ANNUAL TECHNICAL REPORT 1951

FOREST BIOLOGY LABORATORY

WINNIPEG, MAN.

SUBJECT INDEX

MAPS

I INTRODUCTION

ANNUAL TECHNICAL REPORT

Introduction

Major activities during the year were (a) the continuation and expansion of the Forest Insect Survey, (b) the continuation and initiation of several projects on the larch sawfly and (c) the initiation of a co-operative project with the Unit of Forest Pathology on the relation between Hypomolyx piceus and butt rot of white spruce. A study of the biology of the large aspen tortrix was started as a project under the Forest Insect Survey. An important advance was that for the first time the Survey in Winnipeg undertook to screen diseased insect material in co-operation with the Laboratory of Insect Pathology at Sault Ste. Marie.

Owing to staff reductions effected in 1950-51, research projects and the Survey were carried on with a minimum of assistants. These undertakings are suffering from a lack of sufficient summer staff. There is a desperate need for seasonal assistants to maintain on an adequate basis work that has to be done and to develop research projects to their full potential.

Research in the field was conducted at the three main centres, Whiteshell Forest Reserve, Riding Mountain National Park, and Prince Albert. At the Whiteshell field station studies were conducted on natural immunity of the larch sawfly to the parasite Mesoleius aulicus, on the effect of soil moisture gradients on cocooning habits of the larch sawfly and on several physiological and nutritional problems of the larch sawfly and the jack-pine budworm. In Riding Mountain Park joint investigations with personnel from the Laboratory of Forest Pathology, Saskatoon, were conducted on Hypomolyx piceus and butt rot of white spruce. Population changes of the larch sawfly and growth and management of tamarack were studied at Prince Albert, Saskatchewan.

There were several important changes in the status of major forest insect pests. Severe epidemics of the forest tent caterpillar developed in northwestern Saskatchewan and southeastern Manitoba. An egg survey indicated that the area expected to be severely attacked in 1952 is likely to be much greater than in 1951, especially in Saskatchewan. Tamarack stands in central and eastern Saskatchewan and northwestern Manitoba continued to sustain heavy defoliation from the larch sawfly. Elsewhere in Manitoba severe infestations were more localized and scattered. In western Saskatchewan the larch sawfly has not yet built up to epidemic proportions. The jack-pine and spruce budworms were more widely distributed than they have been for several years. Severe infestations of the jack-pine budworm were confined to a few small areas in central and eastern Manitoba. Although nowhere are spruce budworm populations heavy enough to cause alarm, the fact that this insect was so widely distributed in 1951 points to the need for observing population changes very closely. The severe outbreak of the large aspen tortrix in northern Manitoba has decreased in intensity but increased in size.

Notable progress in the development of forest resources, management practices, and wood utilization may call for a revision in the approach to a number of forest insect problems. In Manitoba, the Sandilands Forest Reserve has been greatly enlarged and further extensions are planned. It is primarily a jack-pine area that is economically important because of its proximity to major markets. This has magnified the importance of the jack-pine budworm in this region. The Reserve is being managed more intensively and cutting practices have been in progress for several years to reduce the area covered by budworm-susceptible stands. Splendid opportunities are available here for more intensive practical research on efforts to achieve greater insect control by improved forest management.

Although progress has been slow, interest is growing in the possibility of utilizing more tamarack. Efforts have been made to promote a greater use of this species because of the danger of extensive tree mortality from larch sawfly defoliation.

In Saskatchewan new poplar plywood mills are being built in an effort to make some use of the tremendous volume of poplar in the Province. Some excellent mature stands earmarked for plywood are located in areas of rising tent caterpillar populations and it is possible that active salvage or control programs may be necessary within two or three years.

Another important development is a great increase in the construction of roads in productive forest areas and in recreational areas. These will enable the Forest Insect Survey to provide more thorough coverage. In recreational areas it is probable that local demands will arise for the control of such insects as the forest tent caterpillar and jack-pine budworm to protect tourist and summer home properties.

Laboratory facilities were expanded and the immediate program to provide field accommodation for Biology Rangers was completed. A new office-insectary was built at Winnipeg to provide badly needed space. The new building provides year-round accommodation for the F rest Insect Survey Laboratory staff. It contains a central office, spacious insectaries on the main floor and a workshop in the basement. A house trailer was purchased as an accommodation unit for the Ranger assigned to the Hudson Bay District, Saskatchewan. This unit completes the program drawn up a few years ago to provide essential seasonal accommodation for Rangers.

II STAFF

II STAFF

ARSENAULT, KATHLEEN A.	AGR-SSE-3297, Stenographer, Grade 2A (Jan. 4, 1952 to March 31, 1952) Vice C. Luetchford
AUDETTE, C.P.	AGR-SSE-3322 - Student Assistant (July 17 to September 13, 1951)
CAMPBELL, A.E.	AGR-SSE-3621 - Forest Biology Ranger, Grade 1 Continuous
DESROSIERS, R.A.J.	AGR-SSE-3611 - Clerk, Grade 1 Continuous
DROUIN, J.A.	AGR-SSE-3255, Forest Biology Ranger, Grade 2 Continuous
FELL, W.H.	AGR-SSE-3322, Technical Officer, Grade 1 (Educational leave April 1 to May 14, 1951) On duty May 15 to June 19, 1951
GIBSON, C.	AGR-SSE-3694, Caretaker, part time, Grade 1 Continuous
GROVES, D.E.	AGR-SSE-3680 - Student Assistant May 2 to September 22, 1951
HERON, R.J.	AGR-SSE-3308 - Agricultural Research Officer, Grade 2 Continuous
HILDAHL, V.	AGR-SSE-3177, Forest Biology Ranger, Grade 3 Continuous
IVES, W.G.H.	AGR-SSE-3680 - Technical Officer, Grade 1 (On duty May 18 to September 17, 1951) On educational leave September 18, 1951 to March 31, 1952.
LALOR, G.T.	AGR-SSE-3257 - Forest Biology Ranger Grade 1 Continuous

LAWRENCE, J.J.	AGR-SSE-3434 - Forest Biology Ranger, Grade 1 Continuous
LEJEUNE, R.R.	AGR-SSE-283 - Agricultural Research Officer Grade 5 Continuous
LISCOMBE, E.A.R.	AGR-SSE-3461 - Technical Officer, Grade 1 On Educational Leave, April 1 to June 30, 1951. Resigned.
LUETCHFORD, CLARE O.	AGR-SSE-3297 - Stenographer Grade 2A April 1 to December 31, 1951
MACHACEK, ELIZABETH A.	Extra labour, May 15 to September 15, 1951
McDOWALL, L.L.	AGR-SSE-3256, Forest Biology Ranger, Grade 2 Continuous
McKINNON, H.A.	AGR-SSE-3679, Technical Officer, Grade 1 To June 30, 1951 Technical Officer Grade 2, July 1, 1951 Continuous
McLEOD, B.B.	AGR-SSE-3258, Forest Biology Ranger, Grade 1 Continuous
MARTIN, J.B.	AGR-SSE-3176, Forest Biology Ranger, Grade 1 Continuous
MELVIN, J.C.E.	AGR-SSE-3522, Assistant Technician, Grade 2, Continuous
MULDREW, J.A.	AGR-SSE-3372, Technical Officer, Grade 2, Continuous
PRATT, M.R.H.	AGR-SSE-3622, Forest Biology Ranger, Grade 1 Continuous

PRENTICE, R.M.	AGR-SSE-254, Technical Officer, Grade 1 from April 1 to June 30, 1951; Technical Officer Grade 2 July 1, 1951. On duty April 1 to September 22, 1951. On Educational Leave September 23, 1951 to March 31, 1952.
SMITH, J.D.	AGR-SSE-3167, Technical Officer, Grade 1 On duty April 1 to September 30, 1951. Resigned.
TURNOCK, W.J.	AGR-SSE-3320, Technical Officer, Grade 2, April 1, 1951 to February 29, 1952; Agricultural Research Officer Grade 2, March 1, 1952. Continuous
STEEL, RUTH E.	AGR-SSE-3147, Stenographer Grade 2A Continuous
WARREN, G.L.	AGR-SSE-3679, Technical Officer, Grade 1 On duty May 5, 1951 to March 31, 1952
WONG, H.R.	AGR-SSE-3321, Agricultural Research Officer, Grade 2 Continuous

III FOREST INSECT SURVEY

A. Reports of rangers.

1. Southern and Interlake Districts of Manitoba - 1951

by

L. L. McDowall

(a) Introduction

The following report outlines the activities of forest insect ranger L. L. McDowall during the summer season of 1951, in the Southern and Interlake districts of Manitoba.

