ANNUAL REPORT

1945

VERNON FOREST INSECT LABORATORY

VERNON, BRITISH COLUMBIA

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I N T R O D U C T I O N

During 1945, the Staff of the Vernon Forest Insect Laboratory has continued the forest insect survey, covering all of British Columbia, including the coastal region which is under the jurisdiction of the Victoria Laboratory, as well as the National Parks in Alberta. Other investigations included the spruce budworm in various parts of the Interior, the larch sawfly in the Southern Interior, the hemlock looper in the Big Bend region, and the mountain pine beetle and lodgepole pine needle miner in Kootenay, Banff, and Yoho National Parks.

Members of the Vernon Staff cooperated with the Belleville Parasite Laboratory in carrying out extensive collections of spruce budworm parasites in the Lillooet district.

In the spring the Vernon Staff was augmented by the addition of two forest insect rangers, S. H. Farris and G. M. S. Cowan. After the summer field work Mr. Cowan transferred to the War Time Prices and Trade Board. In the fall, C.V.G.Morgan transferred to the Vernon Fruit Insect Laboratory.

Carrying on the work was made more difficult by these losses as well as illnesses of several officers. Transportation has been another difficulty which, it is hoped, may be remedied in 1946.

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P E R S O N N E L

of the

VERNON FOREST INSECT LABORATORY.

Geo.R. Hopping - Agricultural Scientist (III) in Charge

W. G. Mathers - " " (II)

H. B. Leech - " " (I)

C. V. G.Morgan - " Assistant (now in Fruit Insect Laboratory)

S. H. Farris - Forest Insect Ranger (I)

G. M. S. Cowan - " " " (I) (now in W.P.T.B.)

Miss R. Beckingham - Stenographer (II)

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ATTENDANCE OF OFFICERS AT CONFERENCES; ADDRESSES AND LECTURES

G. R. Hopping and H. B. Leech attended the 44th Annual Meeting of the Entomological Society of British Columbia held in Vancouver, B.C. on February 24. G. R. Hopping delivered a paper on the lodgepole pine needle miner and H. B. Leech presented a paper dealing with the publication put out by the Society. H. B. Leech was elected Honorary Secretary-Treasurer and G. R. Hopping elected to the Advisory Board. While in Vancouver conferences were held with Dr. M. L. Prebble and G. Ternan, forester of the Vancouver District.

At the request of the B.C. Forest Service, G. R. Hopping addressed the annual meeting of forest rangers of the Vancouver district on March 13. Current forest insect conditions with special reference to the survey were discussed.

G. R. Hopping addressed the rangersof the Nelson forest district on March 28.

W. G. Mathers was absent from Vernon, April 9 to 12 in Lillooet making arrangements concerning further collecting of spruce budworm parasites. In Kamloops he conferred with Forest Service personnel regarding cooperation in certain phasesof the work. Also in connection with this work heads of the Japanese community at Bridge River Station were interviewed through the district supervising agent of the B.C. Security Commission.

Between June 6 and 17, G. R. Hopping and G. M. Cowan held conferences with G. F. Horsey, Superintendent of B. C. National Parks and with Bruce Mitchell, Supervising Warden of Banff Park. Bark beetle and needle miner investigations were discussed.

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RECONNAISSANCE TRIPS

G. R. Hopping and Geo. M. Cowan were away from Vernon June 6 to 17 incl. establishing sample plots in connection with the lodgepole pine needle miner in Banff, Yoho, and Kootenay Parks. They also examined bark beetle control areas and larch sawfly areas in the Kootenay region.

Hopping and Cowan visited the Bolean Lake spruce budworm areas toward the latter part of June, in company with John Noble of the B.C. Forest Service.

W. G. Mathers, S. H. Farris and Harry Coppel of the Belleville Laboratory left Vernon on June 5 for Lillooet to supervise spruce budworm parasite collecting. They returned to Vernon in early August.

G. M. Cowan made a trip to Chute Lake July 9 to 11 to investigate a report of damage to lodgepole pine, presumably by bark beetles. The damage was caused by the blister rust Cronartium coleosporioides and a needle cast disease, Hypodermella sp.

W. G. Mathers and S. H. Farris were in the Bolean Lake district August 13 and 14 and August 20 to 23 establishing sample plots in connection with spruce budworm investigations on the timber limits of the Vernon Box and Pine Lumber Company.

G. R.Hopping, W. G.Mathers, and S. H. Farris were in the Prince George district September 1 to 8, investigating spruce budworm and bark beetle conditions. Two days were spent at Aleza Lake Forestry Station with Dr. Bier and his assistants who are making rot studies on balsam.

S. H. Farris spent September 17 to 19 examining spruce budworm infestations in the Sock Lake and Candle Creek areas of the North Thompson River drainage system.

G. R. Hopping, W. G. Mathers, and G. M. Cowan spent Sept. 17 to 26 incl. examining bark beetle and hemlock looper damage in the Big Bend district of the Columbia River and checking needle miner plots and bark beetle control areas in the National Parks. On the return trip larch sawfly plots were examined throughout the Kootenay region.

VISITORS TO THE LABORATORY

March 23 - A. E. Parlow, District Forester, Kamloops. Object: Discussion of parasite collecting arrangements at Lillooet.

May 21 - Clark McBride, Forester, B.C. Forest Service. Object: Discussion of proposed spruce budworm studies at Bolean Lake.

June 25-26- Dr. V. B. Wigglesworth, London School of Tropical Medicine. Object: Round table discussion of physiological and other insect problems with officers of the Vernon Fruit Insect Laboratory, the Vernon Forest Insect Laboratory, the Kamloops Field Crop Insect Laboratory, the Kamloops Livestock Insect Laboratory and the Provincial Entomological Service.

June 29 - Sam Marling, Forester, B.C. Forest Service. Object: Discussion of selection cutting and other forest management practices in relation to forest insects.

August 17- G. B. Rawlings and A. W. Sexton, New Zealand Forest Service. Object: To gain a general idea of forest insect problems in Canada with particular reference to parasites of Hylastes which might be introduced into New Zealand.

September 13 - F. S. McKinnon, Chief of Economics Division, B.C. Forest Service; Eric Druce, in charge of public relations for the same service; and Foresters John Noble and Eric Robinson. Object: Discussion of spruce budworm investigations in the Prince George region, and at Bolean Lake.

October 23- Dr. Don C. Buckland of the Dominion Forest Pathology Laboratory, Victoria. Object: Discussion of lodgepole pine needle cast disease in the Monashee and Arrow Lakes district.

December 27 - A. E. Parlow, District Forester, Kamloops. Object: Discussion of hemlock looper damage in the Big Bend district and possibilities of control

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COOPERATION WITH OTHER AGENCIES

The usual cooperation has been maintained between our service and the B.C. Forest Service. The supplying of a truck by the latter service for use in the parasite collecting work at Lillooet was particularly appreciated. The collection of samples in the survey has been about average by the Rangers. Cooperative studiesof the spruce budworm in relationto reproduction is being carried out at Bolean Lake. Much of the demonstration material used at the Ranger School at Green Timbers was supplied by the Vernon Laboratory.

Cooperation with the National Parks Service has been maintained in connection with bark beetle control and needle miner studies.

Various private timber companies have sought advice and have requested assistance with forest insect problems. These included bark beetle damage and damage to logs in decks by borers.

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DETAILED REPORT OF PROJECTS

E.30.01 - Forest Insect Survey - Leech

I. Introduction

In 1945 the Pacific Coast section of the Canadian Forest Insect Survey was made possible through the cooperation of the personnel of the British Columbia Forest Service, the National Parks Branch, in British Columbia and western Alberta, and a few private individuals. Officers of the Division of Entomology have made special collections, visited the more serious outbreaks, and have assisted in the preparation of this report.

Objects of the Survey:

1) To learn what kinds of insects are present in our forests. There are thousands of kinds, some destructive, some harmless, some beneficial . Species unknown to us have been sent in each year, and several proved to be new to science.

2) To observe the habits of the various species, and learn what their effects may be on the growth of trees and other forest life.

3) To accumulate over long periods, information on distribution, fluctuations in numbers, and factors which control them, including parasites, predators, weather and different kinds of forest management. Such data are necessary in preventing loss by insect damage.

4) To obtain an annual check on the numbers of potentially destructive insects so that all will be forewarned of serious outbreaks. Advance warning gives a chance to reduce loss; parasites may be introduced, or cutting and management programs may help to restore balance. If control of the pest is not feasible, planned salvage cuttings will help to reduce loss in commercial stands.

5) To assist those working in the woods, as well as the owners of woodlots and forests, in becoming familiar with the signs of insect activity in the forest, Many causes of poor growth and unthrifty conditions go unnoticed, or are not noticed until it is too late to correct them.

These objectives cannot be accomplished by a small staff, so the project has become a cooperative one and depends for its efficiency on maximum assistance from those who can cooperate.

II. Methods

Cooperators have been asked to make two collections a month, June to September inclusive, one from the dominant evergreen in the district, the other from a tree species of their own choice. Additional samples are sent in by men interested in the work. Outbreaks should be reported as soon as noticed, accompanied by the insects and damage if possible. Notes on the extent and severity of infestations are particularly valuable. Forms are available for special reports.

It is important that collectors include insects from only one kind of tree in one box. They should state clearly what kind of tree has been sampled, and enclose foliage.

When a box reaches this laboratory its contents are given a serial number, examined and identified if possible. Adult insects are killed and kept for study; the more interesting kinds are placed in the Canadain National Collection at Ottawa.

Immature stages (caterpillars, maggots, pupae etc.) are taken to theTrinity Valley Field Station near Lumby, where some are killed and preserved for reference and study;the remainder are placed in small cages and reared to maturity if possible. Notes are kept on the life-histories and habits of the various species and the

parasites which may serve to keep them under control. When adults have been obtained and identified, all available information is summarized and placed on permanent record.

Every collection is acknowledged by letter. Each kind of insect in a shipment is listed by its scientific name, and a short description is added so that the collector may recognize the different forms. Data on life history and habits are added for the more interesting or important species, or upon request.

III Results in 1945

As in 1944, mailing boxes were usually well sealed, and the insect specimens reached us in good condition. Individual short reports on damage and the extent of infestations are appreciated, and are especially helpful in making this report. It will be noticed that cooperators get full credit herein.

Of 6,004 specimens received this year, 4,293 were immature stages, most of them suitable for rearing to obtain adults and/or parasites.

Received at Vernon	1941	1942	1943	1944	1945
Survey collections	945	773	657	771	764
Total specimens in collections	8,114	8,325	6,638	11,939	6,004
Negative Report Forms	137	87	74	70	77

In the Interior of British Columbia the spruce budworm (Archips fumiferana)* was again the major pest, but the hemlock looper (Lambdina fiscellaria lugubrosa)* has increased greatly in several areas and will be a

serious pest in 1946. The European larch sawfly (Pristiphora erichsonii) caused little damage, though it is still extending its range southwestward within the range of western larch. The Douglas fir tussock moth (Hemerocampa pseudotsugata) is becoming abundant in the city of Vernon.

In Jasper National Park no serious outbreaks have been reported, but the lodgepole pine needle miner (Recurvaria milleri) should be watched for in 1946. In Banff, Yoho, and Kootenay National Parks the lodgepole needle miner and the mountain pine bark beetle (Dendroctonus monticolae) are most important, though the bark beetle outbreak appears to be under control. In Waterton Lakes National Park most damage has been caused by leaf-roller caterpillars (Tortricidae) on aspen.

On the Queen Charlotte Islands the hemlock sawfly (Neodiprion tsugae) and the introduced alder sawfly (Hemichroa crocea) have caused severe defoliation. In the Terrace district an unidentified looper caterpillar (Geometridae) has defoliated broadleaf trees and shrubs. On Vancouver Island an outbreak of hemlock looper was found in the Cayeuse River area, and severe damage is likely to result in 1946. An infestation of tent caterpillars (Malacosoma sp.) was reported from the Cooke area.

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* Three important forest insect pestshave had their names changed within the last few years:

The spruce budworm used to be Cacoecia fumiferana,
now is Archips fumiferana
The black-headed budworm used to be Peronea variana
now is Acleris variana
The hemlock looper used to be Ellopia f. lugubrosa
now is Lambdina f. lugubrosa

IV. Status of Major Forest and Shade Tree Insect Pests During 1945

A. Species causing Serious Injury at the Present Time.

1. On Spruce, Balsam and Douglas fir.

The Spruce Budworm (*Archips fumiferana* Clemens).-- Current outbreaks were treated fully in the Annual Report for 1944. The high-altitude spruce-balsam form has a two-year life cycle, and 1945 being the "off-year" in which the larvae are small probably accounts for the fact that no reports of damage were received.

Douglas fir was less heavily infested on Mt. McLean and Mission Ridge in the Lillooet district, and in Botanie Valley near Lytton (W. G. Mathers). On Cayoosh and Fountain Creeks in the Lillooet district defoliation was more evident, while at Moha it was reported as heavy (W. G. Mathers). In the Sock Lake area on the Clearwater River, a tributary to the North Thompson, feeding this year was light to heavy, most severe on balsam; loggers claimed that the "worms" were not as numerous as in 1944 (S. H. Farris).

The following report was received from E. W. Thomas early in the year, and refers to damage done probably in 1944: Ed. Oberg, trapper from Goat River in the McBride district, reports all the young spruce and balsam killed for two miles each side of MacLeod Creek with lesser damage on North Star Creek and LaSalle Creek. A sample containing empty pupal skins of the budworm made identification positive. Richard Hamilton, who traps on the nearby Milk River, reports similar damage on the upper reaches.

Budworm larvae and pupae and their parasites were again collected in thousands at Shalalth and Mt. McLean, and shipped, chiefly by air express, to the Dominion Parasite Laboratory at Belleville, Ont. In charge of the crew of 40 were Dr. A. Wilkes and Mr. H. Coppel of Belleville, and Messrs. W. G. Mathers and S. H. Farris of Vernon. The object of the work was to obtain budworm parasites for experiment and release in the severe infestations in eastern Canada.

2. On Pine

Mountain Pine Bark Beetle (Dendroctonus monticolae Hopk.)--
The infestation in Kootenay National Park continues to decline; only the northern portion remains active and there the pure stands of lodgepole pine give way to a mixture of pine, spruce and balsam (G.R.Hopping).

The outbreak in Banff National Park appears to be under control, but the bark beetle has become active in the vicinity of Leancheil in Yoho National Park and control will be undertaken in January, 1946.

Lodgepole Pine Needle Miner (Recurvaria milleri Busck.)--
This species has a two-year life cycle. It is only in flight years (i.e. years in which moths are produced) that damage shows much. Rapid feeding by the nearly fully grown caterpillars reddens the needles quickly, and shows the extent of the infestation.

The outbreak is known to cover about 200 square miles in Banff, Yoho and Kootenay National Parks. This (1945) is not a flight year, but twenty collections showed the population of larvae to be high. From tips picked, 18,595 needles were examined; 3,522 had been mined, and of these 1,656 actually contained caterpillars during the month of October (G. R.Hopping, R.G. Mathers and G.M. Cowan).

3. On Hemlock

Hemlock Looper (Lambdina fiscellaria lugubrosa Hulst.)--
There is an important infestation along the Big Bend of the Columbia River, from a point 35 miles north of Revelstoke northward for about 50 miles. It occurs on both sides of the valley, and heavy defoliation occurred over localized areas in 1945. The peak of infestation will probably be in 1946 (G. R. Hopping).

A large flight of moths was seen on the Big Bend Highway, 35 to 40 miles out from Revelstoke (H.J. Coles, Sept.4). No defoliation was reported from the North Thompson and Adams River valleys but large numbers

of moths were observed 4 miles south of Blue River (P. T. Muskett, Aug. 28), and at Lempriere (S. H. Farris). Sept.19). Moths were said to be numerous in the vicinity of Tumtum Lake on the Upper Adams River also.

An outbreak of the looper has been found in one of the most valuable forest stands on Vancouver Island, in the Cyacuse River area. The infestation is restricted for the most part to valley bottoms, extending up the sides for 300 to 400 feet in elevation. Moths already had emerged and died when the examination was made, but they littered the forest floor in vast numbers and completely covered the water in back-eddies. Partially eaten needles covered the ground to a depth of 1/4 inch. Counts of eggs made on felled trees gave an average of 40 per 60 square inches. It seems evident that a great increase has occurred in 1945 and will continue through 1946 (H. A. Richmond).

Hemlock Sawfly (Neodiprion tsugae Midd.).-- All reports are from the Queen Charlotte Islands. A large collection of caterpillars was sent from Skidegate Lake (R. E. Elliot, Aug.1). In the Masset Inlet area the infestation was less severe than in 1944 (L. C. Chamberlin, Aug.2). In Skidegate Inlet, Alliford Bay was particularly hard-hit, with caterpillars even on tree trunks, stumps and on all limbs etc. on the ground (J. B. Scott Aug.18). Collections were received from Cumshewa Inlet also (J. B. Scott).

4. On Poplar, Willow and Shrubs

Alder Sawfly (Hemichroa crocea Fourc.) -- An introduced species, already reported from the Vancouver district, Agassiz, and Gleneden near Salmon Arm; only alders were attacked. This year it caused severe defoliation in the Queen Charlotte Islands; it must have been present but unnoticed for some years, to enable it to build up such a large population. "This attack is very severe and covers most trees, which are completely defoliated from Port Clements to Queen Charlotte City. It struck within the last month" (J. B. Scott, July 19). Reported to be very bad at Dobieville, Alliford Bay (J. B. Scott).

Poplar Sawfly (Nematus nigriventris Curran).-- Prevalent only at one or two places in the Eagle River district; fairly heavily defoliated trees were found in the vicinity of Three Valley Lakes near the headwaters of Eagle River (G. R. Hopping and G. M. Cowan).

Tent Caterpillars (Malacosoma spp.).-- A heavy infestation on alder all over the Sooke district, Vancouver Island, was reported in late May (R. A. Rickey). In the Peace River district an outbreak occurred along the Peace River at Taylor Flats and on adjacent benchlands; by mid-July the trees were beginning to leaf out again (C. L. French and N. V. MacLean); caterpillars were also present to the south, along the Kiskatinau River (I. B. Johnson). The caterpillars were numerous on poplars in the vicinity of Three Valley, B.C. (G. R. Hopping and G. M. Cowan.)

Satin Moth (Stilpnotia salicis L.) -- Satin moth caterpillars completely defoliated most of the native poplars over several acres on the west side of Botanie Valley, some seven miles from Lytton (W.G. Mathers).

B. Species Not Causing Injury at the Present Time but Known to be Capable of Doing So.

1. On Douglas fir

Douglas Fir Tussock Moth (Hemerocampa pseudotsugata McD.)-- Though not yet reported from the surrounding timbered country, the caterpillars were numerous in the town of Vernon, and drew comment from citizens. In the past, severe outbreaks have come at eight or nine-year intervals in British Columbia. Vernon trees were heavily defoliated in 1921-22, 1929-30 and 1938-39. In each case, the outbreaks subsided quickly, as a result of a virus disease, but in the one or two peak years the caterpillars did much damage. Trees completely defoliated will die; where individual branches or a section

of the trees are defoliated, those parts usually fail to recover, and give the trees a ragged and sickly appearance.

