ANNUAL REPORT OF THE OFFICER-IN-CHARGE, FOREST BIOLOGY LABORATORY, CALGARY, ALBERTA, FOR THE FISCAL YEAR ENDED MARCH 31, 1958

by

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CANADA DEPARTMENT OF AGRICULTURE
SCIENCE SERVICE
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ANNUAL SUMMARY STATEMENT
FOREST BIOLOGY LABORATORY
CALGARY, ALBERTA

Fiscal Year 1957-58

This report covers the activities of the Forest Biology Laboratory, Calgary, with the exception of Forest Pathology Projects. Activities and staff pertaining solely to Forest Pathology are covered in a separate report by Dr. G. P. Thomas, Officer-in-Charge of that section.

General Review of Projects

1. Forest Insect Survey

The spruce budworm outbreak along the Mackenzie River was surveyed from the air during the summer of 1957. The status appeared to be about the same as in 1956, although there was considerable shift in the intensity of attack as between one area and another.

Poplar defoliators caused the most conspicuous damage in Alberta. Besides the large aspen tortrix and Campsolechia niveopulvella Cham., Bruce spanworm, Operophtera bruceata (Hulst), was much in evidence suggesting that rather severe outbreaks might be expected in 1958.

Among special survey problems was the assessment of bark beetle damage in a mature stand of Engelmann spruce south of the Castlemount Ranger Station in the Crowsnest Forest Reserve. As a result of the findings, the logging procedure was changed from a diameter limit cut of 24 inches to a clear cutting programme. Other special techniques were the sequential sampling to assess lodgepole needle miner populations and the use of similar methods in the larch sawfly and tent caterpillar infestations.

A preliminary egg survey in the fall of 1957 indicated that the forest tent caterpillar could cause complete defoliation in parts of east-central Alberta in 1958. The population of the lodgepole needle miner is still low. The larch sawfly caused rather severe but scattered defoliation over northern Alberta between Lac La Biche and Smith extending as far north as the Peace River. Among the shelterbelt insects, the yellow-headed spruce sawfly and a Neodiprion caused considerable damage in the agricultural districts. Low temperatures and heavy rains during July and August reduced the spruce mite population and prevented serious injury. Other insects of the region caused only minor damage over restricted areas.

The number of survey collections received was 2,170 from 14 principal host trees. Provincial and federal government agencies and forest industries co-operated in making collections and assisting the forest biology rangers.

2. The Lodgepole Needle Miner

Life table work on the needle miner was continued and R. W. Stark presented a Ph.D. thesis on the population dynamics of this insect. Dr. Stark is continuing the investigation of one or two aspects of the biology of the needle miner which are still somewhat obscure. These are concerned with the adult and egg stages.

The study of the effects of needle miner defoliation on trees and stands culminated in two articles in Forest Science, one by J. A. Cook in conjunction with publications on similar studies by Mott and Nairn, and the other by Stark and Cook. J. A. Cook now has the sample data analyzed for a third paper dealing with the practical application of the damage studies in terms of loss to timber operators.

3. The Spruce Budworm

R. F. Shepherd prepared the final report on the spruce budworm project. Two articles have been submitted for publication, one based on his M.Sc. thesis covering the general ecology within outbreak and non-outbreak habitats and the other on larval temperatures under experimental conditions and under natural field conditions.

4. The Lodgepole Root Weevil

During the year when only needle miner larvae are present, the life table sampling is not so time consuming which leaves Dr. Stark some time for work on *Hylobius warreni* wood. Because of extensive investigations of this insect by Lyman Warren of the Winnipeg Laboratory, an effort has been made to avoid duplication of work. However, the situation in Alberta differs markedly from that in Manitoba particularly with respect to large infestations in lodgepole pine stands. Thus far, all adults associated with lodgepole pine and examined at the Calgary Laboratory have the short underwings and therefore should be *H. warreni*. Results very useful to the timber operators could be obtained from a study of survival and migration of larvae and adults under various cutting procedures and how the latter influence population trends. Such a study, of course would have to be closely related to the biology of the insect. The Northwest Pulp and Power Co. at Hinton, Alberta is willing to co-operate in the matter of experimental cuttings when proper techniques have been established.