From May 17 to May 26 insect survey field work was conducted in the Sandilands Forest Reserve. Jack-pine and spruce budworm, along with the forest tent caterpillar, were the major insects under surveillance at that time. One small collection of the forest tent caterpillar was made near Reserve Headquarters but no visible defoliation was recorded. From May 28 to June 2, a spruce budworm survey was carried out in the Spruce Woods Forest Reserve. Very little defoliation was noted at that time and many budworm larvae were still inside the buds. American poplar beetle larvae were found in several localities but in all instances only light to moderate defoliation had occurred.

During the period June 5 to June 9 spruce stands in the Interlake District were examined for the prevalence of spruce budworm and although this insect was found to be widely distributed no serious damage was encountered. From June 11 to June 30 a survey and observations were carried out in the Southern District; mainly at Moose Lake, Sprague, Whitemouth Lake, Piney, and in the Sandilands Forest Reserve. One day, June 19, was spent in an aerial survey of poplar stands in the vicinity of Moose Lake. Several small collections of the jack-pine budworm were made but feeding damage was recorded as very light. A preliminary larch sawfly survey was also conducted during this time. Populations of the yellow-headed and green-headed spruce sawfly were found to be relatively light in all areas where collected.

Six days, July 2 to July 8, were spent in the Spruce Woods Forest Reserve, concentrating mainly on making spruce budworm population counts. A jack-pine budworm survey north of Arborg was conducted during the period

July 9 to July 15. Jack-pine budworm population counts were made in this area along with a preliminary larch sawfly survey in tamarack stands throughout the Interlake District. A general insect survey was carried out in the Southern District during the last two weeks of July.

A survey of larch sawfly and grey willow leaf beetle damage in the Interlake District was conducted from July 30 to August 4. Areas worked during the period August 6 to August 18 were as follows: Sprague, South Junction, Whitemouth Lake, Piney, and Sandilands Forest Reserve, all in the Southern District. Tamarack swamps were examined and defoliation tabulated. Jack-pine budworm and scale damage in the Sandilands Forest Reserve was also mapped. Six days, August 20 to August 25, were spent making mass collections of larch sawfly cocoons and mapping current jack-pine budworm defoliation in the Interlake District. From August 27 to September 29 insect survey work was confined to the Southern District. This work was as follows: a one day aerial survey of tamarack stands north and west of Moose Lake; mass collections of larch sawfly cocoons; recording defoliation of tagged trees in all permanent tamarack plots; establishing permanent sample plots in poplar stands infested with the forest tent caterpillar; and conducting a forest tent caterpillar egg survey in the infested and non-infested areas. A two day trip to southern Manitoba was made on November 7 and 8 for the purpose of completing the forest tent caterpillar egg survey. This brought to a close field activities in the Southern and Interlake districts of Manitoba for 1951.

(b) Insect Conditions

(i) Larch sawfly, Pristiphora erichsonii (Htg.). This insect continued to defoliate tamarack stands in the Southern and Interlake districts of Manitoba during 1951. In south-eastern Manitoba, light to moderate defoliation was recorded from Middlebro, at the United States boundary, west to Sprague and South Junction. North of Sprague in the Moose Lake area located in tp. 4, rge. 16, E.P. mer., heavy defoliation was observed. From Moose Lake west to White-mouth Lake moderate to heavy defoliation occurred. Tamarack stands south of Whitemouth Lake to Vassar showed only light defoliation. The most severe defoliation in this area occurred in a large tamarack and black spruce swamp, located in sec. 15, tp. 1, rge. 13, E.P. mer., one quarter of a mile northwest of South Junction. Defoliation here ranged from 85 to 95 per cent. Moderate to heavy defoliation was recorded in a large swamp in the vicinity of Wampum. A small percentage of trees with dead or dying tops was noted. Swamps from Vassar west to Piney and Menisino suffered light to moderate defoliation. North of Piney to Badger, Garrick, and Woodridge, sawfly populations appeared very light and no serious defoliation was encountered. In the southern part of the Sandilands Forest Reserve defoliation was recorded as light. No lessening of defoliation was noted in tamarack swamps along the road between the Forest Reserve Headquarters and the town of Marchand, where moderate to severe damage occurred in 1950. Sawfly populations remained about the same as in 1950 in the northern part of the Sandilands Forest Reserve. Light to moderate defoliation still prevailed from Dawson Cabin to the west boundary of the Reserve. From Dawson Cabin northeast to Hadashville moderate to severe defoliation was recorded in all swamps examined. Light to moderate defoliation occurred in tamarack swamps east of Hadashville to McMunn and East Braintree. East of East Braintree along the G.W.W.D. Railroad to Waugh moderate to severe defoliation was recorded in the numerous scattered swamps. Tamarack swamps between East Braintree and Falcon Lake, where moderate to heavy defoliation occurred, showed a small percentage of tree mortality.

This larch feeding insect, although widely distributed throughout the Interlake District, caused severe damage in only one area. This heavily defoliated area was located approximately two miles north of Riverton in sec. 29, tp. 23, rge. 4, E.P. mer. Severe defoliation was recorded also in this area in 1950. A number of trees with dead and partially dead tops were scattered throughout the infested stand. Light to moderate defoliation occurred in the area north of Riverton to Sugar Creek along the east side of Washow Bay. Tamarack in this area is very scattered and most of it is located on private land. West of Riverton to Arborg defoliation was recorded as light. Excepting one area, located in sec. 35, tp. 23, rge. 2, E.P. mer., where moderate defoliation was seen, only light defoliation was recorded from Arborg north to Rosenburg. Light defoliation was recorded in scattered tamarack stands between Broadvalley in the south to Hodgson and Red Rose in the north. In the vicinity of Ashern and north to Moosehorn sawfly populations appeared very light and little or no defoliation prevailed. Light defoliation was recorded from Moosehorn north to Spearhill, Grahamdale, Faiford, and Gypsumville. One area of light to moderate defoliation was encountered northeast to Gypsumville. This area, located in sec. 25, tp. 32, rge. 9, W.P. mer., (parasite release area) showed no increase in defoliation over 1950.