Vernon: Trees defoliated; caterpillars common on sidewalk (G. M. Cowan, July 10); caterpillars numerous, invading tents of the Forest Service Suppression Crew camp (A. Specht). Larvae showed no external signs of virus disease. Peak infestation is expected in 1947.

2. On Pine

Lodgepole Pine Sawfly (Neodiprion sp.) -- Reported to be present in large numbers on small lodgepole pine trees on Wallace Mountain, four miles south of Beaverdell (J. Haywood).

3. On Hemlock

Black-headed Budworm (Acleris variana Fern.).--One hundred examples of stages of this species were submitted, in 58 different collections, but there were no reports of damage.

4. On Larch

European Larch Sawfly (Pristiphora erichsonii Hartig).--Medium to heavy defoliation occurred over several hundred acres of second-growth larch on the summit between Rossland and Sheep Creek, 8 miles west of Rossland (J. Lawson, July 23). Cocoons taken on this area in September showed a combined parasitism by Mesoleius and Tritneptis wasps of close to 10 per cent (G. E. Hopping, W. G. Mathers and G. M. Cowan).

Larvae were numerous at Christian Valley (J. F. Killough, July 20), but scarce at East Goatfell, Creston district (A. I. Ross, May 3). The lightest

attack in recent years, is the report from the Nelson district (R.C. Christie, Sept.21); no defoliation at all was noticed in the Cranbrook district (F. H. Fym Sept. 13); and no serious defoliation in the Invermere section (J. L.Johnson, Sept.13).

Two extensions of known range were reported this year: Christian Valley on the main Kettle River (J. F. Killough), and between Penticton and Ellis Creeks near Penticton (D. W. Richardson).

V. Status of Minor Forest and Shade Tree Insects Pests During 1945

1. On Spruce

Spruce Needle Miner (Taniva albolineana Kearf.)--Dissections of 100 larvae from a localized infestation in Vernon, B.C. in April, 1945, showed 83 per cent parasitism by Ascogaster sp., a smallblack wasp (C.V.G. Morgan).

2. On Pine

Needle Miner in Lodgepole Pine.-- Examples of needle miners and damage from near Squilax, B.C. were submitted (C.S. Whelan, Sept.4). The small reddish caterpillars resemble those of the Recurvaria miner known from the Rocky Mountain Parks but the habits differ: in the Squilax species the needles are usually entered at the base, there is an appreciable webbing, and apparently a one-year life cycle.

3. On Arborvitae

Juniper Scale (Diaspis carueli Targ.) -- An arborvitae hedge at Kelowna, B.C. was found to be heavily infested (F. W. Pridham, Sept.26). This is our first record of this pest in British Columbia; it is reported to attack juniper, incense cedar and cypress also.

4. On Poplar, Willow and Shrubs

Leaf Rollers on Aspen (Tortricidae).-- In Waterton Lakes National Park, Alta., Cacoecia caterpillars infested a large area both in the park and outside, covering approximately the same sections so badly damaged last year (J. M. Giddie). In Banff National Park a high insect population occurred in the Lake Minnewanka district (SW ¼ sec. 19. Tp. 26. R.11) with severe defoliation in some parts (J. E. Stention, June 29); the trees were entirely defoliated, but by early August had put out a complete new growth of leaves (J. E. Stenton). In Jasper National Park, about 29 miles south of Jasper, ten acres were infested more severely than last year (F. Wells).

Examples of an entirely different species with similar habits were sent in mid-June by J. Cameron of Cedarvale, B.C. with the remark: "These worms have covered thousands of acres of poplar in this district." No further report was received.

Cottonwood Leaf Miner (Phyllocnistis sp.)-- A sample of typical Phyllocnistis work was sent from the Hazelton area (L. G. Taft, June 29), but the insects were not reared.

Tortricid Caterpillars on Willow.-- A heavy infestation occurred on two species of willow on the slopes around Revelstoke (G. R. Hopping and G. M. Cowan). The sample contained many green leaf-rollers, a few other tortricids and some green cutworms.

Leaf Miner on Willow.-- Willows in a district 7 miles south of Nakusp were severely infested with small lepidopterous larvae (G. R. Hopping and G. M. Cowan). The caterpillars were pupating by mid-June. The same species was sent from Silverton Creek, about 30 miles further southeast (F. Hill).

Black Willow Leaf Beetle (Galerucella carbo Lec.). -- The beetles and their little yellow and black larvae caused extensive damage to willow leaves in the vicinity of Revelstoke (G. R. Hopping).

5. On Manitoba Maple

Box Elder Bug (Leptocoris trivittatus Say).-- The only collection submitted was from Chase (H. A. Ferguson). The species continued to be a pest on Manitoba maple in the towns of the Okanagan Valley and at Lillooet (W. G. Mathers).

6. M i s c e l l a n e o u s

Blister Beetles on Lilac (Lytta sphaericollis Say).--These bright blue beetles are often common in years of grasshopper abundance. The immature stages eat the hopper's eggs and thus do good, but the adults defoliate shrubs and garden plants. Reported as stripping lilac bushes at Clinton, (R. V. Williams, July 10).

Strawberry Weevil (Brachyrhinus ovatus L.).-- Small black flightless beetles which often enter houses in spring and fall. Reported from a residence in Invermere (G. M. Carter).

Bark Beetles in Sawdust (Hylastes sp.) -- Examples of a small blackish bark beetle, apparently Hylastes nigrinus Mannh., were reported as present in sawdust used in the insulation of a garage at Prince George (J.E. Manning, March,1945). They were also found in sawdust in the attic of a house there: "These insects apparently gained entrance through the medium of some Lodgepole Pine posts which were put underneath the foundations some time in 1943 and were not peeled. It would seem that they have multiplied to such an extent that they are now found in the understructure as well as in the insulation material used in the upstairs" (R. E. Carter).

California Tortoiseshell Butterfly (Nymphalis californica Bdv.) - The spiny caterpillars of this species feed usually on buckbrush (Ceanothus) but during severe outbreaks will defoliate other shrubs, fruit trees, and even alfalfa. No reports of damage were received this year, but a huge flight of the butterflies travelling from east to west occurred at Waterton Park townsite, Alta., August 18-19 (H. A. de Veber). Another flight was seen on the Big Bend Highway between Bush River and Blackwater Lakes, B.C., August 24, the butterflies travelling from northeast to southwest (H. J. Coles). A third flight, at Kelowna, B.C. August 18, was reported in the local press.

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TREATMENT OF FOREST INSECT SURVEY MATERIAL OF 1944

Overwintered in Insectary or Overwintering Chamber on November 6, 1944.

Summary of Forest Insect Survey Material of 1944 Overwintered At Field Station During Winter of 1944-45. (Overwintering began on Nov. 6, 1944)

	Placed in overwintering chamber		Left in Insectary		Total	
	Vials	Specimens	Vials	Specimens	Vials	Specimens
Lepidoptera--Pupae	191	263	9	33	200	296
Lepidoptera--Larvae	0	0	36	45	36	45
Parasites	46	235	87	228	133	463
Sawflies	90	171	36	128	126	299
Miscellaneous	3	10	26	99	29	109
T o t a l	330	679	194	533	524	1212

The overwintered material was placed in the incubator in two lots as follows:-

1st Lot -- January 17,1945
2nd Lot -- February 3,1945

Lot I

Treatment of Forest Insect Survey Material of 1943, overwintered at Field Station

January 15,1945 -- Material (see following) brough to Vernon and placed in room in Court House at 4 P.M. Temperature of room then was 41° F.
January 16,1945 -- Temperature at 9 A.M. - 48° F.
-- " 10 A.M. - 49 "
-- " 12 (noon) 50 "
January 17,1945 -- " 8:30 A.M.- 62 "
-- " 10 A.M. - 70 " (brought into laboratory)
-- Between 11 A.M. and 2 P.M. the material was sorted and placed in the constant temperature cabinet.

Material	Material placed in incubator		Material Dead and discarded		Total	
	Vials	Specimens	Vials	Specimens	Vials	Specimens
Lepid. pupae (from vault)	183	248	8	15	191	263
Lepid. pupae (from insectary)	8	23	0	0	8	23
Misc. (from vault)	3	10	0	0	3	10
Misc. (from insectary)	25	98	1	1	26	99
Lepid. larvae (from Insectary)	1	1	0	0	1	1
T o t a l	220	380	9	16	229	396

Lot II

February 1,1945 -- Material (see below) brought to Vernon and placed in room at Court House at 1 P.M.
-- Temperature of room at 1 P.M. -- 35°F
-- " " " 3 P.M. -- 37 "
-- " " " 5 P.M. -- 45 "

February 2,1945 -- Temperature " " 8:30 AM.-- 43 "
-- " " " 5:30 PM.-- 50 "

February 3,1945 -- " " " 8:30 A.M.-- 62 "
-- " " " 9 A.M. -- 70 " (brought into lab.)
-- Between 9:30 A.M. & 11:30 A.M. the material was sorted and placed in constant temperature cabinet.

Material	Material placed in Incubator		Material Dead and discarded		Total	
	Vials	Specimens	Vials	Specimens	Vials	Specimens
Sawflies (from insectary)	36	128			36	128
Sawflies (from vault)	87	165	3	6	90	171
Parasites (from Insectary)	84	223	3	5	87	228
Parasites (from vault)	45	220	1	15	46	235
T o t a l	252	736	7	26	259	762

SUMMARY OF TREATMENT IN 1945 OF FOREST INSECT SURVEY MATERIAL OF 1944.

MATERIAL	Material placed in incubator			Material discarded			Material left at Field Sta. to overwinter & emerge there.	Total A+B+C
	Lot 1	Lot 2	Total A	Lot1	Lot2	Total B	C	
Lepid. -- pupae	271		271	15		15	10	296
Lepid. -- larvae	1		1				44	45
Parasites		443	443		20	20		463
Sawflies		293	293		6	6		299
Miscellaneous	108		108	1		1		109
T o t a l	380	736	1116	16	26	42	54	1212

TABLE I. SUMMARY OF EMERGENCE FROM LEPIDOPTEROUS PUPAE

(Vials placed in Incubator Jan.17,1945)

Insect	No.of pupae	Moths etc. Emerged	Moths etc. Incubation period	Parasites Emerged	Parasites Inc.period	No.of pupae died	Per cent emergence
Cacoecia cerasivorana	10					10	0
Caripeta sp.	36	31	13-72 dys.	1	35 dys.	4	88.9
Ectropis crepuscularia	2	1	35 "			1	50.0
Eupithecia palpata	14	12	11-17 "			2	85.7
Eupithecia sp.	25	20	4-117 "			5	80.0
Feralia jocosa	11	1	8 "			10	9.1
Geometridae	5	2	19-59 "			3	40.0
Hydriomena renunciata	7	7	9-15 "				100.0
Lepidoptera	15	4	5-41 "	2*	12-22 "	9	40.0
Melanolophia imitata	25	19	7-17 "			6	76.0
Nictobia limitaria	3	2	15-30 "			1	66.7
Panthea sp.	3	2	15-36 "			1	66.7

continued..

Table I cont.)

Insect	Pupae	Moths Emerged	Moths Inc. period	Parasites Emerged	Parasites Inc.per.	Pupae died	% Emergence
Phalaenidae	2			2	18-24 dys.	1	100.0
Semiothisa granitata	61	54	7-55 dys.			7	88.5
S. sexmaculata	39	24	9-110 "	1	24 "	14	64.1
Semiothisa sp.	7	4	10-28 "			3	57.1
Sphingidae	1	1	17 "				100.0
Tortricidae	4	3	8 "			1	75.0
Zale sp.	2	1	5 "			1	50.0
T o t a l	272	188	4-117 "	6	12-35 "	78	
Per cent		69.1		2.2		28.7	71.3

* 11 Hymenopterous parasites emerged from one pupa.

SUMMARY OF EMERGENCE FROM SAWFLY COCOONS - TABLE II
(Vials placed in incubator Feb.3,1945)

Insect	No.of cocoons	No. Sawflies Emerged	No. Sawflies Inc. per.	No. Parasites Emerged	No. Parasites Inc.per.	No. of cocoons died	% Emergence
Anoplonyx sp.	43	11	12-42 dys	2	12 dys.	30	30.2
Arge sp.	1					1	0.0
Neodiprion sp.	34	9	13-53 "	9	13-45 "	16	55.9
Neodiprion tsugae	6			2	18-37	4	33.3
Pamphiliidae	4	1	4 "			3	25.0
Pikonema alaskensis	23	10	19-32 "	4	18-32 "	9	60.9
P. dimmocki	37	5	16-34 "	2	22 "	30	18.9
Pikonema sp.	4	1	26 "	1	18 "	2	50.0
Pristiphora erichsonii	88	11	22-25 "			77*	12.5
Pristiphora n. sp.	49	4	11-26 "	1	20 "	44	10.2
Zaraea sp.	1	1	17 "				100.0
Sawfly	3	2	15-21 "			1	66.7
T o t a l	293	55	4-53 "	21	12-45 "	217	
Per Cent		18.8		7.1		74.1	25.9

* Unemerged cocoons examined on March 28,1945
One contained live sawfly larvae,
Five " " " larvae + live Mesoleius larvae
Three " " Mesoleius larvae only
Sixty-eight contained dead sawfly stages

TABLE III- SUMMARY OF EMERGENCE OF HYMENOPTEROUS PARASITES

(Vials placed in Incubator Feb. 3, 1945)

Host	No. Parasite cocoons	Hymenoptera No. emerged	Hymenoptera Incubation period	No. of cocoons died	% Emergence
Autographa sp.	1	1	8 dys.		100.0
Cacoecia cerasiv-orana	1			1	0.0
C. fumiferana	27	11	12-47 "	16	40.7
Caripeta sp.	38	33	10-32 "	5	86.8
Eupithecia palpata	3	3	13-25 "		100.0
Eupithecia sp.	86	83	1-32 "	3	96.5
Geometridae	2	1	4 "	1	50.0
Host ?	3	2	15-21 "	1	66.7
Hyphantria textor	4	3	10 "	1	75.0
Malacosoma sp.	1			1	0.0
Melanolophia imitata	7	3	7-32 "	4	42.9
Nepytia canosaria	1	1	13 "		100.0
Nymphalis antiopa	7	7	8-14 "		100.0
Olene sp.	2	1	24 "	1	50.0
Peronea variana	3	1	16 "	2	33.3
Phalaenidae	1	1	31 "		100.0
Semiothisa granitata	28	18	10-41 "	10	64.3
S. sexmaculata	18	16	8-28 "	2	88.9
Tortricidae	4	2	21-25 "	2	50.0
T o t a l	237	187	1-47 "	50	
Per Cent		78.9		21.1	78.9

TABLE IV - SUMMARY OF EMERGENCE OF DIPTEROUS PARASITES
(Vials placed in Incubator Feb.3,1945)

Cacoecia cerasiv-orana	17			17	0.0
C. fumiferana	82	63	8-75 dys.	19	76.8
Malacosoma sp.	30	19	3-38 "	11	63.3
Nepytia phantasmaria	1	1	18 "		100.0
Peronea variana	53	3	20-24 "	50	5.7
Semiothisa granitata	5	3	42-46 "	2	60.0
S. sexmaculata	5	1	34 "	4	20.0
Sphingidae	8	8	26-32 "		100.0
Unknown	5			5	0.0
T o t a l	206	98	3-75 "	108	
Per Cent		47.6		52.4	47.6

TABLE V

SUMMARY OF EMERGENCE OF MISCELLANEOUS FOREST SURVEY MATERIAL

(Vials placed in Incubator Jan.17,1945)

Insect	No. Specimens	Adults Emerged	Adults Inc. per.	Parasites Emerged	Parasites Incc Per.	No. died	% Emergence
Aphids-immature*	7			1	24 dys.	6	14.3
Chrysopa sp-cocoons	2					2	0.0
Cinara sp.-immat.	13			8	11-19 "	5	61.5
Dermestidae-larvae	3	1	76 dys.	1	19 "		100.0
Hemerobiidae-cocoon	1					1	0.0
Hydriomena renunciata-larva*	1					1	0.0
Malacosoma sp. larvae*	2					2	0.0
Neophasia menapia - eggs	28					28	0.0
Neuroptera-cocoon	1					1	0.0
Phytodecta americana-larvae*	8					8	0.0
Syrphidae - larvae& puparia	43	1	11 "	[illegible]	[illegible]	42	2.3
T o t a l	108	2	11-76 "	10	11-24 "	96	
Per Cent		1.8		9.3		88.9	11.1

* Parasitized

FOREST INSECT SURVEY
1945

- O PERONEA VERIANA
- ⊕ PIKONEMA ALASKENSIS
- # PIKONEMA DIMMOCKI
- ■ CACOECIA FUMIFERANA
- ▲ PRISTIPHORA ERICHSONII
- ● LAMBDINA FISCELLARIA LUGUBROSA
- ◪ MALACOSOMA SPP.
- ✳ SEMIOTHISA GRANITATA

Miles 0 25 50 100 150 200

PRINCE RUPERT
SMITHERS
QUEEN CHARLOTTE
POUCE COUPE
PRINCE GEORGE
JASPER
WILLIAMS LAKE
LILLOOET
KAMLOOPS
VERNON
REVELSTOKE
BANFF
NELSON
CRANBROOK
VANCOUVER
VICTORIA

E.30.03 - Miscellaneous Forest and Shade Tree Insects.

E.30.03-(?) - The Poplar Sawfly, Nematus (Pteronidea) nigriventris (Hymenoptera, Tenthredinidae). - Morgan -

In 1944 the life cycle of Nematus nigriventris Curran was outlined and described. It was shown that in the Interior of British Columbia there is only one generation a year. Adult, egg and larval stages are completed in little over one month between the latter part of April and early June. The sawfly spends the remainder of the year in a cocoon which is formed in the soil. Several facts were left in doubt, the most important of which were:

1) The possibility of a cocoon diapause of unknown duration and
2) the number of larval instars.

In 1945, the details of these and other facts were investigated and positive results obtained. Also, additional information was added to already known data.

All experiments conducted in 1945 were initiated with adult sawflies obtained from diapause cocoons of the 1943-44 generation. These cocoons were collected by G. R. Hopping and the writer on April 20,1944, from soil just east of Taft, B.C. The collection consisted in part of 92 apparently sound cocoons from which 10 sawfly adults and 53 hymenopterous parasites emerged in the spring of 1944. Eighteen of the remaining 29 cocoons contained live sawfly larvae on Sept. 15,1944. These diapause cocoons were overwintered in a jar of duff in the insectary. On May 2, 1945, the duff was removed from the jar.

1. Proof of a Cocoon Diapause.

Apparently emergence from 18 diapause cocoons had just begun on May 2, 1945 for on that date a female adult was found in the duff while removing the latter from the jar.

Two females and one male were obtained on May 4. Between May 4 and May 14 the cocoons were placed in a cool place to hold back development until black cottonwood foliage at the field station had developed sufficiently for egg-laying. On May 14, two females and two males were recovered. Two females were obtained on May 15, and then emergence ceased. The eight unemerged cocoons were examined on May 18 with the following results: One cocoon contained a live female adult sawfly with the head, legs and right wing stuck to the pupal skin; four cocoons contained dead, soft, prepupal larvae and three cocoons contained dead, dry larvae.