5. The Mountain Pine Beetle - Biology

In the previous summary report on this project it was pointed out that the life history of the mountain pine beetle cannot be categorically stated because the factors governing brood development and activity can vary greatly from year to year. Some of the factors which cause this variation are cool weather periods between March and October, over-crowding, predators and parasites, low winter temperatures, and the moisture conditions in the micro-habitat beneath the bark. Most of these factors are inter-related but R. W. Reid's work is demonstrating the causes of population fluctuation in the mountain pine beetle more clearly every year. Two papers have been accepted for publication, one on the internal morphological changes in the female bark beetle associated with certain functions in the life cycle, and one on the behavior of the adults in the main gallery.

Dr. M. A. Khan has recognized 10 species of nematodes associated with the mountain pine beetle. Two of these, Sphaerularia hastata Khan and Aphelenchoides sp. are internal parasites of the beetle. The others occur in various parts of the bark beetle gallery system. Thus far, nematodes have not been important in control.

6. Mountain Pine Beetle - Population Studies

R. F. Shepherd started the population studies of the mountain pine beetle by analyzing the distribution of strikes on 60 entire trees. The data were set up on Remington Rand punch cards. The distribution of strikes did not conform to any of the more common distribution types. There was a tendency for strikes to be evenly distributed when considered within a small area e.g., a square foot, but in the whole tree there was a regular decrease from the base toward the top. There were significantly more strikes on the north aspect of the tree, and on the rougher bark types, but there was little relationship between intensity of attack and diameter within bark types. Explanations for the distributions found were sought by cutting logs with different characteristics and exposing them to attack in different ways. Each test was replicated in four different locations. These in conjunction with laboratory experiments to test the reaction of the beetles to different light intensities and temperature regimes have provided some plausible explanations for the distribution of strikes over the tree.

7. The Mountain Pine Beetle - Drought Studies

J. A. Cook is conducting artificially induced drought in lodgepole pine related to successful attack by the mountain pine beetle. Platforms covered with plastic are constructed about the base of each test tree to prevent precipitation from reaching the soil beneath. Soil moisture is measured at suitable intervals beneath each test tree as well as beneath 6

undisturbed check trees in the same locale. Trees were tested beforehand by placing a few beetles (conditioned for attack) on each tree in a small cage on the bark. Attacks occurred in each cage but were unsuccessful in all cases. These tests will be repeated as drought effects become more apparent. If successful attacks occur, moisture and growth relationships will be investigated in the test and check trees.

8. The Pine Needle Scale

A problem which arose out of the survey was the method of spread of the pine needle scale. The wingless female can move only very limited distances on the foliage. It was postulated that the spread over considerable distances could be by wind-borne nymphs. C. E. Brown used a fan and wind tunnel to find the distances nymphs could be carried by winds of various speeds. An infestation in the Crowsnest area surrounded by open country provided an excellent opportunity to find out what distances the nymphs were actually carried by wind under natural conditions. An article has been accepted for publication.

9. Adelgidae

Another problem arising out of the survey is the identification and study of biologies of the species of gall aphids infesting conifers in the Canadian Rocky Mountain Region. The most common species, which damages white spruce over extensive areas, is Adelges cooleyi (Gillette). Miss M. E. P. Cumming has studied the biology of this insect and has been able to provide new data on some parts of the complicated life cycle. A paper is being prepared for publication.

10. Larvae of the Geometridae

For the past several years Dr. W. C. McGuffin has been concentrating his efforts on a study of the immature stages of the Geometridae. This involves the morphology of larvae, relationships, distributions, and some phases of biology. Dr. McGuffin's recent study on larvae of the Larentiinae is now in press and will be issued as a supplement to the Canadian Entomologist.

11. G. R. Hopping has found a little time to do some work on bark beetles of the Rocky Mountain area. Currently he is working on the Pityophthorus in which several new species have been found. The specimens loaned by other Forest Biology Laboratories, the Systematics Unit, and the U.S. National Museums have been most valuable in determining species. Survey personnel and others have collected approximately 60 species of bark beetles from the Canadian Rocky Mountain Region.

12. Bioclimatology

Through the generosity of Yale University, a profitable arrangement has been in operation whereby Dr. W. R. Henson has been able to return to the Eisenhower Field Station during each of the past three summers to continue work on bioclimatology related to poplar insects. Several papers on this have already been published and one or more will be published in future.