(ii) Jack-pine budworm, *Choristoneura* sp. Populations of the jack-pine budworm continued to decline in 1951 in the southern part of the Province, whereas near Rosenburg, in the Interlake District, a marked increase in larval activity was noted. A special survey of current jack-pine budworm defoliation was conducted at Rosenburg and in the Sandilands Forest Reserve, where damage was mapped showing the varying degrees of defoliation. In the Southern District two small areas of light defoliation occurred, both in the Sandilands Forest Reserve. The first was located in sec. 27, tp. 6, rge. 10, E.P. mer., and the second in sec.30, tp. 7, rge. 11, E.P. mer., south of Dawson Cabin. Elsewhere throughout the Sandilands Forest Reserve no defoliation was observed. Slight traces of jack-pine budworm feeding were found at Menisino, Piney, and South Junction, all in the Southern District. The most severe damage caused by this insect occurred in jack-pine stands in tp. 24 and 25, rge. 2, E.P. mer., near Rosenburg in the Interlake District. The heaviest defoliation in this area was observed on jack-pine regeneration. Some trees suffered as much as ninety per cent defoliation. In the larger tree sizes a small percentage of dead or dying tops was recorded. A more detailed report on this infestation will be found under "Special Investigations". No larvae of the jack-pine budworm were collected from areas south of Gypsumville, where collections had been made in previous years. Jack-pine budworm counts from 18" twigs were made in the infested stands at Rosenburg.

(iii) Spruce budworm, *Choristoneura fumiferana* (Clem.). The infestation of spruce budworm in the Spruce Woods Forest Reserve continued to flourish in 1951. Although this insect has shown a gradual decline of late a few islands of heavy defoliation still remain. These areas of severe damage occurred in secs. 17 and 23, tp. 9, rge. 13, W.P. mer., in the east block of the Spruce Woods Forest Reserve. In the west block of the Reserve, the spruce needleworm, *Dioryctria reniculella* (Grt.), appeared to be as numerous as the spruce budworm and may have caused most of the observed damage. In the Spruce Woods Forest Reserve, one collection of budworm was made also from a pure jack-pine plantation. Trees in the plantation ranged from 1 to 2 inches d.b.h., and 5 to 10 feet in height.

One collection of the spruce budworm was made from balsam in sec. 13, tp. 3, rge. 16, E.P. mer., near Moose Lake. No defoliation was recorded from this area. Another collection containing two larvae was made from spruce in the vicinity of South Junction.

Although this insect was found to be quite widespread throughout the Interlake District little or no feeding damage was detected. Collections of from one to nine larvae were obtained from standard five tree samples at the following places: Arborg, Camper, Moosehorn, Spearhill, Fairford, Hodgson, Davis Point, and Gypsumville.

(iv) Spruce needleworm, *Dioryctria reniculella* (Grt.). The only appreciable damage caused by this insect was recorded in the Spruce Woods Forest Reserve. However, since this insect is closely associated with spruce budworm in both population density and feeding habits, it is difficult to differentiate between the two when making damage estimates. One collection of the spruce needleworm was made near Riverton in the Interlake District.

(v) Yellow-headed spruce sawfly, *Pikonema alaskensis* (Roh.). Larvae of this species were commonly found throughout the Southern and Interlake districts of Manitoba in 1951. The largest populations were recorded in the Sandilands Forest Reserve, where defoliation was light. In the Spruce Woods Forest Reserve populations appeared very light. Collections of this insect were made at Camper, Gypsumville, Ashern, and Riverton. Feeding occurred for the most part on open-growing isolated trees. Light feeding damage, to a small ornamental stand, was noted in the vicinity of Sprague.

(vi) Green-headed spruce sawfly, *Pikonema dimmockii* (Cress.). This species, although found to be quite widespread throughout the Southern and Interlake districts was causing very little damage in areas where collected.

(vii) Balsam-fir sawfly, Neodiprion abietis (Harr.). Populations of this insect appeared much lighter in the Southern and Interlake districts in 1951. One small collection was made at Sprague in the Southern District with no defoliation being recorded. Collections were made from the following places in the Interlake District: Gypsumville, Moosehorn, Ashern, and Riverton. Defoliation in all instances was recorded as light.

(viii) Grey willow leaf beetle, Galerucella decora (Say.). The most severe damage recorded by this insect occurred in the Interlake District. Large areas of willow from St. Laurent north to Eriksdale, Camper, Ashern, Moosehorn, and Gypsumville suffered very heavy damage. From Eriksdale east to Poplarfield and north to Hodgson moderate to severe damage was observed. Light to moderate skeletonizing of willow took place in areas around Arborg and Riverton.

Last year's severe infestation in the southeast corner of the Province subsided somewhat in 1951. From Middlebro west to Sprague light skeletonizing occurred. Moderate damage was recorded west of Sprague to South Junction and Vassar. Adult beetles were frequently collected from white poplar during the season.

(ix) American poplar beetle, Phytodecta americana Schffr. This insect was found in both the Interlake and Southern Districts of Manitoba during 1951. Populations of this species were much heavier in the Spruce Woods Forest Reserve than in any other area. Defoliation to poplar in the Spruce Woods Forest Reserve ranged from light to moderate and attacks were concentrated on young open-growing stands in the west block of the Reserve. In the Interlake District where collections were very scattered, defoliation was recorded as light and only the smaller trees were affected.

(x) Ugly-nest caterpillar, Archips cerasivorana (Fitch.). Nests of this insect were less conspicuous in the southern part of Manitoba in 1951 than in previous years. Scattered collections were made throughout the Sandilands and Spruce Woods Forest reserves. A small number of collections were made in the Interlake District, but no heavy co centrations were encountered.

(xi) A tent caterpillar, Malacosoma lutescens (N. & D.). The heaviest concentrations of this insect occurred in the Spruce Woods Forest Reserve in southern Manitoba. Larvae were found feeding mainly on choke cherry. As many as 25 nests could be counted within one mile. No appreciable damage was encountered in the Interlake District and the collections made were widely scattered.

(xii) A pine-scale, Toumeyella sp. This pine scale continued to attack jack-pine stands in the southern portion of the Sandilands Forest Reserve. A more widespread distribution of this insect occurred throughout the Reserve than in 1950. The heavy infestation in secs. 17 and 20, tp. 5, rge. 10, E.P. mer., continued to flourish. Several collections were made in the northern part of the Reserve but no serious damage was encountered. Elsewhere throughout the Southern District only light damage was noted. Damage by this insect, where it occurred, appe red very light in the Interlake District.

(xiii) Pitch nodule maker, Petrova albicapitana (Busck.). Several light infestations of this insect occurred in the Sandilands Forest Reserve. Areas affected were quite small and in all instances only jack-pine regeneration was suffering nodule damage. Elsewhere throughout the Southern and Interlake districts small collections were made at widely scattered po nts.

(xiv) Birch tube-maker, Acrobasis betulella (Hlst.). Collections of this species were made in both the Southern and Interlake districts in 1951. Defoliation was recorded as light at the following places: South Junction, Vassar, Sandilands Forest Reserve, in the Southern District, and Moosehorn in the Interlake District.

(xv) Large aspen tortrix, Archips conflictana (Wlk.). Several small collections of this insect were made in the Southern and Interlake districts, but in all instances only one or two arvae were found and no defoliation was recorded.

(xvi) Cedar sawfly, Monoctenus juniperinus (MacD.). Collections of this insect were made from cedar at the following places in the Southern District: Moose Lake, Sprague, South Junction, and Sandilands Forest Reserve. Populations were light and little or no defoliation occurred in areas examined. One collection was made from juniper in the Rosenburg a ea.

(xvii) Eastern tent caterpillar, Malacosoma americanum (F.). One collection of this insect, found on choke cherry in the Sandilands Forest Reserve, was the only one recorded throughout the Southern and Interlake Districts in 1951.

(xviii) White-pine weevil, Pissodes strobi (Peck.). Scattered collections of this insect were made from white spruce and jack pine in the Southern and Interlake districts. Very little damage was noted and only one or two trees were affected in each area examined.

(xix) Pine shoot moth, poss. Eucosma sonomana Kft. This newly recorded species found last year in the northern part of the Sandilands Forest Reserve was again present in 1951. Increased activity by this insect was noted although the boundaries of the out-break remained stable. An estimated forty per-cent of the young jack-pine leaders in the infestation area were damaged by this insect. At present the infestation covers about three acres, and is located in sec. 28, tp. 6, Rge. 10, E.P. mer.