The above emergence established the fact of a cocoon diapause of two-year duration. These 18 cocoons were formed not later than in the early summer of 1943. In the average life cycle, adult sawflies were obtained in the spring of 1944, but the diapause specimens continued their hibernation until 1945. A conservative estimate of the percent diapause for the 1943-44 generation is 12.8. This figure is based on the 92 apparently sound cocoons plus the 49 empty cocoons (from which sawflies had apparently emerged previously -- see 1944 Annual Report), contained in the collection of April 20, 1944. Per cent diapause emergence for the generation is 7.1.

2. Parthenogenesis: Females can reproduce parthenogenetically. The progeny resulting from such females are all males.

3. Number of Larval Instars:

Male larvae were found to cocoon directly from the fourth instar, while female larvae cocooned from the fifth. Measurements of width of head capsule were made of live larvae originating from fertilized and unfertilized females. The same larvae were measured after each molt. The following results were obtained for head capsule width and length of larvae.

INSTAR	Width of Head Capsule				Lengths of Larvae
	Larvae from unfertilized females		Larvae from fertilized females		
	Range	Average	Range	Average	Range
	mm.	mm.	mm.	mm.	mm.
1	0.53-0.55	0.54	not measured		2.4-4.0
2	0.74-0.77	0.75	0.70-0.74	0.72	4.5-5.5
3	1.00-1.08	1.05	0.98-1.02	1.00	6.5-9.0
4	1.28-1.32	1.30	1.25-1.36	1.30	10.0-13.0
5			1.62-1.64	1.63	13.0-16.0

4. Descriptions of Second and Third Instar Larvae.

In 1944, only the first, fourth and fifth instars were described. The following notes describe the second and third instars.

Second Instar.

Head light brown (lighter than first instar); shining; setae light brown, short, fine. Eyes black; mouthparts brown. Head without markings but in some a greyish tinge microscopically shows at apex of frons, along coronal suture, and in a lateral line between coronal suture and compound eyes. Dorsum of body green. Body marked by a subspiracular greyish line which is indefinite in posterior abdominal segments. Spiracular (or tracheal) line narrow, green, indefinite. Dorsum of thorax with greyish markings which tend to form a latero-dorsal line, only in thoracic region. Claws brown.

Third Instar.

Head light greenish-brown. Eyes black; mouthparts brown. No head markings seen with naked eye but with microscope, markings as indicated in second instar more prominent. Subspiracular line as in second instar. Tracheal line now more definite. No thoracic grey markings. Dorsum of body

green. Ventre of body light green. Heartline dark green, bordered by light green lines.

5. Number of Eggs Produced per Female.

One unfertilized female produced 43 eggs and 83.7 per cent of these hatched. In one case, two fertilized females produced 142 eggs, an average of 71, while in a second case, two fertilized females produced 60 eggs, an average of 30. In the latter instance about 75 per cent of the eggs hatched.

6. Number of Eggs Laid on a Leaf.

In 1944, not more than seven eggs were laid on one leaf. This year as many as 12 eggs were laid on a leaf by an unfertilized female, while one fertilized female deposited as many as 24 on a leaf.

7. Duration of the Egg Stage

Unfertilized eggs laid on May 4 began to hatch 18 days later on May 22 and continued until May 25. Eggs laid on May 4 by fertilized females developed for the same period before hatching occurred. Eggs deposited on May 15 by fertilized females began to hatch 11 to 13 days later on May 26 and 28. In 1944, the duration of the egg stage was 13 days commencing on May 3.

8. Duration of the Larval Stage

Larvae hatching on May 22 from eggs produced by unfertilized females began to cocoon on June 6 and continued until June 8, for a larval-period of 17 days. Progeny of fertilized females, hatching on May 26 and 28 cocooned between June 9 and June 12.

9. Duration of the Adult Stage

One unfertilized female lived for 12 days, that is, from May 2 to May 14. A male adult which emerged on May 4, lived for about 10 days. Fertilized females which emerged on May 15 lived for six to eight days.

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E.30.03-(?) - **Notes on the Spruce Needle Miner Taniva albolineana Kft.) (Lepidoptera, Olethreutidae) - Morgan**

During 1945 the spruce needle miner, Taniva albolineana Kft. continued to be a serious pest of a variety of ornamental blue spruce, (Koster's blue spruce) in the Vernon district. Also, a new area of infestations was reported for the first time by a Mrs. M. D. Mair of Summerland, B.C. It is believed however, that these infestations will now subside very quickly because of the work of the hymenopterous parasite Ascogaster sp. At Vernon the larval parasitism by this species increased from approximately 49% in the spring of 1944 to about 83% in the spring of 1945. A small sample receivedfrom Summerland in April,1945 showed 100% parasitism. Investigation work done this year consisted of the examination of collections and the recovery of moths and parasites.

Biological Notes

A. Parasites

1) Leech on April 24 and the writer on April 26,1945 collected webs from trees at the Anglican Church in Vernon. On the latter date a microscopic examination of 100 larvae from the two collections showed that 17 were healthy, unparasitized specimens and 83 were parasitized internally by larvae of Ascogaster sp.

2) Twenty-six T. albolineana larvae collected on April 25,1945 from Mrs. M. D. Mair's place in Summerland and were examined in Vernon on April 26. One hundred per cent of the larvae were internally parasitized by Ascogaster sp.

3) On April 27,1945, 80 T. albolineana larvae were removed from the webs collected at Vernon on the 24 and 26 of that month, and placed on healthy ornamental blue spruce twigs in a constant temperature cabinet operated at 74° F. and

90 to 95% relative humidity. Two Ascogaster cocoons were observed on April 30. Emergence began early in May for on May 7, two of these adult parasites were found in the cabinet. Between May 7 and 14, 38 adults emerged. On the latter date the spruce twigs were removed from the constant temperature cabinet to the insectary at the Trinity Valley field station. Only two more adults were recovered, one on May 21 and one on May 23.

B. Taniva albolineana

1) From an examination on April 26 of the webs collected on April 24 and 26 at Vernon, it was found that of 76 larvae, 12 were still wholly or partly within the mined needles and 64 were out of these needles amongst the frass and webbing. In the sample of webs from Summerland, six of the 26 larvae were still partly within the needles, while the remainder were outside in the frass etc.

2) No dead larvae were found on the needles or in the webs collected in Vernon or in those received from Summerland.

3) At Vernon, feeding had been in progress apparently for some time , for one small web, made entirely of the current generation of 11 larvae, consisted of 32 dead, brown needles mined in the summer of 1944 and 15 green ones mined just prior to the date of examination.

4) Of 65 mined needles taken from the two Vernon collections, the entrance hole in 56 was found at the basal third of the needle while 5 contained this hole in the middle third and 4 contained it at the distal third.

5) Head capsule measurements made on April 26 of 30 Vernon larvae showed a variation in width of from 0.566 mm. to 0.680 mm. and an average of 0.615 mm. Ten larvae from Summerland measured on the same date varied in head width from 0.585 mm. to 0.661. mm. and averaged 0.627. mm.

6) Only three moths were recovered from the 80 larvae incubated on April 27. The first two (males) were noticed in the cabinet on May 14. The third (female) was taken at the field station on May 17.

Lodgepole Pine Needle Miner
- Hopping -

The following plots were established in June, 1945, for determination of injury and tree mortality and for population and parasitism studies in connection with the lodgepole pine needle miner (Recurvaria milleri Busck.)

Plot I - ¼ acre 1.6 mi. W. of Wapta Lodge; 52 trees; D.B.H. - 4" to 10", ave. 6.8"

Plot II- ¼ acre 38 mi. W. of Banff on Lake Louise Creek; 51 trees, D.B.H. - 4" to 14 "; ave. 9.5"

Plot III-¼ acre; 2.8 mi. W. of Altrude Creek Bridge; 296 trees; D.B.H. - 1" to 7"; ave. 3.1"

Plot IV- 1/16 acre; 3.7 mi. W. of Altrude Creek Bridge; 21 trees; D.B.H. - 2" to 9"; ave. 4.7".

Plot V - ¼ acre; 0.4 mi. S. of B.C. -Alberta Boundary, Banff-Windermere Highway; 27 trees; D.B.H. -5" to 17" ; ave. 10.3".

Random samples of infested tips were taken from all of the plots in September as follows Plot I-36; Plot II-24; Plot III-26; Plot IV-25; Plot V-24. The accompanying table gives the data on the needles examined from each plot.

Plot No.	Total needles		Mined		Larvae in needles		Free in Box	Larvae dead	Total larvae
	1st yr.	2nd yr.	1st yr.	2nd.yr.	1st.yr.	2nd.yr.			
I	2344	1479	390	397	86	123	40	12	261
II	1812	1608	375	541	236	273	26	50	585
III	1740	1572	227	366	115	120	35	26	296
IV	2530	2448	242	551	81	216	94	49	440
V	1676	1386	179	254	88	102	21	13	224
Total	10102	8493	1413	2109	606	834	216	150	1806

At the time the samples were taken, larvae were migrating from second year to current year needles as evidenced by the larvae noted wandering over the foliage. Those found free in the collection boxes probably had the same motive. The average number of first year needles per terminal was about 75; of second year needles, 63 or a total of 138. The average number of first year mined needles per terminal was about 10; of second year, 16, a total of 26 or 19 per cent. This percentage will increase considerably next year because two needles of the current year are generally mined by each larva on moth-flight years. The average number of larvae per terminal was 13 with 8.3 per cent dead. Cause of death was not apparent.

Comparison with data on samples taken during the moth-flight year of 1944 shows the increased number of needles mined per terminal. In that year, approximately 43 per cent of the total needles were mined. The number of needle miner stages dead and alive averaged 33 per terminal which rather indicates a reduction in 1945 as compared to 1944. However, the results are not conclusive since sufficient personnel was not available to make an adequate population survey in either year. With added personnel and facilities it will be possible to place the sampling on a more systematic basis in 1946.

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E.30.07-3 SPRUCE BUDWORM, Archips fumiferana (Clem) -(Mathers)-

The work on this project in 1945 can be subdivided as follows:

1) Summary of spruce budworm received during the year in the Forest Insect Survey.

2) Examinations of spruce budworm infestations.

3) Continuation of the joint project with the Dominion Parasite Laboratory for the collection of parasites in the Lillooet district. In connection with this project, special recovery collections were made during the collecting period for detailed data on parasitism and on the development of the spruce budworm.

4) Laying out of sample plots on the Bolean Lake area for use in determining stand susceptibility and the influence of selection cutting of spruce on the budworm population.

5) Preliminary trip to the Prince George district for planning a much more extensive study of stand susceptibility in the spruce-balsam stands of that district.

Forest Insect Survey

TABLE I
Spruce Budworm Collections - Forest Insect Survey

Year	Number of Collections				Number of Specimens			
	Sp.-Bal.	D.fir	Misc.	Totals	Sp.-Bal.	D.fir	Misc.	Totals
1940	-	-	-	29	-	-	-	501
1941	14	4	5	23	39	7	7	53
1942	33	5	8	46	213	6	12	231
1943	6	8	1	15	6	136	2	144
1944	41	19	1	69 *	2125	109	172	2928 *
1945	13	8	7	28**	34	240	16	290 **

* including 8 special collections totalling 2406 specimens
** " 2 " " " 223 "

The marked decrease in the numbers of collections and specimens received in 1945 as compared with 1944 is accounted for by the fact that 1945 was the off-year on the two-year life cycle areas.

A more detailed summary of the spruce budworm received in 1945 in the survey is given in Table II.

TABLE II

Spruce Budworm Collections-Forest Insect Survey
1945

Host	No. of Collections	Number of Specimens: Larvae	Sound pupae	Empty pupae	Adults	Totals
Abies lasiocarpa	2	1	-	7	-	8
Picea spp.	11	21	4	1	-	26
P. taxifolia	8 *	123	109	8	-	240
Tsuga heterophylla	5	12	2	-	-	14
Pinus contorta	1	-	-	-	1	1
Thuja plicata	1	1	-	-	-	1
T o t a l s	28	158	115	16	1	290

* including 2 special collections containing 116 larvae and 107 pupae

Of the two special collections included in the survey, one consisted of 112 larvae and 15 pupae collected June 29 from Douglas fir in Botanie Creek Valley, 6½ miles from Lytton, B.C., while the second collection, containing 4 larvae, 92 pupae and several parasite cocoons was taken about 5 miles up Fountain Creek Valley, Lillooet district, B.C.

The balance of the specimens from Douglas fir were from Mt. McLean and Moha in the Lillooet district and from Falkland and Sooke, B.C. Fourteen small larvae were taken on spruce in Kootenay National Park, but the rest of the collections from spruce consisted of only one or two specimens each from the following localities: Kitwanga on the Skeena River, Southbank on Francois Lake, Dome Creek on the Upper Fraser River, 100 Mile House and Clinton in the Cariboo district, Dixon Creek and Barriere in the North Thompson district, and Jasper, Alta. The 7 empty pupal cases from balsam were taken early in the year on Goat River, a tributary of the upper Fraser River and one larva was from Dixon Creek near Barriere, B.C. One specimen from hemlock was from Mile 88 north of Revelstoke, BC. while the balance of the hemlock material was from the Bella Coola valley. The single cedar specimen was also from the latter area and was probably a stray. The moth from lodgepole pine was from near Banff, Alta.

Spruce Budworm Infestations - 1945

The spruce budworm continued to be the most active defoliator in the Interior of British Columbia but as 1945 was the off-year on the two-year life cycle area very little feeding occurred in the spruce-balsam stands at the higher elevations. As a result, definite information on the trend of the infestations reported in 1944 on Monashee Summit, at Bolean Lake and in Kootenay National Park, etc. will not be available until 1946. However, Douglas fir stands on Cayoosh and Fountain Creeks in the Lillooet district showed considerable defoliation and heavy feeding was also reported at Moha, 20 miles northwest of Lillooet. A reduction was evident, however, in the intensity of the infestations in Douglas fir on Mt. McLean and Mission Ridge in the Lillooet district and in Botanie Valley near Lytton, B.C.

An examination was made in September of the Sock Lake area on the Clearwater River, tributary to the North Thompson River. On this area feeding (1945) was light to heavy with balsam receiving the heaviest defoliation. Loggers claimed that the "worms" were not so numerous as in 1944.

Early in 1945 a report was received through a trapper of an extensive infestation in spruce and balsam on the headwaters of Goat River in the Prince George district. This is undoubtedly a two-year life cycle area and if possible will be examined in 1946.

Mass Collecting of Spruce Budworm Parasites in the Lillooet District.

As a result of the success of the mass collecting of spruce budworm parasites in 1944 on the Lillooet area, plans were formulated by the Dominion Parasite Laboratory for the continuation of the project in 1945. The work was to be again carried out in co-operation with the Vernon Forest Insect Laboratory.

The general set-up was to be similar to that of 1944 but the collecting was to be on a slightly reduced scale and confined to Mission Ridge and Mt. McLean and employing only local school boys and Japanese in the district. Preliminary arrangements were completed through the Vernon Laboratory. In this connection, W. G. Mathers made a trip to Lillooet in the first part of April. Heads of the Japanese community at Bridge River Station and the principal of the Lillooet school were contacted. Assurance was received that the required number of Japanese would be available for collecting on Mission Ridge and at least 15 school boys would be ready to collect on Mt. McLean, the latter to be available before the normal ending of the school term. Also while at Lillooet, inquiries were made regarding accommodation for the field laboratory, transportation for the collectors and the construction of rearing traps. The British Columbia Forest Service had offered full cooperation and a visit was made to the district office at Kamloops, where plans were discussed with the district Forester, Col. A. Parlow and Asst. District Forester R. G. McKee. Arrangements were later completed for the loan from the B.C. Forest Service of a light delivery truck, 12 blankets and 3 tent flies for use at Lillooet. The blankets and tent flies were supplied by the Kamloops office.

Mr. H. Coppel of the Dominion Parasite Laboratory arrived at Vernon on June 4 and with Mr. Mathers and Insect Ranger S. H. Farris of the Vernon Laboratory, proceeded to Lillooet on the following day to organize and supervise the collecting. Mr. Farris was made responsible for the actual field collecting on Mt. McLean.

The first few days at Lillooet were spent on general scouting, fixing up the temporary field station, preparing trays for rearing and lining up the collecting crews.

Collecting by the Japanese on Mission Ridge commenced on June 11 and by the school boys on Mt. McLean on June 18. At first, 16 collectors were employed on Mission Ridge and 13 on Mt. McLean. However, hot weather during the first part of July so accelerated the rate of budworm development that, in order to obtain the maximum amount of material before emergence started, the number of collectors on Mission Ridge was increased to 23 and on Mt. McLean to 21, the latter including Japanese from the East Lillooet community. Field collecting terminated on Mt. McLean on July 14 at about the 3,500 foot level, but the crew on Mission Ridge continued until July 20, by which time the collectors were working in spruce and blasam at over 3,800 feet elevation.

The organization of the work this year was much the same as in 1944. One Japanese acted as overseer of the crew on Mission Ridge while the collectors on Mt. McLean were divided into two crews with Mr. Farris and the principal of the Lillooet school acting as overseers. All the rearing and final sorting of the material was done at the field laboratory and for this phase of the work an average of 4 school boys was employed under the direct supervision of a high school teacher. Each day's collection from Mt. McLean was received at the end of the day and those from Mission Ridge were received the following morning by train. All field-collected and laboratory-reared budworm pupae and dipterous puparia were sent as soon as recovered to the Parasite Laboratory at Belleville, Ont. by air express; shipments going forward regularly at not more than three-day intervals. Cocoons of the hymenopterous parasite, Phytodietus fumiferanae, were held at the field laboratory until the end of the season as no emergence would occur before 1946. During the

latter part of July attention was concentrated on field recovery of possible alternate hosts of certain budworm parasites. Dr. A. Wilkes of the Dominion Parasite Laboratory was at Lillooet from June 30 to July 9 during which time he rendered valuable assistance.

Mr. Mathers returned to Vernon on August 2 with Mr. Farris following a few days later. Mr. Coppel continued with the collecting and rearing of possible alternate hosts of parasites throughout August and was assisted in this work by two local boys. Arrangements had been made for Mr. Farris to remain at Lillooet longer but an urgent request from the Provincial Forest Service to return the forestry truck to Kamloops necessitated a change in plans.

No record was kept at Lillooet of the number of specimens collected nor of the number of pupae and puparia shipped to Belleville. However, counts were made on the receipt of the material at the Parasite Laboratory and the results are summarized in the following table.

TABLE III

Shipments received at the Dominion Parasite Laboratory from British Columbia - 1945.

	Mission Mt.		Mt. McLean	
	Pupae	Puparia	Pupae	Puparia
June22-30	17,839	2,747	6,925	2,375
July 1-30	109,714	17,244	77,664	7,678
Totals	127,553	19,991	84,589	9,053

Grand total pupae 212,142
Grand total puparia 29,044

In addition, over 4,400 Phytodietus cocoons were recovered and shipped at the end of the season to the Parasite Laboratory. Although the budworm infestation on the two collecting areas was not as intense this year as in 1944, the results were considered quite satisfactory.