Laboratory and Field Accommodation

1. Main Laboratory, Calgary

At last the Zoology Section has moved to the second floor of the Northern Electric Building (now government owned) thus consolidating the entire staff and facilities on the second and third floors. The administrative offices were consolidated on the third floor in August 1957, but the second floor renovations were not completed until after the start of the 1958 field season. The result is that many of the Zoology staff will not occupy the new quarters until the end of the field season in September or October. It will be a great relief to get out of the inadequate quarters in the Customs Building and to have reasonably good laboratory and library facilities.

2. Field Stations

No structures have been added to either the Kananaskis or Eisenhower Field Station, but at the former the trailer space has been improved by gravelling and a better entrance provided.

3. Forest Biology Ranger Accommodation

One new 30 ft. trailer was added to the fleet for survey work in the National Parks. The trailer previously used for this purpose was transferred to R. F. Shepherd for use on the mountain pine beetle project.

Two new Forest Biology Ranger cabins have been built, one at Peace River and one at Crimson Lake near Rocky Mountain House. This makes a total of three (the cabin at Entrance was built in 1949). The intention is to replace all survey trailers with permanent cabins. One or two of the best trailers can be converted to laboratory trailers for which there will be a great need a little later on. One or two can also be used advantageously to provide living quarters for Research Officers in conjunction with the laboratory trailers.

Staff and Functions

This section covers personnel in the Zoology Section and all others, such as clerical staff, who have functions pertaining to the Forest Biology Laboratory as a whole. The staff engaged strictly in pathology work is covered in Dr. Thomas' report on the Pathology Section.

Name, Classification	Functions, Projects
Hopping, G. R. R.O. (A) 4, 802SFB-1	Officer-in-Charge, Calgary Forest Biology Laboratory - Organization, administration, direction of projects. Special project - Bark Beetles of the Rocky Mountain Region.
Thomas, G. P. R.O. (A) 3, 802SFB-3	Officer-in-Charge, Forest Pathology Section - Administration, direction of forest pathology projects.
Stark, R. W. R.O. (A) 3, 802SFB-10	Lodgepole needle miner - Bionomics, population dynamics, defoliation studies. Hylobius of lodgepole pine.
Cook, J. A. R.O. (A) 2, 802SFB-12	Lodgepole needle miner. Damage to trees and stands (completed). Mountain pine beetle. Induced drought related to attack success by the beetle.
Reid, R. W. R.O. (A) 2, 802SFB-11	Mountain pine beetle - Biology and ecology.
Shepherd, R. F. R.O. (A) 2, 802SFB-13	Mountain pine beetle - Population dynamics.
McGuffin, W. C. R.O. (A) 3, 802SFB-2	Larvae of Geometridae - Morphology, food plants, distribution, classification, with emphasis on those associated with forest areas.
Brown, C. E. R.O. (A) 2, 802SFB-28	Head, Forest Insect Survey - Administration, organization, special projects.

Name, Classification	Functions, Projects
Cumming, M. E. P. R.O. (A) 1, 802SFB-29	Forest Insect Survey - Supervision insectary work. Determination of insect diseases. Special project - Adelgidae of Rocky Mountain Region.
Watt, A. T. R.O. (A) 3, 802SFB-8 Position occupied by Watt in 1958 as Student Assistant (Bioclimatology Section)	Bioclimatology related to Forest Insects of the Rocky Mountain Region. (Mr. Watt is presently in training at Sault Ste. Marie Lab.).
Robins, J. K. FBR (Supv.) 1, 802SFB-5	Chief FBR, Forest Insect and Disease Survey, Supervision of FBR staff, reconnaissance and special survey techniques.
Petty, J. FBR-1, 802SFB-40	Forest Insect and Disease Survey Crowsnest - Bow River District. Supervisory in National Parks and Clearwater District.
Stanley, R. R. FBR-2, 802SFB-14	Forest Insect and Disease Survey Brazeau-Athabasca District. Supervisory - Lac La Biche - Slave Lake - Peace River Districts.
Patterson, V. B. FBR-1, 802SFB-15	Forest Insect and Disease Survey Lac La Biche District.
LaRue, P. F. FBR-1, 802SFB-7	Forest Insect and Disease Survey Clearwater District.
Wilkinson, N. W. FBR-1, 802SFB-16	Forest Insect and Disease Survey National Parks District.
McNeil, J. H. FBR-1, 802SFB-44	Forest Insect and Disease Survey Peace River District.
Emond, F. J. FBR-1, 802SFB-45	Forest Insect and Disease Survey Grande Prairie District.
Smith, W. F. H. A.T.2, 802SFB-30 (Resigned, summer 1957)	Mountain pine beetle and lodgepole needle miner projects.
Thornton, E. F. FBR-2, 802SFB-14	Forest Insect and Disease Survey Peace River District (ceased Field Work in June because of illness).