(xx) Black-headed budworm, Acleris variana (Fern.). Small, scattered collections of this insect were made in the vicinity of Riverton and in the Spruce Woods Forest Reserve. Populations were light and no defoliation was recorded.

(xxi) Spruce pineapple gall aphid, Adelges abietis (Harr.). No serious damage by this species was recorded in either the Southern or Interlake districts in 1951. A small number of collections were made in the Spruce Woods and Sandilands Forest reserves.

(xxii) Cone worm, Polychrosis sp. Scattered collections of this insect were made from spruce stands throughout the Southern and Interlake districts, but in all areas where collected populations were light.

(xxiii) Aspen blotch miner, Lithocolletis tremuloidiella (Braun.) Very little damage by this insect was recorded in poplar stands in the Southern and Interlake districts during 1951.

(xxiv) Forest tent caterpillar, *Malacosoma disstria* Hbn. Large stands of poplar in the area around Moose Lake and north to the Northwest Angle on the Ontario-Manitoba boundary suffered partial and complete defoliation by the forest tent caterpillar in 1951. Larvae of this insect were found from Moose Lake south to Sprague but were causing less defoliation in the extreme south. Several "islands" of severe defoliation were observed in tp. 3, rges. 15 and 16, E.P. mer., between Moose Lake and Whitemouth Lake. From Whitemouth Lake south to Vassar and west to Piney poplar stands were only lightly infested. Severe defoliation of birch was also noted in the vicinity of Moose Lake. One collection of eighteen larvae, all from one tree, was made in sec. 35, tp. 5, rge. 8, E.P. mer., in the Sandilands Forest Reserve. At the time of collecting, May 22, no defoliation was observed.

Later on in the season a forest tent caterpillar egg survey was made in southern Manitoba. All available poplar stands were examined at five-mile intervals, for forest tent caterpillar egg bands. A complete report regarding air survey of heavily infested areas north of Moose Lake will be found under "Special Investigations".

(c) Special Investigations

(i) Aerial reconnaissance of tamarack in southeastern Manitoba. A one day aerial survey of tamarack stands in the southeastern part of Manitoba was conducted on August 28. This survey revealed that tamarack in several areas had suffered severe defoliation by the larch sawfly. North of Moose Lake in tp. 4, rge. 16, E.P. mer., heavy defoliation was recorded. From Moose Lake west to Whitemouth Lake in tp. 3, rges. 15, and 16, E.P. mer., moderate to heavy defoliation occurred. North of Whitemouth Lake along the Whitemouth River, as far north as St. Labre Creek, moderate to severe defoliation was noted. The areas of severe defoliation were recorded in tp. 5, rge. 14, E.P. mer., and tp. 6, rge. 13, E.P. mer.

A high percentage of tree mortality to tamarack was noted in mixed stands of black spruce and tamarack in the area west of Moose Lake to Whitemouth Lake and north to tp. 6, E.P. mer. Ground checks were not possible in these localities but it is thought that the larch sawfly attack may be one of the contributing factors in this widespread tree mortality.

(ii) Larch sawfly cocoon collections. During the months of August and September, a number of mass collections of larch sawfly cocoons were made in the So thern and Interlake districts of Manitoba. The cocoons from each area were stored between layers of damp moss in separate containers. The cocoons were placed in cold storage for rearing and dissecting purposes during the winter to determine the presence of parasites.

The exact location and number of cocoons contained in each collection are shown in the following table:

Mass Cocoon Collections

Date	Place	Sec.	Tp.	Rge.	Mer.	Number of Cocoons
Sept. 18	Sprague	8	1	14	E.P.	250
Sept. 18	Piney	3	2	11	E.P.	250
Sept. 15	Sandilands F.R.	31	7	11	E.P.	250
Aug. 31	Sandilands F.R.	5	8	10	E.P.	250
Sept. 14	Sandilands F.R.	34	5	9	E.P.	250
Aug. 29	East Braintree	33	7	14	E.P.	250
Aug. 29	Falcon Lake	9	18	16	E.P.	250
Aug. 25	Riverton	32	23	4	E.P.	250
Aug. 23	Gypsumville	25	32	9	W.P.	250

(iii) Forest tent caterpillar infestation. An aerial survey of the infested area in the southeastern part of Manitoba was conducted and the area mapped on June 19.

Large stands of poplar, the preferred host, s ffered partial and complete defoliation. Ground checks, made in the vicinity of Moose Lake, revealed that birch also was subjected to heavy attack. Other hosts attacked in order of their preference were as follows: alder, choke cherry, saskatoon, pin cherry, dogwood, balsam, poplar, and white spruce.

Larvae were found feeding on the young new growth of spruce, but to a much lesser degree than on deciduous trees. Pupation was in progress at this time and a large number of pupae were observed in the grass and on small undergrowth.

The infested area covered approximately three townships in southeastern Manitoba. Starting at the Northwest Angle on the Manitoba-Ontario boundary it gradually fanned out in a southwesterly direction, extending south of Moose Lake three to four miles. Townships 3, 4, and 5, rge. 17, E.P. mer., were affected by this widespread defoliation. The most westerly point mapped was in the vicinity of Twin Lakes located between Moose Lake and Whitemouth Lake.

Three separate "islands" of poplar in 3 and 4, rge. 15 and 16, surrounding Twin Lakes were completely defoliated. Partial defoliation of poplar was observed only along the lake shores.

(iv) Jack-pine budworm surveys. During August, a special survey of current jack-pine budworm defoliation was conducted throughout the Sandilands Forest Reserve. The survey also covered the areas that will be incorporated in the Reserve in the near future. Only two very small areas of defoliation were recorded. These occurred in the northern part of the Sandilands Forest Reserve and defoliation in both instances ranged from nil to light. The first was located in sec. 27, tp. 6, rge. 10, E.P. mer., and the second in sec. 30, tp. 7, rge. 11, E.P. mer. A complete map of the area surveyed was made, showing locations of jack-pine budworm collections and defoliation. Areas of jack-pine that were infested by the jack-pine scale were also mapped.

During the latter part of August a survey of jack-pine budworm defoliation was conducted in the Rosenburg district. As in previous surveys, defoliation was recorded at half-mile intervals, in each of three diameter classes: 5 inches and under; 5 inches to 10 inches; and over 10 inches. The largest number of trees fell in the 0 to 5 inch class, followed next by the 5 inch to 10 inch with very few in the 10 inch and over class. The most severe defoliation was recorded in the vicinity of the fire tower and covered approximately 6 sections. Feeding damage was found to be much more severe on jack-pine regeneration in this area with defoliation ranging up to 90 per cent. In the larger trees a small percentage of dead tops was recorded but throughout the survey no tree mortality was noted. Jack-pine in this area is between 40 and 50 years of age and of light to medium density. Rock outcropping is present through most of the area. A map of the infested area was prepared showing the varying degrees of defoliation.