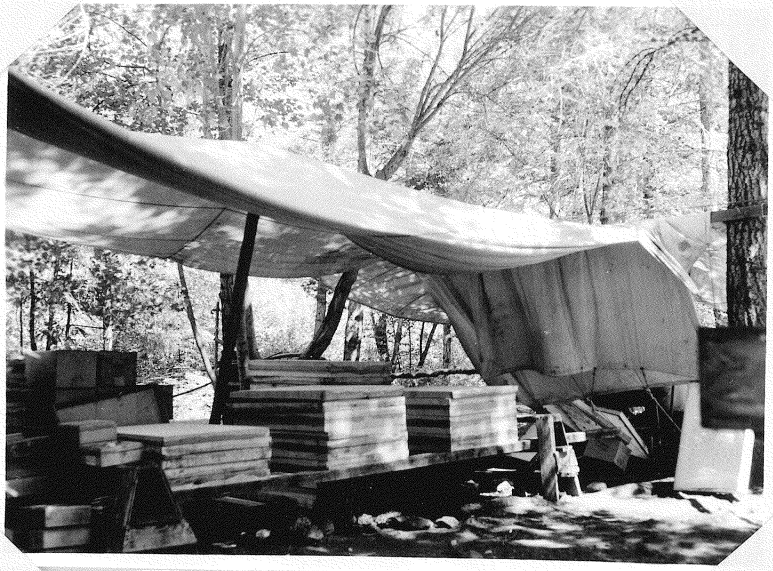
Showing Japanese labour collecting spruce budworm material - July, 1945.

Mission Ridge, Lillooet district, B.C.

Rice Time

Showing Japanese collectors at Shalalth, B.C., transferring a day's collection to containers for transhipping to the Lillooet Field Station, July, 1945.

Showing temporary field station at Lillooet, B.C., used for handling and rearing mass collections of spruce budworm for the recovery of parasites June - July. 1945.



Showing set-up for spruce budworm rearing trays at field station, Lillooet, B. C. June-July, 1945.

Showing school boys working over a budworm rearing tray. Budworm larvae transferred to a new tray with fresh foliage, budworm pupae and dipterous puparia removed for shipment to Belleville Parasite Laboratory, Ontario. July, 1945.

As in 1944 the success of this project could not have been possible without the excellent cooperation of the British Columbia Forest Service and the British Columbia Security Commission. We are particularly indebted to the B. C. Forest Service for the loan of the truck and to the District Forestry Office at Kamloops for the loan of the blankets and tent-flies.

Parasites

I. Special Recovery Collections

This year a comprehensive plan was drawn up for making special recovery collections in connection with the work at Lillooet for detailed data on parasitism. This plan included the making of special collections at weekly intervals at the 1,000, 2,000 and 3,000 foot levels on both Mt. McLean and Mission Mt. The collections were made jointly by members of the Parasite and Vernon Laboratories.

All specimens in these collections were placed individually in vials for rearing and were handled at the temporary field laboratory at Lillooet until the end of July when the records and the material remaining were transferred to the Dominion Parasite Laboratory at Belleville, Ont. The summary is being prepared there, and to date has not been received by the Vernon Laboratory.

A record of the material collected is given in Tables IV and V.

TABLE IV

Special Recovery Collections made on Mt. McLean, Lillooet, British Columbia, in 1945.

Date Collected	Elevation (feet)	Number of Specimens Archips larvae	Archips pupae	Free Parasites	Totals
June 7	1000	145	1	-	146
June 14	1000	199	4	1	204
	2000	525	-	-	525
	3000	353	-	-	353
June 21	1000	416	119	5	540
	2000	580	2	-	582
	3000	330	-	-	330
June 28	1000	31	70	6	107
	2000	530	151	-	681
	3000	583	1	-	584
July 5	1000	collection not made			-
	2000	162	722	10	894
	3000	624	74	-	698
July 12	1000	collection not made			
	2000	-	195	61	256
	3000	132	522	62	716
July 19	1000	collection not made			
	2000	-	83	25	108
	3000	19	175	77	271
July 26	1000	collection not made			
	2000	-	93	76	169
	3000	-	59	22	81
T o t a l s		4629	2271	345	7245

TABLE V

Special Recovery Collections made on Mission Ridge, Shalalth, British Columbia in 1945

Date Collected	Elevation	Number of Specimens			
		Archips		Free	
		larvae	pupae	Parasites	Totals
June 9	1000	351	7	-	358
	1000	431	13	-	444
June 14	2000	492	-	-	492
	3000	367	-	-	367
	1000	155	150	15	320
June 21	2000	508	19	-	527
	3000	375	-	-	375
	1000	8	40	34	82
June 28	2000	315	193	8	516
	3000	468	-	-	468
	1000	No collection			
July 5	2000	21	255	37	313
	3000	573	10	20	603
	1000	No collection			
July 12	2000	-	-	12	12
	3000	159	333	20	512
	1000	No collection			
July 19	2000	No collection			
	3000	22	277	18	317
Totals		4245	1297	164	5706

In addition to the above collection 119 egg clusters from Mt. McLean and 52 clusters from Fountain Valley near Lillooet were gathered at end of July by Mathers, Coppel and Farris and forwarded to the Parasite Laboratory for the recovery of any egg parasites that might be present. At the time (July 24) of making the egg collections at the 2,000 foot level on Mt. McLean, a large number of Tachinid adults were noticed in flight. A series of 109 specimens were captured and sent to Belleville for identification. They consisted of the following:

Ceromasia auricaudata	104 males
Zenillia caesar	3 "
Phorocera erecta	1 "
Phryxe pecosensis	1 "

II Special Forest Insect Survey Collections

Two special spruce budworm collections were included this year in the Forest Insect Survey. One collection was made from Douglas fir on June 29 by W. G. Mathers on Botanie Creek road about 6½ miles from Lytton, B.C. This collection (B.C. 45-213) was received at Vernon on June 30 and contained 105 larvae and 13 pupae. The second collection, also from Douglas fir, was made on July 22 by Mathers, Coppel and Farris at about 2,500 feet elevation 5 miles up Fountain Creek valley from the Fraser River. This collection (BC. 45-531) was made up of 4 budworm larvae, 92 pupae, 10 Glypta cocoons, 6 Apanteles cocoons, 1 Phytodietus cocoon and 1 dipterous puparium.

The results obtained from these two collections are shown in Tables VI and VII.

TABLE VI
Parasite Recoveries from Spruce Budworm Collections at Botanie Creek Road - 1945

Date Collected	June 29.1945				June 29.1945			
Stage Collected	Larvae (45-231)				Pupae (45-231A)			
	♂♂	♀♀	Totals	%	♂♂	♀♀	Totals	%
No.Collected			105				13	
No.host emerged	18	32	50	47.62	5	-	5	38.46
No.host larvae dead (not parasitized)			38)					
No.host pupae dead (not parasitized)			10)	45.71			4	30.77
Primary Parasites								
Hymenoptera -								
Glypta fumiferanae			2	1.90				
" cocoons (dead)			1	0.95				
Apechthis ontario					1	-	1	7.69
Itoplectis obesus					1	1	2	15.38
Total Hymenoptera			3	2.86			3	23.07
Diptera								
Ceromasia auricaudata			3	2.86			1	7.69
Dipterous puparium-unemerged			1	0.95				
Total Diptera			4	3.81			1	7.69
Total Primary Parasitism			12	6.67			4	30.77

TABLE VII

Parasite Recoveries from Spruce Budworm Collections at Fountain Creek valley - 1945

Date Collected	July 22,1945				July 22,1945			
Stage Collected	Larvae (45-531)				Pupae (45-531A)			
	♂	♀	Totals	%	♂	♀	Totals	%
No. collected			22				92	
No.host emerged			-				39	42.39
No.host larvae dead (not parasitized)			4	18.18				
No.host pupae dead (not parasitized)			-				21	22.83
Primary Parasites								
Hymenoptera								
Glypta fumiferanae	2	3	5)					
" cocoons dead			3)					
" " para. by hyper.			2)	45.45				
Apanteles spp.		1	1)					
" cocoons dead			4)	27.27				
" " para. by hyper.			1)					
Itoplectis obesus						1	1	1.09
Phaeogenes hariolus					3	2	5	5.43
Amblymerus verditer							(12)1	1.09
Phytodietus cocoon para. by hyper.			1	4.55				
Hymenoptera undeter.							1	1.09
Host pupae para. by Hymen.(unemerged-dead)							1	1.09
Total Hymenoptera			17	77.27			9	9.78
Diptera								
Ceromasia auricaudata							3.	3.26
Dipterous puparium-dead			1	4.55				
Dipterous maggots - "							8	8.70
Host pupae para. by Diptera-unemerged,dead							12	13.04
Total Diptera			1	4.55			23	25.00
Total Primary parasitism			18	81.82			32	34.78

Table VII cont.

Hyperparasites	♂	♀	Totals	% *	Totals	%
Itoplectis obesus ex Glypta cocoons	1	1	2	20.00		
Amblymerus verditer ex Apanteles cocoon		(2)1		16.67		
A.verditer ex Phytodietus cocoon			1	100.00		

* Percentages of primary parasites parasitized by hyperparasites

III Regular Forest Insect Survey Collections

Parasite material was recovered in 1945 from only three of the regular Forest Insect Survey collections. These were as follows:

a) B.C. 45-160: from 4 budworm larvae collected on Douglas fir near Falkland, B.C., one Phytodietus fumiferanae reared.

b) B.C. 45-438: from one budworm larvae from Englemann spruce at Forest Grove, near 100 Mile House, B.C., a dipterous puparium (dead) recovered.

c) B.C. 45-442: from one budworm larva and 2 pupae sent in from Douglas fir on Mt. McLean, Lillooet, 2 undetermined dipterous puparia recovered.

The Phytodietus adult, a female, had an incubation period of 18 days at 74°F. and 90 per cent R.H. in the constant temperature cabinet.

Further Notes on Dipterous Parasites Recovered from Collections made in 1944

In the Annual Report for 1944, reference was made (page 63) to a special collection of spruce budworm (B.C.44-423) made on July 25, 1944 from spruce and balsam on Monashee Summit. The results obtained from this collection were given in Table IX (page 64). The 77 unemerged dipterous puparia listed in the table were placed in February, 1945 in the constant temperature cabinet and from them were recovered 46 males and 18 females, adults of ~~the Tachinid~~ Pseudosarcophaga affinis (Fall.). The balance of the puparia died. The incubation period at 74°F. and 90% R.H. for the P. affinis ranged from 18 to 73 days.

Five adults of P. affinis were also reared in the incubator from the 10 unemerged dipterous puparia listed in Table XI as having been recovered from the Forest Insect Survey collection (B.C.44-233) from Douglas fir at Owl Creek in the Pemberton district, B.C. The incubation period for these specimens was from 13 to 43 days.

The P. affinis maggots emerged from either prepupal larvae or pupae before forming their puparia. The host had a one-year life cycle at Owl Creek and a two-year life cycle on Monashee Summit.

Additional Spruce Budworm Parasite Records

Determinations of the following species have been received recently from Ottawa.

Monodontomerus sp. One male and 4 females of this Chalcid emerged on May 27,1944 at Vernon from a Phytodietus cocoon collected at Pemberton, B.C. on August 22,1943.

Scambus sp. near hispae (Harr.) One male emerged on May 29,1944 at the Trinity Valley Field Station from a Phytodietus cocoon collected on August 25,1943 at Pemberton, B.C.

? Euplectrus sp. One female of this doubtful species was reared from a spruce budworm larva collected on June 24,1943 from Douglas fir near the Trinity Valley Field Station. The parasite larva feeds externally and at the time of collection was present as a small green larva attached on one side of the thorax of the host larva.

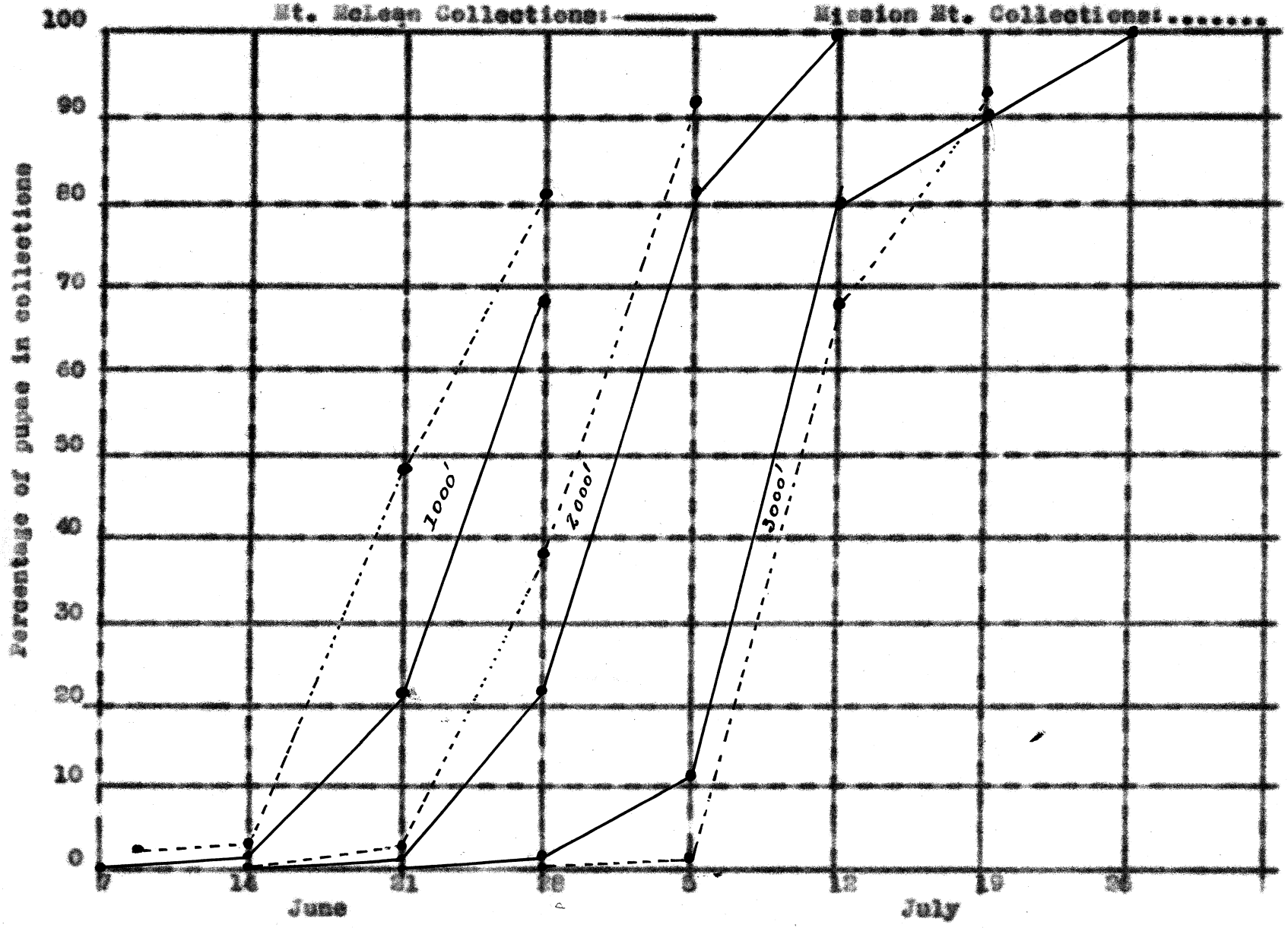
Seasonal Development of the Spruce Budworm

The special recovery collections made in 1945 in the Lillooet district provide an indication of the effect of altitude on the seasonal development of the spruce budworm. In Table VIII are recorded the numbers of Archips larvae and pupae together with the percentage of each, taken on the collecting dates at the three levels, 1,000, 2,000 and 3,000 feet on Mt. McLean and Mission Mt.

TABLE VIII

Numbers and Percentages of Archips larvae and Pupae in Special Recovery Collections - 1945.

	Mt. McLean				Mission Mt.				
	Larvae		Pupae		Larvae		Pupae		
	No.	%	No.	%	No.	%	No.	%	
June 7-9	145	99.3	1	0.7	351	98.0	7	2.0	)
" 14	199	98.3	4	1.7	431	97.0	13	3.0	)
" 21	416	77.8	119	22.2	155	50.8	150	49.2	) 1000'
" 28	31	30.7	70	69.3	8	16.7	40	83.3	)
June 14	525	100.0	0	0.0	492	100.0	0	0.0	)
" 21	580	99.7	2	0.3	508	96.4	19	3.6	) 2000'
" 28	530	77.8	151	22.2	315	62.0	193	38.0	)
July 5	162	18.3	722	81.7	21	7.6	255	92.4	)
" 12	0	0.0	195	100.0	-	-	-	-	)
June 14	353	100.0	0	0.0	367	100.0	0	0.0	)
" 21	330	100.0	0	0.0	375	100.0	0	0.0	)
" 28	583	99.8	1	0.2	468	100.0	0	0.0	)
July 5	624	89.4	74	10.6	573	98.3	10	1.7	) 3000'
" 12	132	20.2	522	79.8	159	32.3	333	67.7	)
" 19	19	9.8	175	90.2	22	7.4	277	92.6	)
" 26	0	0.0	59	100.0	-	-	-	-	)


Mt. McLean Collections: ———
Mission Mt. Collections: .....
Percentage of pupae in collections
100
90
80
70
60
50
40
30
20
10
0
1000'
2000'
3000'
June
July

The percentages of pupae in each collection are also shown in the accompanying graph. Due to the scarcity of specimens collections were not made at the 1,000 foot levels on Mt. McLean and Mission Mt. after June 28, at the 2,000 foot level on Mission Mt. after July 5 nor at the 3,000 foot level on Mission Mt. after July 19.

From the data given in Table VIII and the graph, it is evident for each locality that the higher the elevation the later the seasonal development of the budworm. For example on Mt. McLean, although over 69 per cent of the budworm had pupated by June 28, at the 1,000 foot level, by the same date only about 22 per cent had pupated at the 2,000 foot level and less than 1 per cent at the 3,000 foot level. On Mission Mt. the corresponding percentages on the same date were: over 83 per cent at 1,000 feet, 38 per cent at 2,000 feet and none at the 3,000 foot level. The progressively later pupation as the elevation increased made the two areas, Mt. McLean and Mission Mt., ideal collecting areas for the mass recovery of parasites. Under such conditions the collecting period could be extended over a much longer period than had the collecting been restricted to one level, since the crews could start at the lower levels and gradually work up the slopes as the season advanced.

- 0 -

Status of Spruce Budworm in Prince George District

-(Hopping)-

At the request of the B.C. Forest Service, an investigation was made of the status of the spruce budworm in timber stands of the Prince George district. Foresters have become worried about the creation of pure balsam stands by the removal of spruce in logging operations. Because of the lateness of the season there was not much time for a detailed examintion but some logging operations and timber stands were examined between Prince George and Hansard, including the Forestry Experimental area at Aleza Lake. Some operations and timber stands were also examined north and northwest of Prince George. No evidence of any spruce budworm work was found on any of the areas examined although reports have come in of an infestation east of Hansard in the Tonequo Range. Trees showed 50 per cent defoliation here in 1944. The area has not yet been examined by entomologists.

In connection with spruce budworm in the Prince George district, one problem which should be investigated was suggested by B.C. Forester M. Pague, who has been making reproduction studies there. He has indicated that the commercial-sized balsam left on logging operations dies in the course of eight or ten years. The cause may be bark beetles or a combination of bark beetles and unaccustomed exposure. Whatever the cause, if these conditions prevail in the region it means that the mature balsam left will cease to be a problem from the standpoint of residual stand susceptibility to budworm attack. The only consideration then would be the relative percentages of spruce and balsam reproduction and the trees under commercial-size remaining on the logged areas. Sample plot studies are planned in this connection for 1946.

