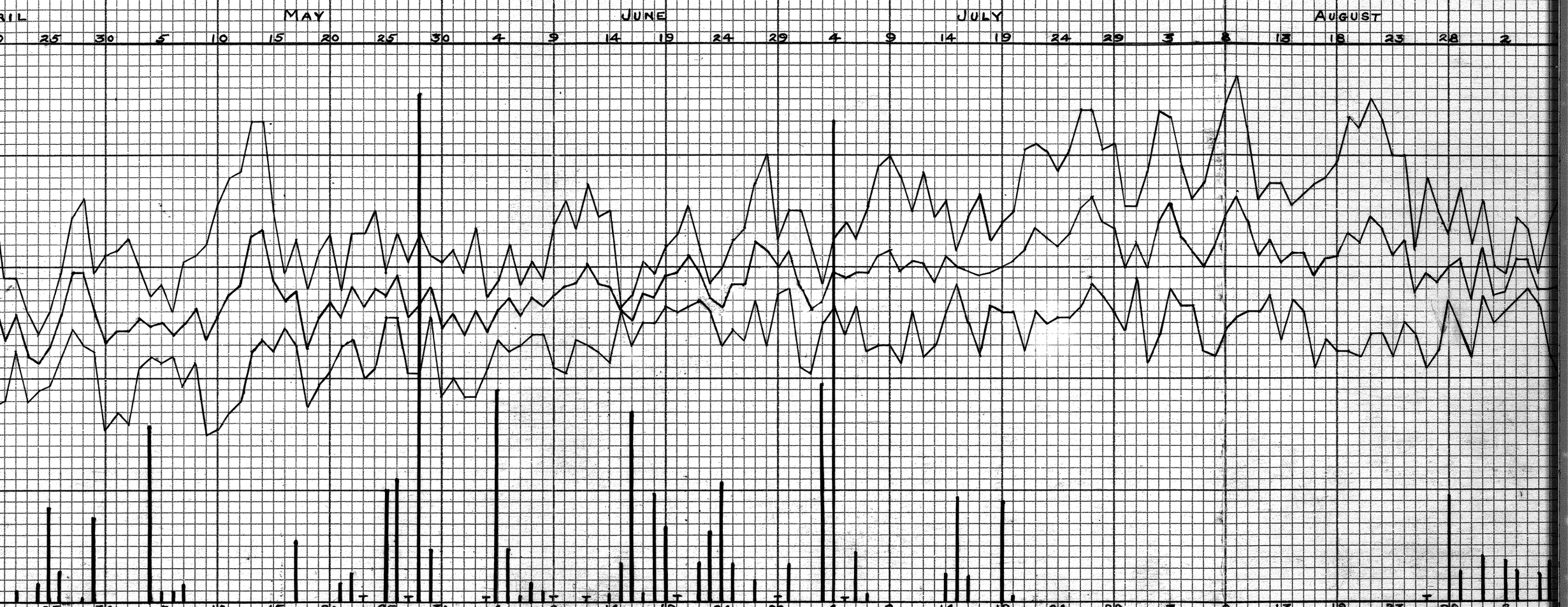
Weather Record - Green Timbers Forestry Station B.C.

1939



Weather Record - Green Timbers Forestry Station B.C.

1939



PUBLICATIONS

Leech, Hugh B. On some nearctic species of Agabus, with the description of a new species (Coleoptera: Dytisidae) Can. Ent., 71(10):217-221. October, 1939.

Leech, Hugh B. Three new species of nearctic rove beetles from the Pacific coast (Coleoptera: Staphylinidae). Can. Ent., 71(12):258-261. December, 1939.

Note: The above articles by Mr. Leech were done outside of Departmental work hours.

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