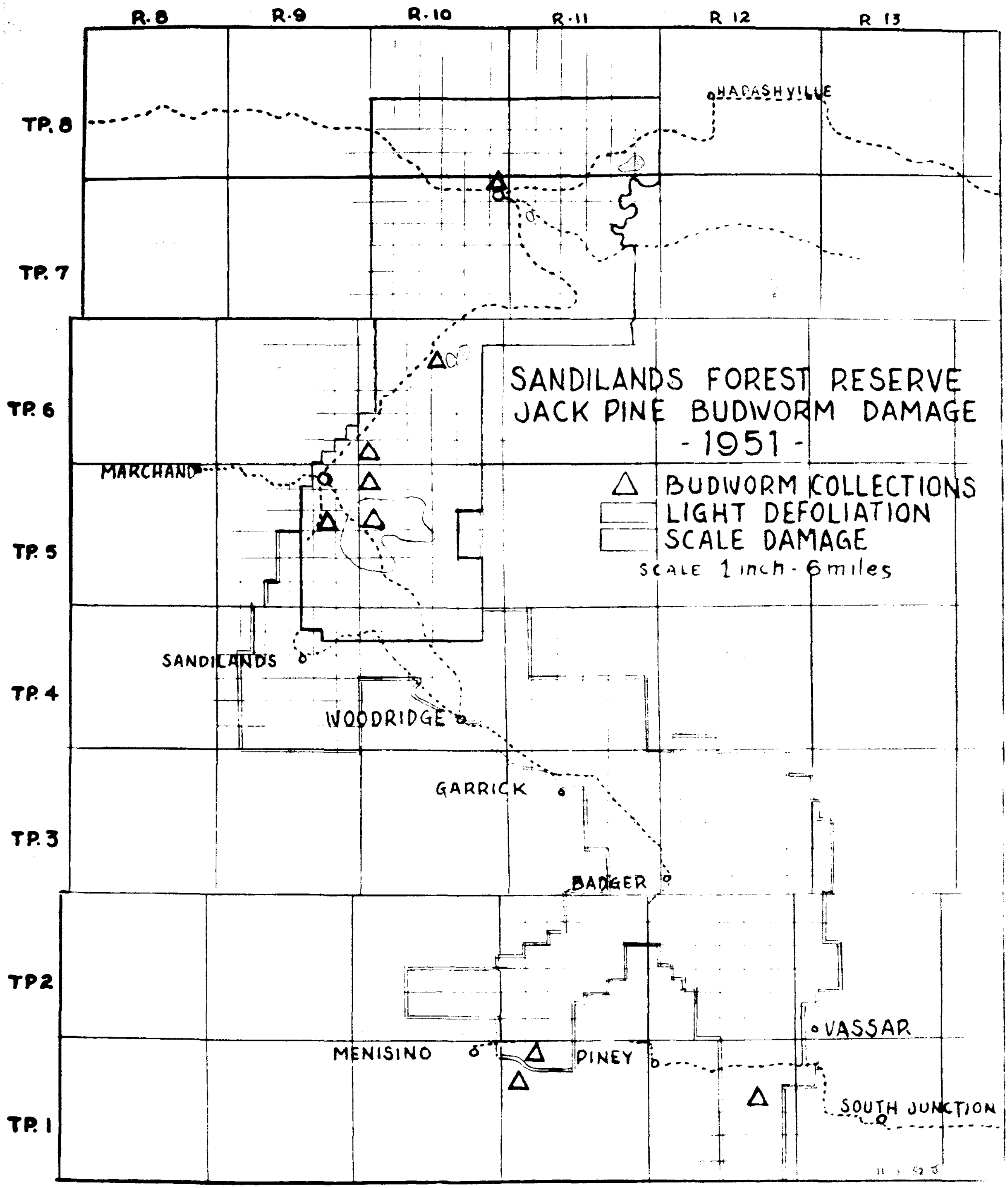
TABLE "A"

Jack-pine Budworm Damage Rosenburg - 1951.

Location	Defoliation per Diameter Class			% Dead tops per Diameter Class			No. of Dead Trees	Stam.	Est. Av. of d.b.h.	Remarks
	0"-5"	5"-10"	10"+	0"-5"	5"-10"	10"+				
SE-16-25-2	mod.	light	---	nil	nil	---	nil	---	4"	(fairly good stand, density medium,
SW-16-25-2	mod.	light	---	nil	nil	---	nil	---	4"	(heavy rock outcrop.
SE-20-25-2	light	light	---	nil	nil	---	nil	---	3"	(poplar & jack pine patchy.
NW-35-24-2	heavy	---	---	nil	---	---	nil	---	2½"	jack pine scattered boulders present.
SW-35-24-2	heavy	---	---	nil	---	---	nil	---	2"	some light poplar.
SW-26-24-2	light	---	---	nil	---	---	nil	---	2"	poplar & jack pine mixed.
NW-23-24-2	light	light	---	1%	nil	---	nil	---	3"	very few trees in 5"-10" class.
SE-23-24-2	mod.	light	---	nil	nil	---	nil	---	3"	jack pine & poplar mixed.
SE-26-24-2	mod.	mod.	---	nil	2%	---	nil	---	4"	(jack pine very scattered, (small spruce scattered
NW-25-24-2	heavy	mod.	---	1%	1%	---	nil	---	4"	(throughout.
SE-35-24-2	heavy	heavy	---	1%	1%	---	nil	---	4"	jack pine & poplar heavy rock outcrop.
NE-12-25-2	light	---	---	nil	---	---	nil	---	2"	jack pine small and very branchy.
SE-13-25-2	light	---	---	nil	---	---	nil	---	2"	majority poplar in this area
NE-13-25-2	light	---	---	nil	---	---	nil	---	2"	some light regeneration here
SE-24-25-2	very light	---	---	nil	---	---	nil	---	2"	scattered jack pine, large open meadows.
SW-24-25-2	light	light	---	nil	nil	---	nil	---	4"	scattered jack pine.
SW-23-25-2	light	light	---	nil	nil	---	nil	---	4"	poplar & jack pine mixed.

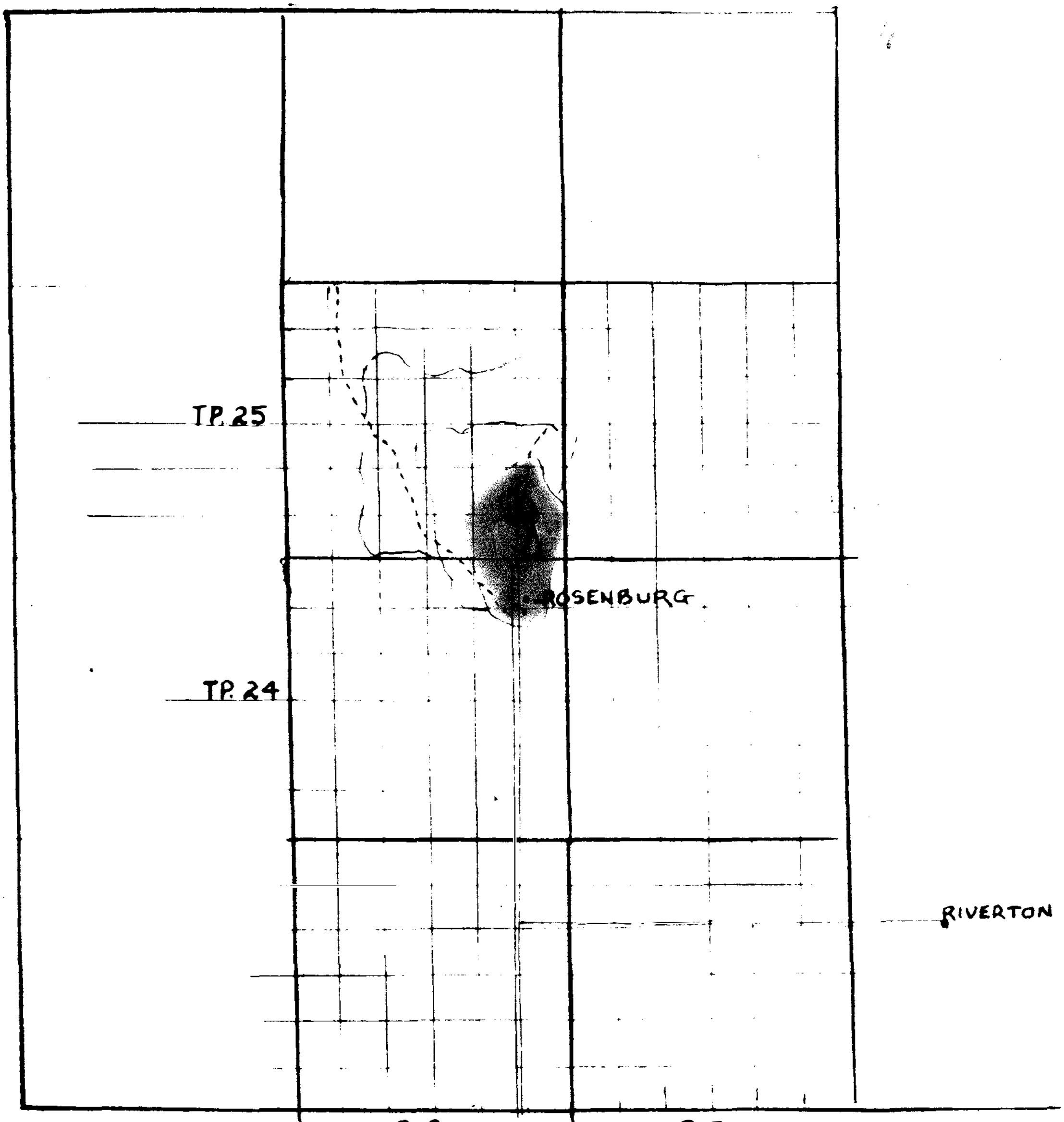
Jack-pine Budworm Damage Rosenburg - 1951 (Cont'd)