- 0 -

E.30.07-3 Spruce Budworm - Hopping

Spruce Budworm Studies at Bolean Lake

A r e a

The area under study comprises the timber limits of the Vernon Pine and Box LumberCo. and is situated in the vicinity of Bolean and Arthur Lakes, near Falkland, B.C. The present limits have an area of 1,317 acres of commercial timber but the operations cover a much larger area because the merchantable stands are somewhat broken up by swamp areas and lakes. Contiguous areas may be available for expansion of the operation which may extend over a period of 18 to 20 years. Elevations: from 4,600 to 5,500 feet above sea level. Being a high plateau country, the slopes are gradual for the most part and the area is generally wet, making it necessary to build plank logging roads in some sections. (See accompanying map.)

Timber Types

The stand is considered to be a climax type for the high, wet, plateau country of the Interior. It is a mixture of Engelmann spruce (Picea engelmanni) and alpine fir (Abies lasciocarpa) commonly referred to as balsam. The relative percentages of these two species vary to some extent on different parts of the area. On site A (dark green areas on map) spruce runs from 10 M. to 15 M. board feet to the acre. Balsam on the same site originally averaged about 10 M. board feet tothe acre, but about 35 per cent has been killed either by bark beetles or possibly in some cases by disease. This leaves about 6 to 7 M. board feet per acre of living commercial-size balsam. Site B. (light green on map) has 6 to 8 M. board feet of spruce per acre. Figures for the

balsam are not yet available. Site C (blue area adjacent to and southwest of Bolean Lake) is occupied by a stand of almost pure balsam running 25 M. or over on a sample acre. In point of relative numbers of trees (commercial size) of the two species on a sample acre basis, site A has 87 spruce and 143 balsam; site B, figures not yet available; site C. 209 balsam and only 12 spruce.

Stand Management

The Vernon Box and Pine Lumber Co. first commenced logging operations on this area in January, 1944. No logging had preceded this. At the inception the B.C. Forest Service planned a system of selection cutting applying to the spruce whereby 30 to 35 per cent by volume is left standing. Selection of trees to be left is apparently governed to some extent by diameter classes and vigour as denoted by crown characteristics. Up to the above percentage volume, those trees are left which give promise of sufficient increased growth from release to justify leaving them for later harvesting. There appears to be no regulation with regard to the cutting of balsam. The latter is reported to be so defective from rots as to preclude profitable logging although a small percentage, which proves to be sound, is utilized. It should be points out, however, that no adequate studies have been made to determine how much defect is present.

The Entomological Problem.

The growth rate of both spruce and balsam may be considerably affected by an outbreak of the spruce budworm which is now in progress on this area. There is also the possibility that considerable tree mortality may ensue as a direct result of budworm feeding or indirectly, from bark beetle attack on the weakened trees. Therefore the main objects of this study are as follows:-

1. To determine the susceptibility of the logged stand to budworm damage.

2. To determine the mortality of spruce and balsam of all classes as a result of budworm feeding or bark beetle attack on the weakened trees.

3. To determine the relative populations of the budworm from year to year on the various stand types and on the logged and unlogged portions.

4. To determine and evaluate the natural control factors such as parasites and predators, which tend to reduce the budworm population.

5. To obtain all information possible relative tothe stands involved with regard to age, composition, evidence of previous outbreaks, reproduction, and growth rate over the past 60 years.

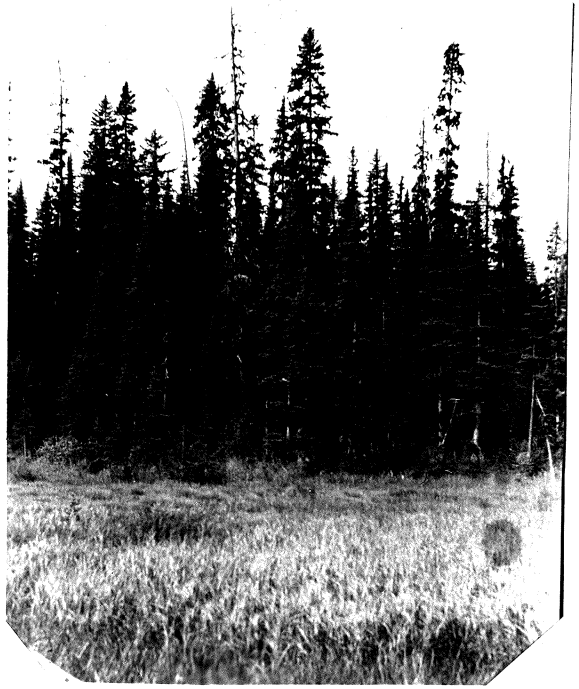
Procedure

The investigation will be carried out mainly by means of sample plots of one acre each. Three of these have already been established but it is probable that additional plots will be required.

Plot I (see map for location of plots) where selection logging has already taken place, represents Site A. Plot II represents Site A, also, but no logging has taken place and probably will not take place for a considerable period. Plot III represents Site C, which is practically pure balsam.

Severity of budworm feeding will be determined for these three types from year to year, supplemented by random samples and observations throughout the general area. Mortality of trees will also be determined by this method possibly supplemented by sample strip cruises to determine bark beetle activity.

Showing logging road on the timber limit at Boleam Lake of the Vernon Box and Pine Lumber Company.



Showing type of spruce-balsam stand in which Plot III is located. Boleam Lake, British Columbia.

Relative populations of the budworm will be determined by counts of larvae on standard branch samples taken from random selected trees on the sample plots supplemented by general observations and random samples throughout the area. Parasite determinations can be made from this same material.

Factors such as age of trees, growth rate, etc., relative to the history of the stand will be made on the sample plots. For this purpose all trees down to 3 inches D.B.H. have been tagged and numbered. Growth studies are made from increment cores, the individual rings measured to hundredths of a millimeter by means of a micrometer disc in a binocular microscope. For plotting purposes these are rounded off to the nearest tenth millimeter.

Results to Date

Seasonal Budworm Development: In this timber type and at these elevations it has been found that the spruce budworm requires two years to complete its life cycle. This departure from the one-year cycle occurs on the higher plateaux of the B.C. Interior and so far as known, does not occur anywhere else in Canada. This was first discovered by W. G. Mathers while making spruce budworm investigations in the Barkerville district some years ago.

On the Bolean Lake areas, the moths appear and lay eggs in late summer to early fall in the even-numbered years. The eggs hatch within about two weeks and, shortly after emergence, the young larvae spin small cocoons in which they pass the winter. They leave these cocoons the following spring and continue feeding throughout the following summer. In the fall they again spin cocoons in which another winter is passed. Feeding is resumed the following spring and by the middle of summer the larvae commence to reach full growth and pupate, the moths emerging about two weeks after pupation. Egg-laying is then completed and the cycle

begins again. This type of development results in heavy feeding in alternate years since the larvae eat much more during the latter part of their growth than they do in the earlier stages. In one respect, this is fortunate because it gives the trees opportunity to recover somewhat during the light-feeding years. However, it may not be so conducive to the increase of parasites.

Injury and Parasitism: Entomologists first visited the Bolean Lake area in July, 1944. Being a moth-flight year, feeding by the caterpillars was fairly heavy over a considerable area around Arthur and Bolean Lakes and extended northeastward at least as far as Spa Lake. The most severe damage occurred on young balsam 5 to 20 feet in height. The tops of some of these were completely defoliated and a few small trees were noted which were completely stripped. Young spruce had the extreme tops quite badly stripped and lateral tips turned red. Spruce and balsam of commercial size were less severely injured, the principal damage being to the extreme tops. Unless the outbreak becomes more intense, it is probable that no serious tree mortality will result in the mature stand. There will undoubtedly be some mortality in young balsam and possibly a small amount in young spruce.

The following parasites were recovered from random collections of larvae and pupae;

Glypta fumiferanae	(parasitic	wasp)
Apechthis ontario	"	"
Itoplectis obesus	"	"
Madremyia saundersii	"	fly

The total amount of parasitism however, was not over 15 per cent and would not exert any marked control influence, unless a material increase occured.

History of Outbreaks

With regard to past outbreaks, data may be secured from two sources: either from observers who visited the area, or from the tree ring record. The former is reliable if the observer is familiar with budworm injury. Growth depressions evident in tree rings are not so reliable but are fairly conclusive if climatic factors can be eliminated. This may be done by a study of rings from tree species which are not susceptible to budworm attack and which are growing on or near the area under study.

G. J. Struther, manager, Vernon Box and Pine Lumber Co., visited the Bolean stands in 1927 and he states that there was no evidence of budworm work then. The present outbreak apparently started quite recently since budworm feeding was not noticed to any extent prior to 1940. Evidence of past outbreaks from tree ring studies is discussed in the following section.

Growth Studies

Data presented here are from 10 spruce and 10 balsam from each plot except Plot II where only 4 spruce were available.

The spruce stand is considerably older than the balsam. The spruce range in age from 150 to over 300 years while balsam ranges from 75 to over 200 years. The average age of 42 spruce is 192 years and of 19 balsam, 135 years. In these figures, only those trees are included where the borer hit the center of the growth or very near it. Diameter is no indication of age in these stands.

In order to evaluate the effect of budworm feeding on tree growth it is necessary to know something about the rate of growth before and after the budworm outbreak and if possible, to determine whether any growth depressions are due to past outbreaks. This is an important point on this particular area because any serious curtailment in growth may counteract expected acceleration due to release.

Figures 1 to 3 show unsmoothed growth curves covering the period 1885 to 1944 inclusive, plotted by decades for spruce and balsam on Plots I, II and III, respectively. Plots I and III show a definite growth depression during the decade 1915 to 1924 which is only slightly in evidence on Plot II where the downward trend for balsam is accelerated and the upward trend for spruce is slightly decreased. For the same 60-year period, Figure 4 shows unsmoothed growth curves indicating yearly average growth of spruce and balsam on the three lots from 1885 to 1944 inclusive. These are plotted from the same data as the decade curves and indicate that the depression lasted for approximately 10 years, 1915 to 1924, and did not encroach appreciably on the preceding or following decades. The fact that this depression is scarcely evident on Plot II suggests that the cause was budworm feeding or at least not due to climatic factors. Over considerable areas, budworm feeding is characteristically varied in intensity and in the present outbreak, the feeding on the area represented by Plot II has been light in spite of the fact that the stand is nearly pure balsam. Site factors may have something to do with this. We can conclude with more confidence that budworm was responsible for this depression if it does not show up in growth studies of nearby lodgepole pine.

The decrease in growth from 1915 to 1924 was 30% below the average decade growth for the succeeding 20 years. The corresponding figures for Plot III are 18% and 85% respectively.

Disregarding for the moment, any acceleration in growth which may result from release, it is pertinent to calculate the increase in volume which may be expected in the spruce left on Plot I, assuming that the growth rate of the past ten years is maintained. This should be compared with the growth rate on Plot III where no logging has occurred. Ten years hence a similar comparison will give some idea of the effect of release.

PLOT I - Bolean Lake - B.C.

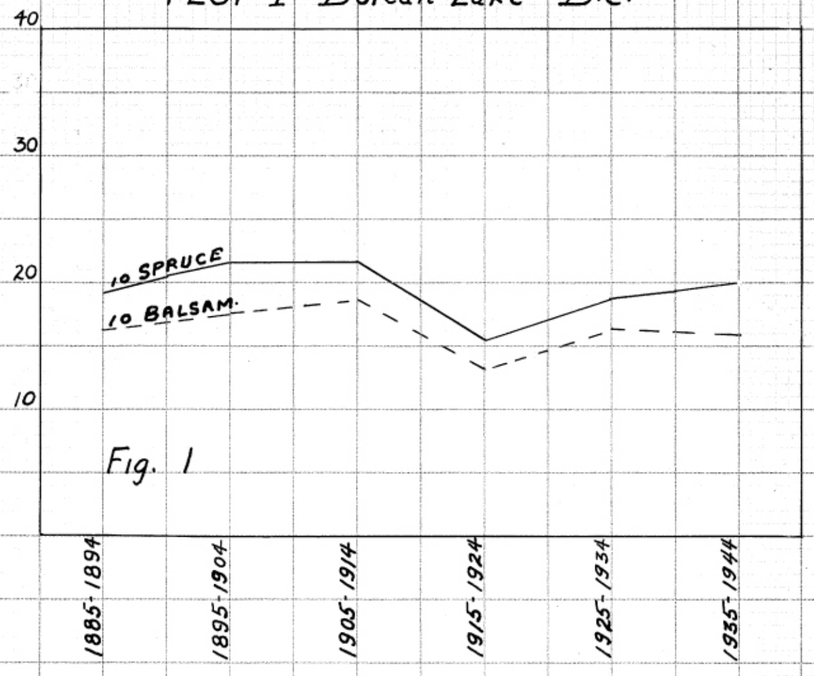


Fig. 1

PLOT II - Bolean Lake - B.C.

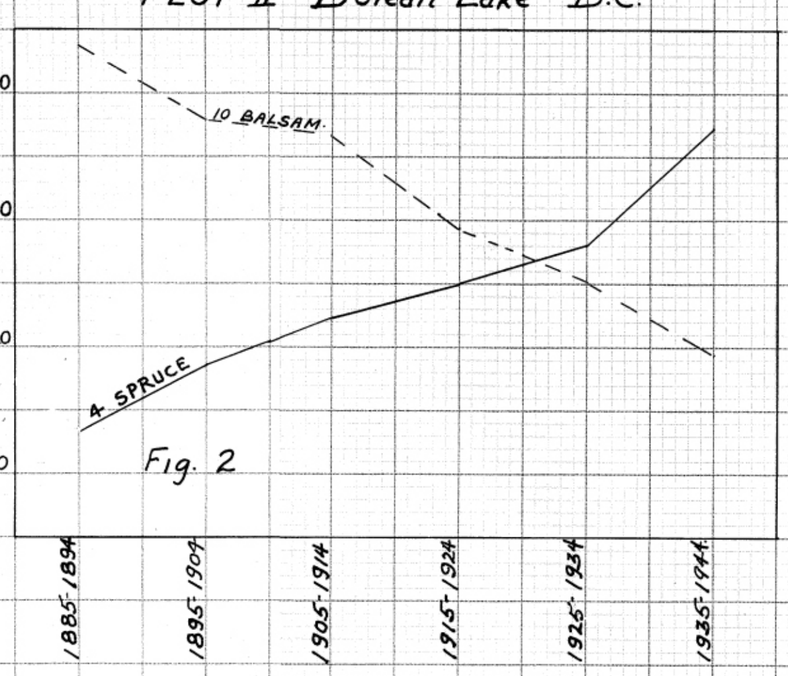


Fig. 2

PLOT III - Bolean Lake - B.C.

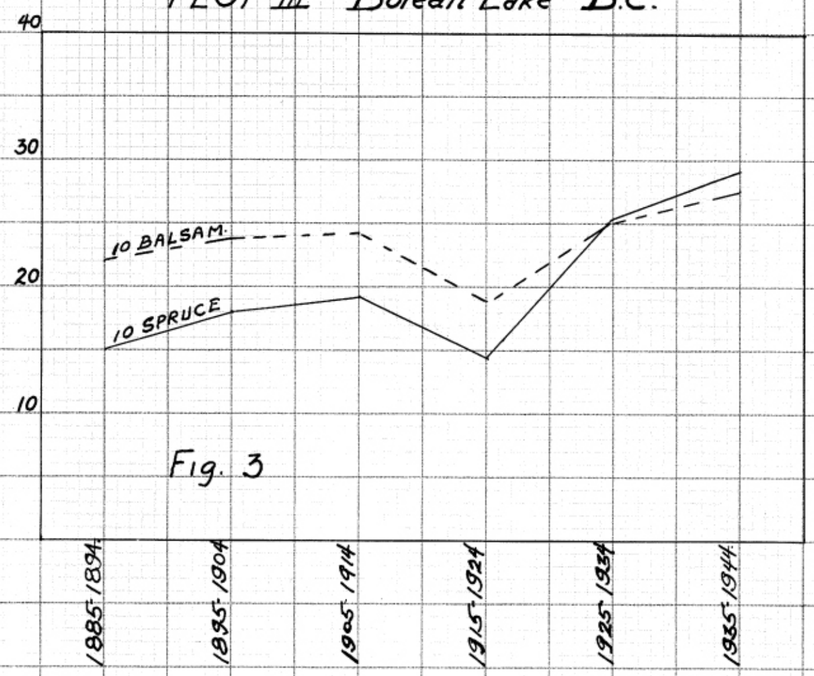


Fig. 3

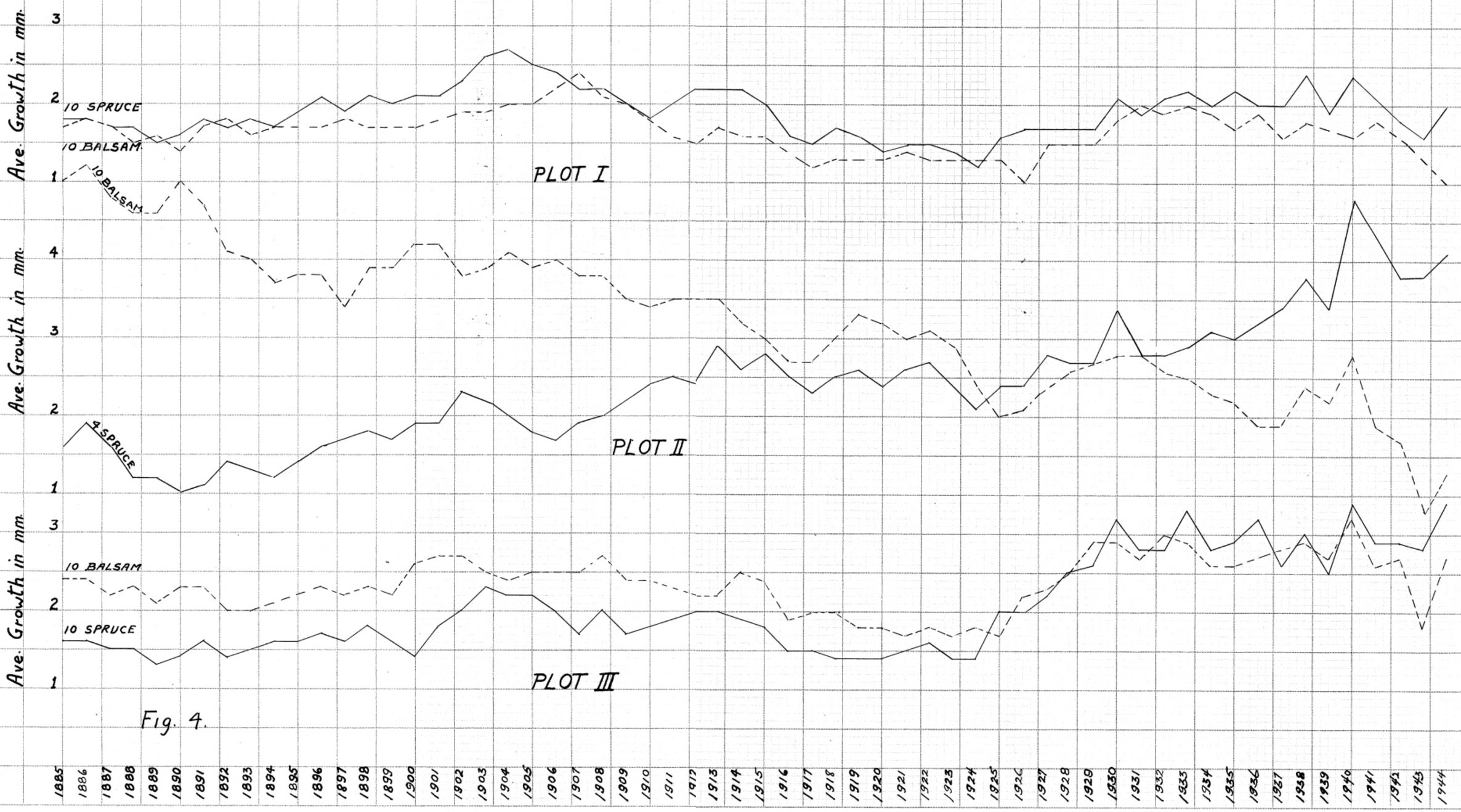


Fig. 4.