Name, Classification	Functions, Projects
Watson, J. A. A.T.2, 802SFB-30 (vice W. F. H. Smith)	Mountain pine beetle and lodgepole needle miner projects.
Lemmon, W. J. A. A.T.2, 802SFB-18 (Promoted to F.B.A. Feb. 3/58)	Forest Insect and Disease Survey. Insectary work, compilation of records, preparation of specimens.
Kusch, D. S. A.T.3, 802SFB-9	Forest Insect and Disease Survey. Supervisory insectary work, reference collection, determination immature stages of survey material.
Debnam, P. S. A.T.3, 802SFB-24	Photography for Calgary Forest Biology Laboratory.
Malchow, D. G. Stud. Assist. 802SFB-36	Lodgepole needle miner project - Eisenhower Field Station.
Vanderwolf, C. H. Stud. Assist. 802SFB-26	Mountain pine beetle projects - Eisenhower Field Station.
Cameron, C. C. Stud. Assist. 802SFB-27	Mountain pine beetle projects - Eisenhower Field Station.
Madge, R. B. Stud. Assist. 802SFB-37	Forest Insect Survey - Kananaskis Field Station.
Popowich, J. W. Stud. Assist. 802SFB-20	Forest Insect Survey - Kananaskis Field Station.
Kerr, M. W. Clerk 3, 802SFB-17	Office Administration - Purchases, accounts, channelling of office work.
Gray, Miss M. H. Steno. 2, 802SFB-48	Chief stenographic functions - Forest Biology correspondence, memoranda, reports, manuscripts, mimeographs.
Gregory, Mrs. G. G. Steno. 2, 802SFB-19	Chief stenographic functions - Forest Pathology correspondence, memoranda, reports, manuscripts, mimeographs.
Gradwell, Miss O. Steno. 1, 802SFB-25	Correspondence, accounts, cost records, reports, mimeographs.

Name, Classification	Functions, Projects
Kiddle, Mrs. A. L. Cook - 802SFBX-Cas.	Eisenhower Field Station (23 weeks).
Baker, D. H. Casual labour	Kananaskis Field Station (8 weeks)
Saunders, J. W. Casual labour	Eisenhower Field Station (8 weeks)

Conferences

American Institute of Biological Sciences, Palo Alto, California.
Aug. 26-29, 1957

R. F. Shepherd (invitation paper)

Western Forest Insect Work Conference, Corvallis, Oregon.
Feb. 26-28, 1958

G. R. Hopping (Chairman, Committee on Reports and Publications)

Canadian Institute of Forestry, Toronto, Ontario.
Oct. 21-24, 1957

R. W. Stark (Chairman, Rocky Mountain Section)

Entomological Society of Canada, Lethbridge, Alberta
Oct. 29-31, 1957

G. R. Hopping (Director)
R. W. Stark
W. C. McGuffin
R. W. Reid
Miss M. Cumming
C. E. Brown
R. F. Shepherd

Publications and Reports

Publications

Brown, C.E. 1958. Dispersal of the pine needle scale, Phenacaspis pinifoliae (Fitch). (Diaspididae : Homoptera). Can. Ent. (in press).

_____. 1957. Margaret E. P. Cumming and J. K. Robins. Annual Report of the Forest Insect Survey (Rocky Mountain Region). In the Annual Report of the Forest Insect and Disease Survey, Forest Biology Division, Science Service, Dept. of Agriculture.