Location	Defoliation per Diameter Class			% Dead Tops per Diameter Class			No. of Dead Trees	Stam.	Est. Av. of d.b.h.	Remarks
	0"-5"	5"-10"	10"+	0"-5"	5"-10"	10"+				
SW-1/4-1-25-2	heavy	heavy	---	2%	nil	---	nil	---	3"	(very few trees in 5"-10"
NW-1/4-1-25-2	heavy	heavy	---	1%	nil	---	nil	---	3"	(class,number of trees have
SW-1/4-12-25-2	heavy	mod.	---	4%	nil	---	nil	---	3"	(weakened tops,Trees up to
NW-1/4-12-25-2	heavy	mod.	---	nil	nil	---	nil	---	3"	(2" appear to have more (defoliation.
SW-13-25-2	mod.	light	---	nil	nil	---	nil	---	3"	trees branchy, poor growth.
SE-14-25-2	mod.	light	---	nil	nil	---	nil	---	3"	(jack pine here on settled
NW-14-25-2	light	light	light	nil	nil	nil	nil	---	5"	(land and mixed with poplar.
SW-14-25-2	light	light	---	nil	nil	---	nil	---	3"	jack pine very scattered, mixed with poplar.
SE-15-25-2	light	light	light	nil	nil	nil	nil	---	4"	cutover area.
NW-11-25-2	mod.	light	---	nil	nil	---	nil	---	3"	light growth of jack pine.
NE-10-25-2	mod.	light	---	nil	nil	---	nil	---	3"	rock outcrop heavy.
SW-11-25-2	heavy	mod.	light	2%	1%	nil	nil	---	5"	jack pine tall and sparse.
NW-2-25-2	heavy	heavy	---	3%	1%	nil	nil	---	3"	many trees have dead branches
SW-2-25-2	heavy	heavy	mod.	1%	nil	nil	nil	---	4"	occasional tree 10"+.
SE-3-25-2	heavy	heavy	---	2%	1%	nil	nil	---	3"	jack pine & poplar mixed.
SW-3-25-2	mod.	nil	nil	nil	---	---	nil	---	3"	jack pine density light cut-over area.
NE-4-25-2	light	light	---	nil	nil	---	nil	---	4"	young regeneration showing most damage.
SE-9-25-2	light	light	---	nil	nil	---	2	---	4"	dead trees not attributed to jack-pine budworm.
NE-9-25-2	light	light	---	nil	---	---	nil	---	2"	poplar and jack pine.


R. 8
R. 9
R. 10
R. 11
R 12
R 13
TP. 8
TP. 7
TP. 6
TP. 5
TP. 4
TP. 3
TP 2
TP. 1
HADASHVILLE
SANDILANDS FOREST RESERVE
JACK PINE BUDWORM DAMAGE
- 1951 -
BUDWORM COLLECTIONS
LIGHT DEFOLIATION
SCALE DAMAGE
SCALE 1 inch - 6 miles
MARCHAND
SANDILANDS
WOODRIDGE
GARRICK
BADGER
VASSAR
MENISINO
PINEY
SOUTH JUNCTION

JACK PINE BUDWORM INFESTATION ROSENBURG MANITOBA - 1951 -

HEAVY
MEDIUM
LIGHT



SCALE 4 miles - 1 inch

8/2/5.U

(d) Personnel Contacted

Name	Address	Title	No. of Contacts	Demonst. of Sampling
J. Somers	Winnipeg	Prov. Forester	1	No
W. Webster	Winnipeg	Dist. Forester	9	Yes
D. Cooper	Marchand	Sr. For. Ranger	11	Yes
G. Hodgins	Marchand	Forest Ranger	7	Yes
E. Polkowski	Woodridge	Forest Ranger	5	Yes
W. Meseman	Piney	Forest Ranger	5	Yes
E. Harrison	Sprague	Forest Ranger	8	Yes
W. Trowsdale	Sprague	Forest Ranger	7	Yes
M. Chatelle	Woodridge	Fire Ranger	2	Yes
R. McIntosh	Steinbach	Game Guardian	5	No
C. Smith	Winnipeg	Forester	6	Yes
G. Edmunds	Winnipeg	Forester	1	No
A. Jardine	Winnipeg	Forester	1	No
H. Johnson	Winnipeg	Forester	3	Yes
W. Ruth	East Braintree	Forest Ranger	4	Yes
C. Beiber	East Braintree	Fire Ranger	2	Yes
L. Porath	East Braintree	Asst. For. Ranger	2	Yes
A. Shannon	Riverton	Forest Ranger	4	Yes
S. Thompson	Arborg	Fire Ranger	3	Yes
J. Thompson	Hodgson	Forest Ranger	3	Yes
H. Clee	Ashern	Forest Ranger	4	Yes
J. Wright	Carberry	Sr. For. Ranger	3	Yes
F. de Delley	Douglas	Forest Ranger	1	Yes
C. Patterson	Lac du Bonnet	Sr. For. Ranger	1	No
V. Patterson	Indian Head	Insect Ranger	1	No

2. Eastern Districts of Manitoba

by

J. A. Drouin

(a) Introduction

The following report outlines the activities of Biology Ranger J. A. Drouin during the field season of 1951. Forest Insect Survey investigations and observations were conducted in the Eastern District of Manitoba from May 4 to Sept. 29, 1951.

Field work commenced on May 17. A preliminary spruce and jack-pine budworm survey and general forest insect survey was carried out in the Lac du Bonnet area. At that time bud development on coniferous trees in the southern section of the district was not quite complete. Light populations of the large aspen tortrix and ugly-nest tortrix were observed but in general, insect activity was light.

In the latter part of May the writer found 2nd instar jack-pine budworm larvae at Seddon's Corner south of Lac du Bonnet. Spruce budworm larvae, the spruce foliage worm, and pitch nodule maker larvae were also located in several areas.

By the beginning of June spruce budworm occurred generally in all areas examined. Several flights with the Manitoba Government Air Service were arranged at this time. Trips were made to Bissett, Sasaginnigak Lake, Hole River, and Bloodvein River on spruce and jack-pine budworm surveys.