The following table shows the volume of the remaining spruce on Plot I and the unlogged stand on Plot III in 1935 and 1945 and the theoretical volume which will be reached in the future years indicated, assuming that the present rate of growth is maintained. In calculating these volumes, account has been taken of trees which will reach merchantable size progressively with each decade.

Plot No.	Volume in Board Feet				
	1935	1945	1955	1965	1975
I	4091	5193	6512	8051	9727
III	12921	15223	16710	20151	23630
	Stumpage value @$1.90 per M.				
I	$ 7.77	$ 9.87	$12.37	$15.30	$18.48
III	24.55	28.92	31.75	38.29	44.90

Actually, the increases on Plot III will not be realized. The stand is mature to overmature and the growth rate will probably drop during the next 30 years due to age and budworm feeding. Inevitably there will be loss from bark beetles, disease, and windfalls so that on this particular acre it is probable that not more than 18 M. board feet could be utilized in 1975. On Plot I there is a better chance of realizing the increases indicated and possibly a little more. The release due to logging may accelerate the growth rate but it must be remembered that these trees also are mature to overmature and may not respond as much as anticipated. Reduction due to budworm feeding, bark beetles and windfalls must also be taken into account. From past experience it is safe to conclude that there will be two periods of budworm attack between 1940 and 1975. One

of these is now in progress and the second one probably will occur between 1960 and 1970. During these periods the reduction in growth rate due to the budworm will work against the acceleration effect due to release.

All things considered, it would not be reasonable to expect much more than the increase indicated for Plot I. On the 1945 stumpage value of $9.87, this would represent a return of only about 2% at compound interest if the area is relogged in 1975. In view of all these adverse factors attendant in this mature to overmature stand, some indication may be gained as to the advisability of this selection cutting system on this particular area. Admittedly, much of this is problematical and the conclusions may be entirely upset by a greatly accelerated growth rate or the disappearance of the budworm outbreak without recurrence. This selection experiment is valuable if for no other reason than to see how the development during the next 30 years bears out the predictions.

- 0 -

Section N° 25

30

29

24

19

20

21

Bolean (Blair) Lake

Arthur Lake

Spa Lake

Plot I

Plot II

Plot III

B.PL.S. 1890

B.PL.S. 1900

B.PL.S. 1885

S.U.P 464

I.P. In Stone Monument Marked F.S.4

Scrub

Swamp

Scattered

To [illegible]

■ — 1 AC. SAMPLE PLOTS 1945

SPRUCE BUDWORM INVESTIGATIONS 1945

TIMBER LIMITS - VERNON B[illegible]

E.30.09-3 **Larch Sawfly** (Morgan, Cowan)

Examination of the larch stands between Kimberley and the Okanagan Valley in June disclosed very few curled shoots throughout the region. A second examination in September showed no appreciable defoliation except near the summit between Rossland and Sheep Creek where several hundred acres suffered medium to heavy defoliation. The larch sawfly population showed an increase in the vicinity of the Trinity Field Station judging by increased amount of defoliation on young larch. Two new sample plots have been established here, on one of which sampling was carried out according to the Prebble method. This was supplemented by random samples which were also taken on the area west of Rossland.

Two extensions of the known range of the sawfly were reported this year by rangers of the B.C. Forest Service, one in Christian Valley on the main Kettle River and the other between Penticton and Ellis Creeks near Penticton. The latter is about the western limit of larch occurrence.

Table I gives results of 20 square foot samples from 20 quadrats on a one acre plot at Trinity Field Station, sampling by the Prebble method. This represents 4 samples of 1 sq. ft. each from 5 trees on the plot.

Table II gives the results of random cocoon samples taken near the Trinity Field Station area.

Table III gives results of random samples taken from an area 8 miles west of Rossland on the Rossland-Sheep Creek summit. Defoliation was medium to heavy over several hundred acres.

TABLE I. -- QUADRAT SAMPLING OF SAWFLY PLOT - TRINITY

A	B	C	D	E	F	G	H	I			J
Tree No.	Total cocoons	Normal sawfly emergence	Opened by rodents	Apparently sound cocoons	Normal sawfly larvae	Mouldy cocoons	Dead-cause unknown	Parasitized by			% Paras. basis E - G.
								Mesoleius	Tritneptis	Both	
1950	68	10	4	54	20	2	0	5	26	1	61.5
1953	14	0	0	14	5	3	0	4	2	0	54.5
1958	27	0	2	25	12	1	0	3	8	1	50.0
1964	29	0	0	29	12	1	2	4	8	2	50.0
1976	27	0	5	22	6	2	0	3	11	0	70.0
Total	165	10	11	144	55	9	2	19	55	4	57.7
Ave.	33.	2.	2.2	28.8	11.	1.8	0.4	3.8	11.	0.8	57.7
Ave. per sq.ft.	8.3	0.5	0.6	7.2	2.8	0.5	0.1	1.0	2.8	0.2	57.7

TABLE II - RANDOM COCOON SAMPLES -TRINITY

A	B	C	D	E	F	G			H
Sample No.	Location	Cocoons examined	Normal sawfly larvae	Mouldy cocoons	Dead cause unknown	Parasitized by Mesoleius	Tritneptis	Both	% Paras. basis C - E
1	1.5 mi. S.of S.W.corner Exp. area	5	1	0	0	3	1	0	80.0
2	125' E. of Insectary	18	8	1	0	2	6	1	52.9
3	100' S. of Insectary	39	16	4	0	7	11	1	54.3
4	.75 mi.N.of N.E. corner Exp. area	100	29	5	4	9	51	2	65.3
5	.5 mi.N.E. of N.E. corner Exp. area	200	67	30	12	18	71	2	53.5
Totals		362	121	40	16	39	140	6	57.5
Ave.		72.4	24.2	8.0	3.2	7.8	28.0	1.2	57.5

TABLE III --RANDOM COCOON SAMPLES-

Rossland-Sheep Cr. Summit

A	B	C	D	E	F	F
Cocoons examined	Live sawfly larvae	Mouldy cocoons	Dead cause unknown	Parasitized by Mesoleius	Tritneptis	% Para. basis A- C
200	115	50	7	15	13	18.7

Notes on Diapause

No. 1. Original collection made fall of 1943. Put in shaded experiment (i.e. W3) for emergence in 1944. Examined Oct.18,1944. Twenty-one cocoons contained only live sawfly larvae Overwintered 1944-45 in insectary without soil.

Emergence:

June 6-45--1 female sawfly emerged and placed in caged larch in field on June 8/45. By June 12, eggs had been laid on two shoots. Eggs began to hatch on June 20.
June 16-45--1 female sawfly emerged
June 23-45--1 male Mesoleius emerged
June 25-45--2 males " " (not examined June2 4)
July 3 -45--1female Mesoleius emerged (not " July 1-2
July 5 -45--1female Mesoleius emerged
July 7 -45--1 female " "
July 9 -45--1 male " "

Sept.28-45--12 unemerged cocoons examined:-
4 contained dead, dry sawfly larvae
3 " " " " pupae
1 " " " " adult,female
3 " " " Mesol. pupae
1 " " " " adult,female

No.2. Original collection made fall of 1943. Examined October 4,1944. Eleven cocoons contained only live sawfly larvae. Overwintered in duff in insectary. Duff removed May 2,1945.

Emergence:

July 3-45-- 1 female Mesoleius emerged
Sept.28-45--10 unemerged cocoons examined:-
6 contained dead, dry sawfly larvae
2 " " Mesol. larvae
2 " " " " "
inside their parasite cocoons.

--

No.3. Original Collection made fall of 1943. Put in soil in field (i.e. Lot 7) Examined Oct. 6,1944. Five cocoons contained only live sawfly larvae. Overwintered 1944-45 in duff in insectary. Duff removed May 2,1945.

Emergence:

June 25-45-- 1 female sawfly emerged.
Sep. 28-45-- 4 unemerged cocoons examined:-
1 contained dead, dry sawfly larva
1 " " sawfly adult (female)
1 " " dry Mesol. larva--no cocoon.
1 " " Mesoleius adult (male)

--

No.4. Collected near Needles (same place as mass collection for Belleville in 1943) on Sept.17,1944. Overwintered in duff in insectary. Duff removed May 2,1945.

Emergence:

June 11-45-- 1 female sawfly emerged
June 14-45-- 1 " " "
June 16-45-- 1 male Mesoleius emerged plus 24 Tritneptis adults
June 18-45-- 4 female sawflies, 2 male and 5 female Mesol., 21 Tritneptis adults emerged. (Not examined June 17.)

June 19/45 - 1 female sawfly emerged
1 male and 2 female Mesoleius emerged
1 Tritneptis emerged

June 20/ - 4 Tritneptis emerged
June 21 - 1 male Mesoleius emerged
June 22 - 1 Tritneptis emerged

June 23,24 - not examined
June 25 - 6 Tritneptis emerged
June 26 - 1 female Mesoleius emerged
June 27 - 1 Tritneptis emerged
July 3 - 1 female sawfly emerged
1 male and 1 female Mesoleius emerged.
(not examined July 1 and 2)

July 5 - 1 female sawfly emerged
July 6 - 1 " " "
July 9 - 1 male Mesoleius emerged
July 12 - 2 males Mesoleius emerged
July 13 - 2 " " "
July 20 - 1 female " "
July 26 - 1 " " "
July 27 - 1 " " "
July 30 - 1 " " "
Aug. 1 - 1 female " "
Aug. 2 - 1 " " "
Sept. 28 - Unemerged cocoons examined:

51	contained	dead,	moldy	sawfly larvae
5	"	"	, dry	sawfly adults (females)
1	"	"	"	sawfly larva
1	"	"	"	" pupa
2	"	"	"	Mesol. pupae
60				

All Tritneptis adults had emerged from 3 cocoons.

E.30.19 - Bark Beetles

E.30.19-3 -- Tree mortality and sequence of attack as determined by sample plots

Up to the present time about 85 per cent of the trees have been killed on most of these ten plots. The exceptions are plots VIII, IX and X. The latter two are in 60 to 70 year old stands where many trees were 6 inches and under in diameter, consequently immune to attack. Plot VIII is in the northern portion of the outbreak where the infestation was later in developing. Plots I to VII have had all infested and dead trees removed by clearing and salvage operations and are of little further use. Plots VIII to X will still give valuable data and should be checked until the outbreak finally subsides. The following table gives record of attack on Plot VIII. No fresh attack occurred on Plots IX and X.

Year	Beetles killed	Green unattacked or recovered	Green attacked	Total trees
1941	1	39	20	60
1942	10	44	6	60
1943	13	39	8	60
1944	18	41	0	59 *
1945	18	35	6	59

* 1 removed by cutting.

It is evident that since 1941 the infestation has been carrying on approximately on a level and rather slowly. At this point the stand changes to a mixture of spruce and lodgepole pine continuing to Vermilion

summit. Nearer the summit some balsam also appears. The infestation has practically run its course in the pure lodgepole pine stand farther south. The sequence of attack in relation to diameter has been covered in previous reports.

E.30.19-(?)-- Control of bark beetle outbreak in Banff National Park.

Examination of the control areas in June and again in September disclosed very few red-tops. A few red-top groups visited in the Hillsdale area, had a few green-infested trees in the vicinity, but the ratio of green-infested to red-top was about 1 to 5. The park wardens have also been keeping an eye out for any signs of increase and report that the areas are in good shape. A more detailed examination is planned for 1946.

E.30.19-(?) -- Control of bark beetle outbreak in Yoho National Park.

An area of several square miles between Leanchoil and the west park gate has been under observation for several years because of the appearance of scattered red-tops. The progress has not been nearly so rapid as it was in Banff Park at the beginning of control. Consequently recommendation for control was not made until 1945. Although the ratio of green-infested trees to those attacked the previous year was still about 1 to 1 , even at this rate the stand could be badly damaged over a period of years and there were no signs of any radical subsidence. Consequently it was recommended to the Parks Branch that cruising and treating of the infested area be started in September 1945. Owing to scarcity of labour it was not possible to commence work until after the first of the next year. The control camp was closed down at the end of March,1946. Control work will be covered in the next technical report.

DDT Experiments on the Douglas fir Bark Beetle -(Hopping)

Objects of Experiments

1. To determine if there was any repellent effect of DDT concentrations specified, on attacking bark beetles.

2. To determine mortality of bark beetle broods emerging from logs treated with DDT concentrations specified.

3. To determine the effect on bark beetle broods both emerging and entering logs, treated and untreated, by DDT concentrations specified.

Materials Used

1. GESAROL A-3.

2. Formula I - 10% oil emulsion
   DDT 2 oz.
   Diesel oil ½ gallon
   DUPONAL 2 oz.
   Water to make 5 gallons.

3. Formula II- 20% oil emulsion
   DDT 2 oz.
   Diesel oil 1 gallon.
   DUPONOL 4 oz.
   Water to make 5 gallons.

Procedure

The experiments may be divided into two sections, A- Field Experiments and B- Cage Experiments (logs confined in cheese cloth cages 4' wide by 6' long by 6' high), for recovery of emergents. All logs used were 3 feet in length.

A. Field Experiments

On May 6 five logs, freshly cut, were placed side-by-side in the open, somewhat sheltered beneath forest trees. One log was treated with GESAROL A-3, one with Formula I and one with Formula II. A check log was untreated.

B. Cage Experiments

Cage I - One log containing spring brood of beetles ready to emerge; treated with GESAROL A-3 on May 7.

Cage II- One log containing spring brood of beetles; treated with Formula II (.5 gallons) on May 7.

Cage III-Two logs; untreated checks containing spring brood of beetles.

Cage IV- Two logs, one containing spring brood of beetles; sprayed with Formula II (.5 gal.) On May 7. One freshly-cut uninfested log to absorb emerging beetles.

Cage V - One log containing spring brood of beetles sprayed with formula I. (.375 gal.) On May 9.

Cage VI- One log untreated containing spring brood of beetles; two freshly-cut uninfested logs, one dusted with GESAROL A-3, one untreated.

Cage VII-One log, untreated, containing spring brood of beetles; two freshly-cut, uninfestedlogs, one treated with Formula I. (.375 gal.), one untreated. (May 9).

Cage VIII As in VII but using Formula II for the treated section. (May 9).

Application of the dust was made with a fine mesh cloth bag, until the bark surface was completely covered. The spray was applied with a bucket pump until allparts of the bark surface were thoroughly wet.

In the field experiments (A) record of fresh attacks on all logs was kept each day and all logs were examined in detail after suitable intervals to allow for any development of the broods.

Beetles from Cages I, II, III and V were collected daily and placed in the insectary on moist blotting paper in petri dishes. Longevity of the beetles in days after emergence was recorded.

After a suitable time to allow for re-entry of the emerging broods into the treated and untreated logs, examination was made of all logs and the mortality of various stages of the bark beetles was recorded. Examination was also made of logs from which thebroods had originally emerged. Results are contained in the following tables and summaries.

It is obvious from the results in Table I that there was no marked repellent action of the materials used and that in these concentrations, development of broods in the treated logs was not prevented.

It is apparent from these experiments that the concentrations of DDT used would not be of any practical value for the control of the Douglas fir bark beetle.

With thin-barked trees, such as lodgepole pine, it might prove to be useful. Cost of treatment would be a major consideration.

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FIELD EXPERIMENT

TABLE I. MORTALITY OF BROODS ENTERING TREATED LOGS

Log No.	Treatment	Surfacearea in sq.feet.	Per square foot						Average gallery length in cm.
			Attacks	Adults		Eggs	Larvae		
				live	dead		live	dead	
1.	GESAROL A-3	8.2	6.1	1.6	1.4	26.7	77.4	0.0	11.1
2.	Formula I	8.6	3.2	1.7	0.8	29.3	73.8	1.4	21.6
3.	Formula II	8.1	4.0	0.1	3.3	18.3	76.0	5.7	16.5
4.	Check	8.8	5.7	2.4	0.6	34.8	34.5	0.0	18.9

CAGE EXPERIMENT

TABLE II. MORTALITY TIME OF BEETLES EMERGING FROM TREATED LOGS

Cage No.	Treatment	No. of beetles dead											Days after emergence														Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21-23	24	25	26	27	
I	GESAROL			4	8	18	20	17	7	1	3																78
V	Formula I	5	4	7	7	6	13	12	9	8	7	7	4	12	7	1	4										113
II	FormulaII	2	3	1	2	7	2	3	2					1	1												24
III	Check			3	1	3	5	11	2	12	8	10	6	13	19	10	7	7	11	8	8	10-1	2	1	1	1	160
Y																											

50% mortality point

I -- 6 days
V -- 7 days

II -- 5 days
III --14 days

CAGE EXPERIMENTS

TABLE III. MORTALITY OF BROODS ENTERING UNTREATED & TREATED LOGS FROM TREATED LOGS

Cage No.	Treatment	Surface area in Sq. ft.	Per square foot						Average Gallery Length in centimeters
			Attacks	Adults		Eggs	Larvae		
				live	dead		live	dead	
IV-1	Untreated	9.9	0.9	0.1	0.4	0.3	2.6	12.6	9.8
VI (2)	Untreated	5.3	3.6	1.9	0.4	1.7	66.0	7.0	23.6
VI	GESAROL A-3	7.8	1.9	1.4	0.4	6.0	48.0	0.8	27.7
VII (3)	Untreated	7.1	10.1	1.1	3.0	0.0	84.2	2.7	20.3
VII	Formula I	8.4	7.3	3.5	4.2	4.0	61.4	24.3	19.0
VIII (4)	Untreated	8.7	2.3	0.7	0.5	1.4	9.0	17.5	13.3
VIII	Formula II	8.2	2.4	0.6	1.6	2.2	23.1	6.5	18.0
Out-side	Check	8.8	5.7	2.4	0.6	34.8	34.5	0.0	18.9

(1) Attacking brood emerged from log treated with Formula II

(2 Attacking brood emerged from log treated with GESAROL A-3.

(3) Attacking brood emerged from log treated with Formula I

(4) Attacking brood emerged from log treated with Formula II

E.30.24 - Western Hemlock Looper

E.30.24-(?) - General survey of outbreak areas, Estimation of damage.

Young larvae in abnormal numbers were present on hemlock and other forest trees from near Revelstoke northward to Mile 88 on the Big Bend Highway. In many places it was not difficult to collect 15 to 20 young larvae on trees 8 to 10 feet high. On June 7 the larvae were so small as to suggest that hatching of eggs may not have been completed.