_____. 1957. Bruce spanworm, Operophtera bruceata (Hulst) in Alberta. Bi-Monthly Progress Report 13(2) March-April.

Henson, W.R. 1958. The effects of radiation on the habitat temperatures of some poplar inhabiting insects. Can. Journ. of Zoology 36(4) : 463-478. (Although not strictly a publication of the Calgary Laboratory, the whole background culminating in this and several other articles was established while Dr. Henson was working at the Calgary Laboratory).

McGuffin, W.C. 1957. Biological and descriptive notes on noctuid larvae. Can. Ent. 90(2) : 114-124.

_____. 1957. The larvae of Deilinea Hübner (Lepidoptera:Geometridae), with notes on other stages. Can. Ent. 90(4) : 216-223.

_____. 1958. Larvae of the Larentiinae (Lepidoptera:Geometridae). Supplement of Can. Ent. (in press).

Mott, D.G., L.D. Nairn, and J. A. Cook. 1957. Radial growth in forest trees and effects of insect defoliation. Forest Science 3(3) : 286-304.

Reid, R.W. 1957. The bark beetle complex associated with lodgepole pine slash in Alberta, Part IV, distribution, population densities and effects of several environmental factors. Can. Ent. 89(10) : 437-447.

_____. 1958. Nematodes associated with the mountain pine beetle. Bi-Monthly Progress Report 14(1) Jan-Feb.

_____. 1958. Internal changes in the female mountain pine beetle, Dendroctonus monticolae Hopk., associated with egg laying and flight. Can. Ent. (in press).

_____. 1958. The behavior of the mountain pine beetle, Dendroctonus monticolae Hopk., during mating, egg laying and gallery construction. Can. Ent. (in press).

Shepherd, R.F. 1958. Phytosociological and environmental characteristics of outbreak and non-outbreak areas of the two-year cycle spruce budworm, Choristoneura fumiferana (Clem.). Ecology (in press).

Shepherd, R.F. 1958. The internal temperatures of spruce budworm larvae. Can. Journ. Zool. (in press).

Stark, R.W. and J.A. Cook. 1957. The effect of defoliation by the lodgepole needle miner. Forest Science 3(4) : 376-396.

_____. 1958. Life tables for the lodgepole needle miner, Recurvaria starki Free. (Lepidoptera:Gelechiidae). Proc. Tenth Int. Congr. Ent. Aug. 1956. (in press).

_____. 1957. Pitch nodule maker in Banff National Park. Bi-Monthly Progress Report 13(4) July-Aug.

_____. 1957. New needle miner in Banff National Park. Bi-Monthly Progress Report 13(2) March-April.

Mimeographed Reports

Reid, R.W. 1958. General notes on the occurrence and damage of cone and seed insects in Alberta and the Rocky Mountain National Parks. Interim Report 1958-9. Calgary Forest Biology Laboratory.

Shepherd, R.F. 1958. Population studies of the mountain pine beetle. Interim Report 1957-1. Calgary Forest Biology Laboratory.

Stark, R.W. 1957. Population dynamics of the lodgepole needle miner, Recurvaria starki Free. (Lepidoptera:Gelechiidae) in Canadian Rocky Mountain Parks. Interim Report 1957-6. Calgary Forest Biology Laboratory. (Also presented as Ph.D. thesis, Dec. 1957).

FINANCIAL STATEMENT

	Allotment	Expenditure	Commitments	Free Balance
Travelling Expenses	15,900.00	15,568.55		331.45
Advances (Travel)				
Freight, Express & Cartage	400.00	619.14		219.14 Dr.
Postage	500.00	718.00		218.00 Dr.
Telephones & Telegrams	575.00	796.39		221.39 Dr.
Materials & Supplies	11,500.00	10,734.57		765.43
Repair & Upkeep of Bldgs. & Works	500.00	308.34		191.66
Rental of Land & Buildings				
Repair & Upkeep of Equipment	8,430.00	8,790.70		360.70 Dr.
Rental of Equipment	750.00	802.70		52.70 Dr.
U.I.C. Contributions	25.00	24.52		.48
Sundries	530.00	439.36		90.64
Sub-Total	39,110.00	38,802.27		307.73
Acquisition of Equipment	20,635.00	20,066.79		568.21
Acquisition of Bldgs. & Works	5,500.00	5,229.45		270.55
Wages	2,515.00	2,168.40		346.60