By June 6 spruce budworm larvae were well advanced and were in the 5th and 6th instar while budworm on jack-pine had reached the 3rd instar. A small localized infestation of American poplar beetle was located on Milner Ridge south of Lac du Bonnet.

As larval development advanced, 18" tip counts and checks were made on white spruce, balsam fir, and jack-pine for budworm populations.

On June 18 the writer proceeded to the Whiteshell Forest Reserve on budworm detection and a general insect survey. An aerial survey was carried out on June 19 with L. L. McDowall of the Southern District, for forest tent caterpillar along the Manitoba-Ontario boundary. Heavy defoliation was mapped south of Waugh to Buffalo Bay and west to Moose Lake. One ground check was made at Moose Lake. A small but severe infestation of forest tent caterpillar was examined on June 20 at the northern end of Big Whiteshell Lake at the Crow-Duck portage. Defoliation was 95 per cent and at the time of survey the majority of the larvae were pupating. By the latter part of June, larch sawfly adults were numerous and curled tips were quite apparent. During the latter part of June, lakes in the Whiteshell Forest Reserve were surveyed by canoe.

The month of July was devoted mainly to ground and aerial surveys for jack-pine budworm. The heavy infestation at Seddon's Corner was mapped and some time was spent making 18" tip counts to determine larval populations.

By July 9 larch sawfly defoliation was quite noticeable and larval development had advanced rapidly.

In the latter part of July, jack-pine budworm mapping was conducted in the Stead and Belair areas. The survey showed a marked increase in jack-pine budworm defoliation over 1950. Mistletoe in the Stead area had decreased considerably through selective cutting. In the Belair area mistletoe had also been reduced somewhat through selective cutting, but outside of the heavily damaged areas the mistletoe was still spreading.

The balance of August was spent on a larch sawfly survey and general sampling in the Eastern District. During this time an aerial reconnaissance was made of the northerly areas as far as God's Lake to determine distribution and extent of larch sawfly defoliation. On August 22, a 3-day survey by canoe was made of the Crow-Duck Lake, Winnipeg River, and Eagle Nest Lake areas in the Whiteshell Forest Reserve for the detection of jack-pine budworm and forest tent caterpillar.

Field activities continued until Sept. 29. Fall work included making mass collections of larch sawfly cocoons and aerial and ground surveys. Collections of 200 larch sawfly cocoons were made in scattered tamarack stands. These collections were stored for dissection and examination at a later date for parasitism. An extensive survey was made also during this period for forest tent caterpillar egg bands on white poplar. Data obtained from the survey will be used to determine the population and distribution of the forest tent caterpillar in 1952. At the same time three permanent sample plots on white poplar were established in the eastern and southern districts with L. L. McDowall.

A two day survey for forest tent caterpillar egg bands was made on November 7-8 in the Moose Lake area. During this time four permanent sampling stations were established in poplar stands.

(b) Insect Conditions

(i) Larch sawfly, *Pristiphora erichsonii* (Htg.). The status of the larch sawfly in the Eastern District changed somewhat during the 1951 season. Less damage occurred in the southern sections where some stands showed only very light defoliation, while in the northern section defoliation, for the most part, was severe.

The northern section is comprised of the areas bounded on the west by Lake Winnipeg and the Nelson River, on the east by the Manitoba-Ontario boundary, and on the south by the Manigotagan River. Aerial surveys were conducted as far north as God's River and it was assumed that conditions in the areas not covered by aerial survey were similar to those lying in the flight paths. South of the Manigotagan River, areas of heavily defoliated tamarack were numerous but generally stands suffered only light to moderate defoliation. This applied to the Lac du Bonnet, Seven Sisters, Whitemouth, and Whiteshell Reserve areas and the Stead district.

Following is a complete breakdown of larch sawfly defoliation by districts. Larch sawfly adults were first observed during the latter part of May in the Lac du Bonnet area. Larvae were found during the latter part of June. By July 3 some of the larvae were well developed and were in the 4th and 5th instars, although the majority were still in 1st and 2nd instars. Temperatures were generally below normal during the summer but larval development was considered fairly normal. By the middle of August larch sawfly defoliation was nearly complete and numerous aerial surveys were made in the Eastern District between August 13 and early September to determine the degree of infestation.

In tamarack stands east of Seven Sisters defoliation was light to moderate. Southwest in a large swamp in tp. 13, rges. 10 and 11, E. P. mer., defoliation was moderate to severe. Light defoliation occurred east to Pointe du Bois, in the Pointe du Bois district, and north along range line 14 to Bird River. All the stands in the Bird River area were lightly defoliated. In the Rice Lake area (sec. 12, tp. 16, rge. 13, E. P. mer.), defoliation was severe at the north end of the lake and light to moderate along the east side. North of Lac du Bonnet to Great Falls and Pine Falls, defoliation remained light to moderate. The same conditions existed in the Traverse Bay area.

The areas south from Pine Falls to Stead, west to Beaconia and south to Libau were surveyed by railroad. North of Stead from section 14, tp. 17, rge. 18, E.P. mer., the railroad traverses a low swampy area, which extends to Pine Falls. A large part of this swamp is grassy low land with small bluffs of black spruce, tamarack and willow. The wooded areas, consisting mainly of black spruce, balsam fir, and tamarack extend south from Pine Falls for about three miles. The tamarack stands in this area were lightly defoliated. All stands examined were either saturated with water or surface water was present. Sawfly populations were low and few curled tips were observed. It was assumed that the high water levels in this area were responsible for the low sawfly populations. In a large stand of pure tamarack covering half a section west of Stead in Sec. 5, tp. 17, rge. 17, E.P. mer., defoliation ranged from 60 to 70 per cent.

Tamarack stands in the area between Wood Siding (mile 12) and Murray Hill (mile 6) were severely defoliated. Through this area the ratio of tamarack to black spruce is approximately 25 per cent tamarack. Pure stands of tamarack occur east and west of the railroad. A large drainage ditch follows the railroad starting at Murray Hill running northeast and extending due north into the Winnipeg River in sec. 14, tp. 18, rge. 9, E.P. mer. The ditch affords good drainage to the Murray Hill area and consequently moisture conditions were low.

There are large stands of pure tamarack to the south along the lakeshore (Lake Winnipeg) between Beaconia and Scanterbury to mile 42 north of Libau. Conditions in this area were much the same as in 1950. Defoliation was light, few curled tips were noticed, and surface water was present in most of the swamps. Growth conditions appeared good along the higher ground while in the lower areas that are frequently flooded from the "tide" of the lake, foliage was scanty and trees had a heavy cone crop. During prolonged westerly winds the lake levels along the east shoreline rise, flooding the low areas.

Information on the area north of the Winnipeg River and east of Lake Winnipeg was obtained through aerial surveys. A number of ground checks were made in the Bissett, Bear Lake, and God's Lake areas. Defoliation in areas surveyed from the air was rated under two classifications of intensity, i.e. light to moderate, and moderate to severe.