A re-examination of the area in September revealed outbreak conditions from a point 34 miles north of Revelstoke northward for 50 miles. Moths could be seen flying and resting on the tree trunks nearly anywhere on this area. On the east side of the valley defoliation was noticeable but not complete on an area about 10 miles long by several miles wide between Mile 54 and 64 north of Revelstoke. Noticeable feeding was also apparent at Mile 73. On the west side of the valley localized areas each a few acres in extent were completely stripped from a point 51 miles north of Revelstoke northward for a distance of 13 miles. It is expected that 1946 will be the peak year of this outbreak. Timber loss in 1945 was less than 1,000 M. board feet, estimated. The entire outbreak area comprises 150 square miles at a conservative estimate.

E.30.24-(?) Population studies and determination of natural control factors.

The work for 1946 for this project will consist of:

1) Egg survey before hatching:- First it will be necessary to find out where the majority of eggs were deposited since localities differ in this respect, according to the amount of moss on trees, character of forest floor, type of timber etc.

Branch or moss samples should be taken from stations from south to north through the area. These stations should be about 6 to 10 miles apart depending on favourable sampling areas.

2) Larval samples by the branch count and beating methods.

These should be taken at about the same intervals as for the eggs. The branch sampling should consist of 8 branch samples from each tree at each location, 4 from near the base of the crown, 4 from a height of about 14 feet. Trees about 20 feet in height would be most suitable but older trees should be tried at the 14-foot level. It might be possible to climb some trees, to see what larval conditions are near the tops, also on a branch sample basis.

3) Pupal collections on the same basis as larval sampling. All samples will be transferred to the Trinity Valley Field Station for mortality and parasite determinations.

E.30.40 - Douglas Fir Tussock Moth

E.30.40-(?) - General survey of localized infestations in the Interior of British Columbia.

Considerable increase of the tussock moth is anticipated in the Vernon district in 1946. In 1945 it was reported from several localities in Vernon city. In one case an ornamental fir was completely stripped before the danger was realized and it was too late for control. Through the local press householders who have valued Douglas firs have been warned to keep a careful check in the spring of 1946 so that any control measures necessary will be in time. The tussock moth is also important because the hairs from caterpillars cause a severe rash of the skin. Quite a number of cases have developed during past outbreaks.

The virus disease which causes the sudden end of some outbreaks was not detected in the field in 1945. Virus material has been saved from a line of tussock moth rearings carried on from the last outbreak. This material should be tested on field larvae in 1946.

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PHENOLOGICAL OBSERVATIONS

Laboratory: Trinity Valley Field Station (Vernon,B.C.) Year: 1945 Observer: C.V.G.Morgan

Sta.	Species	Observations	Date	Remarks
1.	Picea engelmanni	First bud-scales shed	May 21	
		98% bud-scales shed	May 31	
		First staminate flowers shedding pollen	--	
		New growth 2" long	June 1	
		Terminal growth completed	July 30	Last wk. of July
2.	Pinus contorta	First bud-scales shed and Terminal candles 1½" long & lateral candles ¾" long	-- May 19	
		First staminate flowers shedding pollen	June 1	
		First needles separated in bundles	June 5	
		Terminal growth completed	Aug. 7	1st. wk. of Aug.
		Old needles just turning	Aug.18	
		Old needles falling	Aug.30	
3.	Abies lasiocarpa	First bud-scales shed	--	
		First staminate flowers shedding pollen	--	
		New needles ½" long	May 19	
		Terminal growth completed	July 25	Last wk.of July.
4.	Larix occidentalis	First staminate flowers shedding pollen	--	
		First bud-scales shed	Apr.16	On young trees
		Needles full grown	May 19	
		New growth 2-3" long	June 1	" " "
		Terminal growth completed	Aug. 6	1st. wk.of Aug.
5.	Pyrus sitchensis	Leaf buds ½" long	Apr.30	
		Compound leaves 5" long	May 19	
		First leaves fully expanded	May 21	
		First flower open	May 30	
		25% flowers open	June 2	
		90% flowers open	June 4	
		98% flowers open	June 7	
		First fruit ripe	Aug.20	
		First leaves turning color	Sept.7	
		90% leaves turned	Sept.28	20% leaves dropped

Sta.	Species	Observations	Date	Remarks
9.	Clintonia uniflora	First flower open	June 11	
		90% flowers open	June 20	
		100% flowers open	June 23	
		First fruit ripe	July 23	
10.	Cornus canadensis	First green bracts separated	May 24	
		First green bracts turned white	May 30	
		First floret open	June 4	
		10% florets open	June 7	98% green bracts turned white
		25% florets open	June 16	
		95% florets open	June 22	
		First fruit ripe	July 16	
		80% leaves turned color	Sept.12	
		100% leaves turned	Sept.28	
11.	Solidago canadensis	First flower open	July 28	
		95% flowers open	Aug. 7	
12.	Epilobium angustifolium	First flower open	July 11	
		5% flowers open	July 13	
		100% flowers open	Aug. 10	
	Acer glabrum	100% flowers open	May 19	Leaves 1¾" long
		First leaf fully expanded	May 22	
		First leaves turning color	Sept.10	
		95% leaves turned	Sept.28	5% leaves dropped
	Achillea lanulosa	First flower open	June 14	
		30% flowers open	June 22	
		100% flowers open	July 10	
	Alnus sp.	Staminate catkins 1" long	Apr.30	
		Staminate catkins 3" long	May 19	Leaf buds 1"long
	Amelanchier alnifolia	First leaves fully expanded	May 19	Racemes 2" long
		First flower open	May 23	
		70% flowers open	May 26	
		100% flowers open	May 28	
		100% sepals shed	June 1	
		100% fruit ripe	Aug. 8	
		First leaves turning color	Sept.7	
		100% leaves turned	Sept28	
	Anaphalis margaritacea	50% flowers open	July11	

(Phenological Observations)

Species	Observations	Date	Remarks
Aquilegia formosa	First flower open 20% flowers open 90% flowers open 100% flowers open	June 6 June 14 June 22 June 27	
Aralia nudicaulis	Plants 1' tall First flower open 30% flowers open 60% flowers open 100% flowers open First leaves turning color 98% leaves turned	May 26 May 28 June 1 June 7 June 14 Aug. 22 Sept.11	
Arctostaphylos uva-ursi	100% flowers open	May 19	
Berberis aquifolium	Racemes 1/2" long First flower open 100% flowers open 100% berries ripe	Apr.30 May 19 June 2 Aug. 9	
Betula occidentalis	Leaf buds 1/4" long Leaves 1¼" long First leaves turning color 95% leaves turned	Apr.30 May 19 Sept.8 Sept.28	
Calypso bulbosa	100% flowers open	May 19	
Carduus arvensis	First flower open First seeds spreading 95% flowers open	July 17 Aug. 7 Aug. 10	
Castilleja sp.	100% flowers open	June 18	
Ceanothus sanguineus	Leaves 3/4" long First flower open 50% flowers open 100% flowers open	May 19 June 2 June 5 June 15	
Chimaphila umbellata	New leaves 1" long New leaves 1½-2" long First flower open 40% flowers open	June 2 June 14 June 30 July 11	
Corallorhiza multiflora	First flower open 90% flowers open	June 14 June 23	
Cornus stolonifera	100% flowers open	June 23	
Clematis columbiana	100% flowers open	May 26	

(Phenological Observations)

Species	Observations	Date	Remarks
Corylus californ-	Staminate catkins 1" long	April 2	
	Staminate catkins still expanding	April 16	No pollen spreading yet.
	Staminate flowers shedding	April 30	
	First leaves turning color	Aug. 29	
	98% leaves turned	Sept. 28	15% leaves dropped
Disporum trachycarpum	100% flowers open	May 19	
Gragaria spp.	5% flowers open	May 19	
	90% flowers open	May 26	
	95% flowers open	May 31	
	First sepals shed	June 1	
	90% fruit ripe	July 12	
Gentiana acuta	First flower open	June 21	
Habenaria orbiculata	100% flowers open	July 17	
Lathyrus ochroleucus	First flower open	May 31	
	50% flowers open	June 14	
	100% flowers open	June 21	
Lilium parviflorum	Plants 7" tall	May 19	
	Plants 18" tall	June 1	
	Flower buds 1" long	June 7	
	First flower open	June 20	
	10% flowers open	June 23	
	100% flowers open	July 7	
Linnaea borealis var. americana	First flower open	June 12	
	5% flowers open	June 16	
	80% flowers open	June 22	
	100% flowers open	July 3	
Lonicera ciliosa	First flower open	June 18	
	10% flowers open	June 23	
	100% flowers open	July 6	
Lonicera involucratum	Leaves ½" long	April 30	
	Leaves fully expanded	May 19	
	95% flowers open	June 7	
	100% flowers open	June 12	
	100% fruit ripe	July 12	

Species	Observations	Date	Remarks
Lonicera utahensis	Leaf buds 1" long	April 30	Leaves just unfurling
	70% flowers open	May 14	
	90% flowers open	May 19	
	100% flowers open	May 26	
	First fruit ripe	June 25	
	100% fruit ripe	July 3	
Lupinus sp.	First flower open	June 9	
	15% flowers open	June 16	
	50% flowers open	June 22	
	98% flowers open	July 12	
Lysichiton kamtschatcense	100% flowers open	May 19	
Moneses uniflora	100% flowers open	July 12	
Pachystima myrsinites	100% flowers open	June 2	
Pinus monticola	Lateral candles 3/4" long	May 19	Terminal candles 1"
	First needles separated in bundles	June 5	
	Old needles just turning	Aug. 16	
	Old needles falling	Aug. 30	
Populus tremuloides	Leaves 3/4" long	May 19	
Populus trichocarpa	First bud scales shed	April 30	
	First leaves fully expanded	May 19	
	50% leaves turned color	Sept. 28	
Pseudtosuga taxifolia	First bracts splitting	May 19	On trees up to 30'
	First needles completely spared	May 24	
	98% bracts shed	May 31	
	Lateral new shoots 1½" long	June 1	
Pyrola bracteata	50% flowers open	July 12	
Pyrola chlorantha	100% flowers open	June 22	
Pyrola secunda	90% flowers open	July 12	
Ranunculus sp.	First flower open	June 20	
Ribes lacustre	Leaf buds 1/2" long	April 30	Leaves just uncurling
	First flower open	May 19	Leaves 1½" long
	80% flowers open	May 26	
	95% flowers open	June 1	
	First fruit ripe	July 10	
	100% fruit ripe	Aug. 3	

(Phenological Observations)

Species	Observations	Date	Remarks
Ribes sanguineum	First flower open	May 17	
	10% flowers open	May 19	
	20% flowers open	May 21	
	100% flowers open	May 26	
Rosa melina	First leaves just uncurling	Apr.30	
	Leaves 3/4" long	May 19	
	First flower open	June 12	
	15% flowers open	June 16	
	70% flowers open	June 22	
Rubus parviflorus	Plants 10" high	May 19	Leaves 3" long
	First leaves fully expanded	May 26	
	First flower open	June 11	
	5% flowers open	June 15	
	40% flowers open	June 22	
	100% flowers open	July 6	
	First fruit ripe	July 27	
	20% fruit ripe	Aug. 3	
	80% fruit ripe	Aug. 10	
	First leaves turning color	Sept. 4	
	98% leaves turned color	Sept. 28	40% leaves dropped
Rubus viburnifolia	First flower open	June 18	
	50% flowers open	June 22	
	98% fruit ripe	Aug. 3	
Salix sp.	Leaf buds 1/42 long	Apr. 30	
	Leaves 1¼" long	May 19	
Shepherdia canadensis	First flowers open	Apr. 30	
	Leaves 1½" long	May 19	
	First fruit ripe	June 27	
	50% fruit ripe	July 6	
	90% fruit ripe	July 12	
	First leaves turning color	Sept.10	
	10% leaves turned	Sept.28	
Smilacena racemosa	Plants 15" tall	May 19	
	First flower open	May 28	
	20% flowers open	June 2	
	50% flowers open	June 7	
	98% flowers open	June 14	
Spiraea lucida	Leaf buds 1/4" long	Apr. 30	Leaves just uncurling
	First leaves fully expanded	May 19	
	100% flowers open	July 16	
	75% leaves turned color	Sept.11	
	100% leaves turned	Sept.28	25% leaves dropped

Species	Observations	Date	Remarks
Taraxacum officinale	First heads completely shed of seeds	May 29	
Taxus brevifolia	100% flowers open	May 19	
	100% fruit ripe	Aug. 3	
Thuja plicata	First leaves turning color	Aug.27	
Tragopogon pratensis	First seeds ripe & spreading	July 10	
Vaccinium membranaceum			
	50% flowers open	May 26	
	100% flowers open	May 30	
	First fruit ripe	July 5	
	50% fruit ripe	July 10	
	100% fruit ripe	Aug. 3	
	90% leaves turned color	Sept.11	
	100% leaves turned	Sept.28	
Vaccinium ovalifolium	50% fruit ripe	July 12	
Verbascum thapsus	First flower open	July 28	
	90% flowers open	Aug. 10	
Viburnum paucifloram	80% flower open	June 7	
Vicia americana	80% flowers open	June 22	
Viola adunca	100% flowers open	May 14	
Viola canadensis	100% flowers open	May 14	
Viola glabella	100% flowers open	May 14	

GENERAL OBSERVATIONS

Last snow to whiten ground	April 27, 1945
Disappearance of winter's snow in open	" 30
" " " " in forest	" 30
Last spring frost	May 23
First fall frost	Sept. 9
First snow to fly in air	Oct. 19
" " " whiten ground	Oct. 21

TEMPERATURE RECORDS

TRINITY VALLEY FIELD STATION, B. C.

Winter of 1944 - 45

Date	Time	Outside Insectary			Inside Insectary			Overwintering chamber			Snow on ground in inches
		Max.	Min.	At time of reading	Max.	Min.	At time of reading	Max.	Min.	At time of reading	
November 6/44	11:00 A.M.	51.5	30.0	44.0	51.5	31.0	44.0				
13	10:00 A.M.	47.0	27.0	30.0	46.5	29.5	30.5	45.0	38.5	38.5	
20	10:30 A.M.	36.0	16.5	29.0	35.0	21.0	30.0	39.0	35.0	35.0	
30	10:45 A.M.	34.5	14.0	30.5	33.0	24.0	30.5	36.0	34.0	34.0	4.0
Dec. 18	3:00 P.M.	34.0	7.0	22.0	39.0	19.0	25.0	36.0	29.0	30.0	6.7
30	10:45 A.M.	32.0	-6.0	24.0	28.0	7.5	26.0	30.0	25.0	29.0	10.0
Jan. 15	11:20 A.M.	36.0	22.0	32.0	33.0	25.5	31.0	32.0	29.0	32.0	21.0
Feb. 1	11:15 A.M.	34.0	-1.0	25.0	34.0	11.5	23.0	35.0	27.0	28.0	21.0
Mar. 2	10:15 A.M.	43.0	-3.0	28.0	36.0	11.0	27.0	32.0	26.5	30.0	27.0
16	10:00 A.M.	43.5	0.0	30.0	37.0	13.0	29.0	32.0	28.0	31.0	24.0
Apr. 2	10:00 A.M.	50.5	20.0	33.0	45.5	26.0	30.0	33.0	31.0	32.0	16.5
16	10:30 A.M.	52.5	19.0	38.0	53.5	20.0	38.0	34.0	31.0	32.0	10.5 (patc
30	10:30 A.M.	58.5	24.0	47.0	59.0	25.0	47.0	36.5	32.0	34.5	disappeare in open & in forest

TEMPERATURE RECORDS

for

TRINITY VALLEY FIELD STATION, B.C.

1945

(May to October)

Date		Outside Insectary			Inside Insectary		
		Max.	Min.	At time of reading 8:00 A.M. *	Max.	Min.	At time of reading 8:00A.M. *
May 2	10:20 A.M.	68.5	29.5	51.0	68.5	30.0	52.0
4	10:50 A.M.	77.5	34.0	57.0	77.0	35.0	58.0
7	10:30 A.M.	69.5	27.0	45.0	69.0	28.0	43.5
9	10:15 A.M.	66.0	29.0	52.0	65.0	30.0	51.0
14	11:50 A.M.	67.5	31.0	54.0	66.0	32.0	53.0
14	8:00 A.M.	57.0			56.0		
15		59.5	37.0	41.0	57.5	37.5	40.5
16		65.0	31.0	34.0	64.0	31.5	33.5
17		52.5	41.0	43.0	52.0	41.0	43.0
18		56.0	41.0	42.0	55.5	41.0	42.0
19		65.5	39.5	45.5	64.5	39.5	45.0
20		52.5	39.0	42.5	51.5	40.0	42.0
21		67.0	34.5	41.0	66.0	35.5	40.0
22		69.0	32.5	41.5	69.0	33.5	41.0
23		73.0	32.0	41.5	72.0	33.0	41.0
24		69.0	36.0	44.0	68.0	37.0	43.5
25		72.5	36.0	43.0	72.0	36.5	47.0
26		68.0	43.5	47.0	67.5	44.0	46.5
27		75.0	37.5	43.5	74.5	38.0	42.5
28		80.0	37.5	40.0	80.0	38.0	39.5
29		84.0	39.0	46.5	84.0	40.5	45.5
30		83.0	42.0	47.0	82.5	43.0	46.0
31		78.0	43.0	49.0	77.5	44.0	48.0
June 1		69.0	44.0	47.5	69.5	44.5	47.0
2		71.0	44.0	47.5	70.0	44.5	47.5
3		65.5	45.0	49.5	65.0	45.0	49.0
4		64.0	51.5	54.5	64.0	51.5	54.5
5		67.0	47.0	50.0	66.5	47.0	50.0
6		67.0	48.5	52.0	66.0	49.0	52.0
7		71.0	47.5	51.0	70.0	48.0	50.0
8		73.5	46.0	50.0	73.0	47.0	49.5
9		62.5	47.5	50.5	62.0	48.0	50.5
10		69.5	43.0	48.5	68.5	44.0	47.5

* Readings taken at 8:00 A.M. after May 14.

Temperature Records

Date	Outside Insectary			Inside Insectary		
	Max.	Min.	8:00 A.M.	Max.	Min.	8:00 A.M.
June 11	56.0	37..	43.5	55.0	38.0	43.0
12	61.0	39.5	43.0	60.0	39.5	43.0
13	62.0	32.5	40.0	61.0	33.0	40.0
14	67.5	40.0	46.0	66.5	41.0	45.5
15	73.0	34.5	41.0	73.0	35.5	40.5
16	72.0	38.0	46.0	72;0	39.5	46.0
17	80.0	35.0	42.5	80.0	36.0	42.0
18	72.0	50.5	57.0	71.5	51.5	57.0
19	70.5	45.5	50.0	70.0	47.0	50.0
20	71.5	53.0	55.0	70.5	53.5	55.0
21	66.0	52.0	54.0	65.6	52.5	54.0
22	70.0	44.5	49.0	69.5	45.5	48.5
23	76.5	33.5	50.5	76.5	35.0	50.5
24	83.5	38.5	44.5	83.5	40.0	44.0
25	83.0	44.0	49.5	83.0	45.5	49.5
26	60.0	53.5	54.5	59.0	54.5	55.0
27	60.0	41.5	48;5	60.0	42.5	48.5
28	66.5	48.5	51.0	65.0	49.0	51.0
29	60.0	41.5	47.0	59.5	42.0	47.0
30	76.0	35.0	42.5	75.0	36.0	42.5
July 1	80.5	41.5	49.0	81.0	42.0	48.5
2	80.0	51.5	52.0	80.0	51.0	52.0
3	78.5	45.5	48.5	78.0	45.0	48.5
4	79.0	46.5	51.0	78.0	47.5	51.0
5	85.0	39.0	47.0	85.0	40.0	47.0
6	85.5	42.0	48.0	85.0	43.0	48.0
7	88.5	43.0	50.0	88.0	44.0	50.0
8	85.0	47.5	54.0	85.0	49.0	54.0
9	88.0	49.0	54.0	88.0	50.0	54.0
10	92.5	51.0	57.0	92.0	52.0	57.0
11	92.5	52.5	58.0	92.0	53.5	58.0
12	93.5	49.5	55.0	93.5	51.0	54.5
13	93.5	50.5	57.0	94.0	52.0	57.0
14	85.0	54.0	59.5	85.0	55.0	59.5
15	75.0	49.0	54.5	75.0	50.0	54.5
16	70.0	48.5	51.0	69.0	49.5	51.0
17	61.0	48.5	50.0	61.0	49.0	50.0
18	74.0	43.0	47.5	74.0	43.0	47.0
19	78.0	38.5	45.0	78.0	39.5	44.5
20	73.0	43.5	48.0	73.0	45.0	48.0
21	77.0	49.0	52.0	77.0	50.0	52.0
22	67.0	45.5	49.5	67.0	47.0	49.0
23	79.5	41.5	45.5	79.5	42.5	45.0
24	85.5	42.0	50.0	85.5	43.0	50.0
25	76.0	50.5	56.0	75.5	51.5	56.0

Temperature Records

Date	Outside Insectary			Inside Insectary		
	Max.	Min.	8:00 A.M.	Max.	Min.	8:00 A.M.
July 26	83.0	43.5	49.0	83.5	45.0	49.0
27	89.5	45.5	51.0	89.5	47.0	51.0
28	86.5	48.0	55.0	86.0	49.0	54.5
29	73.0	44.0	49.0	73.0	45.0	49.0
30	65.5	48.0	51.0	65.0	49.0	50.5
31	74.0	36.0	41.0	73.5	37.0	41.0
Aug. 1	82.0	38.0	42.0	82.0	39.0	42.0
2	85.0	44.0	47.5	85.0	45.5	47.0
3	71.0	49.0	53.0	70.5	50.5	52.5
4	78.0	44.0	49.5	78.0	45.0	50.0
5	86.0	43.0	48.0	86.5	44.5	48.0
6	89.5	45.5	48.5	89.5	46.5	48.5
7	92.0	48.0	55.0	92.0	49.5	54.5
8	90.0	60.5	63.0	90.0	61.5	63.0
9	84.5	47.5	52.0	84.5	49.0	52.0
10	81.0	45.5	48.5	80.5	46.5	48.5
11	82.0	42.5	46.5	81.5	43.5	47.0
12	86.5	42.0	43.0	86.0	43.5	43.0
13	88.0	45.5	47.5	88.0	46.5	47.5
14	91.5	47.5	50.5	91.0	49.0	51.0
15	92.0	48.0	52.0	92.0	49.0	52.0
16	90.0	48.0	50.0	90.0	49.0	50.0
17	83.5	53.0	56.0	83.5	54.5	56.0
18	73.0	46.0	49.0	72.5	47.0	49.0
19	69.0	30.0	?	69.0	32.0	?
20	76.5	?	?	76.5	?	?
21	83.0	33.5	39.0	83.0	35.0	39.0
22	84.0	39.0	42.5	84.0	41.0	43.0
23	85.0	44.5	46.0	85.0	46.0	47.0
24	86.5	43.5	45.5	86.5	45.0	46.0
25	64.0	47.5	50.0	64.0	48.5	50.5
26	75.0	51.0	54.0	74.0	52.0	54.0
27	80.0	45.0	48.5	79.5	47.0	48.5
28	77.0	49.0	54.5	76.5	50.0	54.0
29	81.0	43.0	47.5	80.5	44.0	47.0
30	67.0	43.0	46.0	66.5	44.0	46.0
31	75.0	39.0	40.5	74.5	40.0	41.0
Sept. 1	82.5	35.0	37.5	82.0	36.0	38.0
2	80.0	43.5	49.0	80.0	44.5	49.0
3	63.0	42.0	44.0	63.0	43.5	44.5
4	68.5	50.0	51.5	68.0	51.0	52.0
5	67.0	35.5	38.0	66.5	37.0	38.5

Temperature Records

Date		Outside Insectary			Inside Insectary		
		Max.	Min.	8:00 A.M.	Max.	Min.	8:00 A.M.
Sept.6		73.0	39.0	44.5	72.5	40.5	45.0
7		69.5	37.0	42.5	69.5	38.5	43.0
8		58.0	41.0	45.5	58.0	42.0	46.0
9		69.0	30.0	32.5	69.0	31.0	33.0
10		71.0	44.0	47.5	70.5	45.0	48.0
11		73.5	40.5	41.5	73.5	42.0	43.0
12		78.0	34.0	35.5	77.0	35.0	36.0
13		79.0	38.0	41.0	79.5	39.5	41.5
14		80.0	37.5	38.5	80.0	39.0	39.5
15		55.0	47.0	48.0	55.0	48.0	49.0
16		57.0	?	?	57.0	?	?
17		53.0	31.5	?	52.5	33.0	?
18		61.5	28.0	29.5	61.0	29.0	30.5
19		61.0	29.0	31.0	60.5	30.0	31.5
20		48.0	42.0	42.5	47.5	43.0	43.5
21		52.0	41.0	41.5	52.0	41.0	41.5
22		46.0	35.0	41.0	46.0	35.0	41.5
23		50.0	32.0	33.0	50.0	33.0	34.0
24		54.5	36.0	37.0	54.5	37.0	38.0
25		50.5	36.5	38.0	50.5	38.0	39.0
26		57.5	30.0	30.0	57.0	31.5	31.5
27		58.0	25.5	25.5	58.0	27.0	27.0
28		61.0	28.0	28.0	61.5	29.0	29.0
29		62.0	29.5	29.5	62.0	31.0	31.0
30		65.0	33.0	33.0	62.0	31.0	31.0
	Time of Reading						
Oct. 1	10:00 A.M.	65.0	31.0	51.0	65.0	33.0	51.0
3	10:00 A.M.	66.0	36.0	48.5	66.0	37.0	48.0
6	"	63.0	30.5	47.0	63.5	32.0	46.0
9	"	66.0	31.5	50.0	66.0	33.0	49.0
12	"	65.5	35.0	50.5	66.0	36.0	50.0
17	"	66.5	26.5	40.5	67.0	28.5	40.0
22	"	42.5	21.0	33.5	43.0	22.0	34.0
29	11:00 A.M.	40.5	23.0	33.0	40.0	24.0	33.5
Nove.1	10:00 A.M.	42.0	28.5	32.5	40.5	33.5	34.0

RAINFALL RECORDS

for

TRINITY VALLEY FIELD STATION, B.C.

1 9 4 5

(April to November)

Date	Time	Rainfall in inches	Remarks
April 2	10:00 A.M.		Rain gauge set up. Sun shining.
16	10:30 A.M.	0.240	Fell since April 2. Not raining at time of reading.
30	10:30 A.M.	0.880	Fell since April 16. Not raining at time of reading.
	Total	1.120	
May 2	10:20 A.M.	0.000	No rain fell since April 30. Not raining at time of reading.
4	10:50 A.M.	0.000	No rain fell since May 2. Not raining at time of reading.
7	10:30 A.M.	0.000	As above.
9	10:15 A.M.	0.000	As above.
14	11:50 A.M.	0.670	Fell since May 9. Not raining at time of reading.
14-15	9 A.M.-9 A.M.	0.185	Showers fell bet. 12:15 and 7:00 P.M. of May 14.
15-16	"	0.060	Showers fell bet. 1:25 & 5:10 P.M. of May 15. Hail fell bet. 2:05 &2:10 P.M. of
16-17	"	0.380	Traces fell in P.M. of May 16. (May 15. Showers fell throughout A.M. of May 17.
17-18	"	0.455	Traces fell in AM. of May 17. Light showers fell in P.M. of May 17 until 8:00 PM. Heavy showers fell thereafter in P.M. of May 17 and A.M. of May 18.
18-19	"	0.005	Traces fell bet. 9:00 A.M. & 10:00 A.M. of May 18.
19-21	"	0.140	Fell mostly throughout May 20.
23-24	"	0.000	Traces fell bet. 3:25 & 3:45 P.M. of May 23.
24-25	"	0.020	Showers fell bet. 1:25 P.M. & 2:10 P.M. of May 24 accompanied by thunder & lightning.
25-26	"	0.165	Showers fell bet. 1:58 P.M. & 3:15 P.M. of May 25. Traces & light showers fell thereafter until 6:10 P.M. of May 25.
26-28	"	0.175	Fell mostly in P.M. of May 26.
	Total	2.255	

Rainfall Records)

Date	9 A.M. to 9 A.M.	Rainfall in inches	Remarks
June 1-2		0.175	Traces fell bet. 3:30 and 4:25 P.M. of June 1. Showers fell bet. 4:25 and 5:00 P.M. of June1& in early A.M. of June 2. Hail fell for about 1 minute at 4:25 P.M. of June 1.
2 - 4		0.260	Fell mostly in late P.M. of June 3 & early A.M. of June 4.
4 - 5		0.140	Showers fell bet. 2:35 and 5:15 P.M. & bet. 6:15 P.M. and 7:20 P.M. of June 4.
5 - 6		0.005	Traces & short light rains fell in P.M. (after 8:00 P.M.) of June 5.
6 - 7		0.000	Traces fell bet. 1:55 P.M. & 2:10 P.M. of June 6.
7 - 8		0.005	Traces fell in A.M. & early P.M. of June 7 & in early A.M. of June 8.
8 - 9		0.005	Traces fell at 6:30 P.M. of June 8 & throughout A.M. of June 9.
9 - 11		0.050	Fell mostly in P.M. of June 9.
11 - 12		0.120	Traces & intermittent light showers fell throughout period. Hail fell at 1:10 P.M. of June 11 for 5 min. at 2:15 P.M. of June 11 for 4 min. (pieces 1/4" diam.) & at 7:25 P.M. of June 11 for 6 min.
12 - 13		0.020	Traces & intermittent light showers fell bet. 9:00 A.M. and 5:50 P.M. of June 12.
13 - 14		0.000	Traces fell bet. 12:20 & 12:30 P.M., bet. 2:50 & 2:55 P.M. & bet. 4:00 & 5:45 P.M. of June 13.
15 - 16		0.000	Traces fell bet. 5:00 & 5:45 P.M. of June 15.
18 - 19		0.000	Traces fell bet. 5:25 & 6:00 P.M. of June 18.
19 - 20		0.030	Traces & light showers fell bet. 11:30 A.M. and 3:30 P.M. of June 19, and bet. 9:00 P.M. of June 19 and early A.M. of June 20.
20 - 21		0.000	Traces fell throughout afternoon of June 20.
21 - 22		0.010	Traces and light rains fell after 1:25 A.M. and throughout P.M. of June 21.
22 - 23		0.000	Traces fell bet. 9:30 & 10:00 A.M. of June 22.
25 - 26		0.010	Traces fell bet. 6:00 P.M. & 6:30 P.M. of June 25. Light showers fell bet. 7:00 & 9:00 A.M. of June 26.
26 - 27		0.020	Traces & light showers fell bet. 9 A.M. & 8 P.M. of June 26.
27 - 28		0.000	Traces fell throughout P.M. of June 27.
28 - 29		0.005	Traces & light rains fell bet. 12:50 & 1:10 P.M. of June 28 & bet. 4:25 & 5:10 P.M. of June 28.
29 - 30		0.055	Traces fell bet. 12:55 & 6:45 P.M. of June 29. Showers fell bet. 6:45 & 7:30 P.M. of June 29.
	Total	0.910	

Rainfall Records)

Date 9 A.M. to 9 A.M.	Rainfall in inches	Remarks
July 3 - 4	0.000	Traces fell bet. 6:00 & 8:00 P.M. of July 3
16 - 17	0.680	Traces fell in P.M. of July 16. Showers fell bet. 9:00 P.M. of July 16 and 9:00 A.M. of July 17.
17 - 18	0.035	Light showers fell bet. 9:00 & 10:30 A.M. July 17.
20 - 21	0.010	Traces & light showers fell bet. 4:00 P.M. and 10:00 P.M. of July 20.
24 - 25	0.640	Heavy showers fell in late P.M. of July 24 and early A.M. of July 25 accompanied by heavy thunder & lightning.
28 - 30	0.110	Showers fell in late P.M. of July 29 and in early A.M. of July 30.
30 - 31	0.010	Light rains fell bet. 9:00 & 11:30 A.M. of July 30, & bet. 5:00 & 7:00 P.M. of July 30.
Total	1.485	
Aug. 2 - 3	0.000	Traces fell at 3:15 P.M. of Aug. 2 and in early A.M. of Aug. 3 until 9:00 A.M.
3 - 4	0.025	Light showers fell bet. 9:00 A.M. & 12:00 (noon) of Aug. 3 and bet. 4:00 P.M. & 5:00 P.M. of Aug. 3
7 - 8	0.005	Light rain fell in early A.M. of Aug. 8.
17 - 18	0.000	Traces fell bet. 8:30 P.M. & 10:00 P.M. Aug. 17.
18 - 19	0.135	Showers fell throughout A.M. & P.M. of Aug. 18.
24 - 25	0.000	Trace fell at 8:40 P.M. of Aug. 24.
25 - 26	0.030	Traces fell bet. 9:15 & 9:25 A.M. of Aug. 25. Light showers fell bet. 9:25 & 10:10 A.M. of Aug. 25.
30 - 31	0.025	Traces fell in late P.M. of Aug. 25. Light shower fell bet. 11:50 A.M. & 1:15 P.M. of Aug. 30. Traces fell thereafter until 7:00 P.M. of Aug. 30.
Total	0.220	
Sept. 5 - 6	0.005	Traces fell bet. 2:05 & 2:10 P.M. of Sept. 5. Light rains & traces fell bet. 4:35 & 6:30 P.M. of Sept. 5.
7 - 8	0.115.	Light rains fell bet. 4:00 & 7:30 P.M. of Sept. 7.
8 - 10	0.045	Light rains fell in A.M. of Sept. 8 & early AM. of Sept. 10.
15 - 17	0.125	Fell throughout Sept. 15 & Sept. 16.
17 - 18	0.000	Traces fell bet. 6:30 & 9:00 P.M. of Sept. 17.
Fwd.	0.290	

Rainfall Records)

Date 9:A.M. to 9 A.M.		Rainfall in inches	Remarks
Sept.	Bgt.Fwd.	0.290	
	19 - 20	1.060	Continuous rain fell bet. 6:10 P.M. of Sept. 19 and 9:00 A.M. of Sept. 20.
	20 - 21	0.315	Continuous light rain fell bet. 9:00 A.M. of Sept. 20 and 10:00 P.M. of Sept. 20.
	21 - 22	0.085	Traces & light rains fell bet. 9:15 & 10:00 A.M., bet. 3:30 & 4:05 P.M. and bet. 7:15 & 9:30 P.M. of Sept. 21 and bet. 7:30 & 9:00 A.M. of Sept.22
	22 - 24	0.020	Fell throughout A.M. & P.M. of Sept. 22.
	24 - 25	0.000	Traces fell bet. 2:25 & 2:50 P.M. of Sept. 24.
	25 - 26	0.035	Showers fell bet. 7:20 & 7:50 P.M. of Sept. 25 and bet. 10:15 and 11:00 P.M. of Sept. 25.
	26 - Oct.1.	nil.	
	Total	1.805	
Oct. 3	10 A.M.	nil	10 A.M. Oct. 3, light shower just starting.
6	"	0.03	Fell Oct. 3.
9	"	nil	
12	"	nil	
17	"	nil	(incl. rain & snow)
22	"	1.25	1" fresh snow fell Oct. 21. 2¼" snow on ground-patchy. First snow on October 19.
29	11 A.M.	1.92	Incl. rain & snow 2 " fresh snow--3" snow on ground--patchy.
Nov. 1	10 A.M.	0.56	Fell prior to Nove. 1.
	Total	3.76	

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Summary of Rainfall Records
Trinity Valley Field Sta., B.C.

Month	1942		1943		1944		1945	
	No. days recorded	Total Precipitation	No.days recorded	Total Precipitation	No. days recorded	Total Precipitation	No.days recorded	Total Precipitation
April	21	0.915"	30	0.735"	30	1.650"	30	1.120"
May	31	5.110	31	1.815	31	2.160	31	2.255
June	30	4.675	30	1.815	30	1.785	30	0.910
July	31	6.625	31	1.035	31	1.270	31	1.485
Aug.	31	0.635	31	1.700	31	2.045	31	0.220
Sept.	30	0.895	30	1.030	30	3.700	30	1.805
Oct.	31	1.535	31	1.910	31	0.840	31	3.760
Totals		20.390"		10.040"		13.450"		11.555"

SUMMARY - WEATHER RECORDS - 1945

Trinity Valley Field Sta., B.C.

	April	May	June	July	Aug.	Sept.	Oct.	Nov.
No. of days recorded		31	30	31	31	30		
Max. temp. of month	58.5	84.0	83.5	93.5	92.0	82.5	66.5	
Min. temp. of month	19.0	27.0	32.5	36.0	30.0	25.5	21.0	
No. days 32°F or less		7	0	0	1	9		
No. days with snow		0	0	0	0	0		
No. days with hail		1	2	0	0	0		
No. days with rain.		13	23	8	8	13		
Total precipitation in inches	1.120*	2.255	0.910	1.485	0.220	1.805	3.760*	

* for full month

PUBLICATIONS

Hopping, Geo. R. - The lodgepole pine needle miner in the Canadian Rocky Mountain Parks (Lepidoptera, Gelechiidae). Proc. Ent. Soc. of B.C. 42:1-2. 1945.

_____ - A new subspecies of Monochamus notatus (Coleoptera: Cerambycidae). Proc. Ent. Soc. of B.C. 42:17-18. 1945.

Hopping, Geo. R. and W. G. Mathers. - Observations on outbreaks and control of the Mountain pine beetle in the lodgepole pine stands of Western Canada. Forestry Chronicle 21(2):98-108. 1945.

Leech, Hugh B. - On three species of Agabus recorded from the State of Montana (Coleoptera, Dytiscidae). Pan-Pacific Ent. 21(1): 16.1945.

_____ - The specific characters and distribution of Agabus vancouverensis and A. hypomelas (Coleoptera, Dytiscidae). Canad. Ent. 77(5):77-78.1945.

_____ - Three new species of Nearctic Neronectes (Coleoptera, Dytiscidae). Canad. Ent. 77(6):105-110, 4 figs. 1945.

_____ - Summary report of the Forest Insect Survey, British Columbia and Rocky Mountain National Parks. In:Ann. Rept. Forest Insect Survey, p. 62-70.1945.

_____ - (also 7 short research notes in the Proceedings of the Ent. Soc. Brit. Col., 42:2,8,18,26,28. 1945.

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Pacific 1945 Insect and Disease Species Index

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