Along the east shoreline of Lake Winnipeg between the O'Hanley and Black rivers and to the Manigotagan River area, defoliation ranged from light to moderate. West of Monkman Bay, in secs. 29, and 30, tp. 29, rge. 7, E.P. mer., and at Pigeon Point and Big Stone Point, defoliation in tamarack stands was recorded as moderate to severe. North to the Poplar and Mukutawa rivers and to Montreal Point, light and widely scattered tamarack stands suffered light defoliation. In the Gunisao River area defoliation was light to moderate with heavy defoliation occurring in the S.W. 1/4 of tp. 55, rge. 3, W.P. mer. Heavy defoliation was observed in stands along a creek running northeast in tp. 55, rge. 3, W.P. mer., and in stands immediately south of the junction of the Gunisao and McLaughlin rivers. Defoliation varied from moderate to severe in stands in tp. 57, rge. 3, W.P. mer., and tp. 58, rge. 3, W.P. mer. The same condition existed in the Norway House district. North and east of Norway House to Bolton Lake, along the Hungry River, north of the west end of Aswapiswanan Lake to Colen Lake and in stands along a small stream running into the Mink River, defoliation was severe. At Touchwood Lake pure stands of tamarack were lightly defoliated but mixed stands suffered severe defoliation. Severe defoliation was recorded along the Wanless Creek, in stands south of Wanless Lake, and at the north end of Vermilyea Lake. At God's Lake defoliation was severe. Ground checks were made in the area at the mouth of God's River and north of the first set of rapids. Stands suffered severe defoliation in this area. South of God's Lake to the Murray and Beaverhill lakes and on the west side of Goose Lake, stands were heavily defoliated. Stands in the vicinity of Island and Cordeau lakes and south to Hudwin Lake were severely defoliated also. Defoliation was lighter south of the Cobham River to Family and Sasaginnigak lakes. Some heavy damage was observed north of the Bloodvein River in S.W. 1/4 of tp. 29, rge. 16, E.P. mer., in stands along the north and south sides of Rice Lake, and along the Gunnar road in the Bissett area.

Defoliation varied from light to moderate along the Trans-Canada Highway, excepting at Telford, 13 miles east of Rennie, in sec. 16, tp. 10, rge. 16, E.P. mer., where 95 per cent defoliation was recorded. North of Rennie through the Whiteshell Forest Reserve to Crow-Duck and Eagle Nest lakes (Winnipeg River) stands suffered light to moderate defoliation. Larch sawfly reports showing degree of defoliation were completed for all tamarack stands examined in this area. Mass collections of larch sawfly cocoons were made wherever possible.

Several days in late September were spent on recording the degree of defoliation and mortality on the tagged trees in the permanent tamarack sample plots. Mortality was higher in the permanent sample plots in 1951 than it was in previous years, but it was impossible to determine the cause.

A few diseased larvae were collected during the season. The diseased larvae were collected at God's Lake, Murray Hill in sec. 30, tp. 17, rge. 9, E.P. mer., and Pointe du Bois, sec. 30, tp. 15, rge. 12, E.P. mer. The diseased larvae were forwarded to Sault Ste. Marie and, in all three cases, the disease was identified as *Empusa* sp.

During the 1951 season a new sampling technique was introduced for sampling in areas where insect populations were high. This method equired a sampling tray 17 inches square and covering an area of 2 square feet, placed on the centre of the beating sheet and counting the number of larvae in the tray. Use of the tray greatly facilitated population sampling since less larvae had to be counted and the number of larvae that fell in the tray generally compared favourably to check counts on the entire sheet.

(ii) Green larch looper, Semiothisa sexmaculata Pack., Marlatt's larch sawfly, Anoplonyx laricis (Marl.). These two species were prevalent in most tamarack stands examined during the season and were present in the majority of tamarack collections. The amount of defoliation caused directly by them was not determined, but since populations were low they probably caused very little defoliation.

(iii) Jack-pine budworm, Choristoneura sp. Defoliation caused by the jack-pine budworm increased during 1951 in the Eastern District of Manitoba. Light populations were general on jack-pine stands throughout the whole district. This species was also occasionally found on black spruce in some areas north of Lac du Bonnet. Defoliation in the Stead-Belair district increased to severe, particularly in the Belair area where light populations were recorded in 1950. Another infestation occurred in the Seddon's Corner-Milner Ridge areas. Here also, defoliation increased noticeably during the 1951 season. Larvae of the jack-pine budworm were first found at Seddon's Corner on May 21.

In the Lac du Bonnet district jack-pine budworm was general and was found in most stands examined. It was also general along the Pointe du Bois road and in the Pinawa and Great Falls areas. Distribution was general in the vicinity of Seven Sisters and along the Winnipeg River to Nutimik Lake. Along the Trans-Canada Highway, through the Whiteshell Forest Reserve, to the Manitoba-Ontario Boundary and north to Betula, Big Whiteshell, Crow-Duck and Eagles Nest Lakes on the Winnipeg River populations were much the same. Populations were slightly higher but damage was negligible in a large open growing staminate stand of jack-p ne in the Betula Lake area.

Jack-pine stands at Seddon's Corner suffered severe damage. The infested area at Seddon's Corner was bounded on the north and west by the Lac du Bonnet road, on the south by the Canadian National Railway, and on the east by a large swampy area which follows the lower slopes of the ridges. The infestation was located on a high elevated ridge (altitude 975') composed mainly of sandy-clay and gravel, running northeast and southwest. The ridge supports a stand of jack-pine. The lower slopes and low areas support a growth of white poplar, birch, black poplar, oak, ash, and scattered elm. In previous years jack-pine budworm populations had varied from light to moderate but during 1951 the intensity of the infestation increased to moderate and severe. From the data obtained it appeared that the most severe damage occurred along the higher elevations of the ridge. Moisture and growth conditions during 1951 were good but poor soil and good drainage seemed to retard the growth along the higher elevations (See map). Areas of severe defoliation were recorded east of Milner Ridge in the southwest quarter of tp. 14, rge. 10, and extended into the northwest 1/4 of tp. 13, rge. 10, E.P. mer. Severe damage in the above mentioned area was more or less confined to a narrow strip extending northeast to southwest along the ridge top. South, in the Seddon's Corner area, damage was heaviest in the extreme southeast and southwest 1/4's of tp. 13, rges. 9, and 10, res ctively and in the northeast quarter of tp. 12, rge. 9, E.P. mer. Severe defoliation also occurred in a jack-pine stand forming a crescent shaps along the northwest 1/4 of tp. 12, rge. 10, E.P. mer. In the areas of severe damage, complete defoliation of this year's growth was common on regeneration and immature (pole) as well as staminate trees.

The jack-pine budworm infestation in the Stead-Belair area was surveyed again in 1951. Survey procedures were similar to the 1950 survey. North of Stead in tp. 17 budworm defoliation had increased extensively. The entire upper part of the ridge which supports a poor to fair growth of jack-pine suffered moderate defoliation. On the more mature, open growing staminate flowering trees defoliation was severe (see photographs). Severe damage was recorded in the northwest 1/4 of sec. 9, the west ½ of sec. 16, and almost all of sec. 21, and a small narrow strip in the west part of sec. 28, tp. 17, rge. 8, E.P. mer. Severe damage was also mapped in sec. 29, the southeast 1/4 of sec. 27, and in the southern part of sec. 22, tp. 17, rge. 8, E.P. mer. Throughout the remainder of the area damage was moderate, decreasing to light along the slopes of the ridge. In tp. 18, rge. 8, E.P. mer., the jack-pine budworm infestation did not show any change over previous years. Budworm was recorded as light at all points examined.

Defoliation increased considerably in tps. 19 and 20, rge. 7, E.P. mer., in the jack-pine stands covering the ridge in the Belair and Albert Beach district. In 1950 a small area of moderate damage had been recorded in sec. 8, tp. 19, rge. 7, E.P. mer. In 1951 this had enlarged and spread into sec. 9, the south half being severely defoliated. This severe defoliation extended into secs. 4 and 33, tp. 18, rge. 7, E.P. mer. Severe damage also occurred in the southern parts of secs. 35 and 36, extending southward into secs. 26, 25, 23 and 22, tp. 19, rge. 7, E.P. mer. In tp. 20, severe damage was recorded in sec. 2, extending northward into sec. 11 in the Albert Beach area. Northeast of Belair in secs. 15, 10, 14, and 11, defoliation was moderate.

East of Lake Winnipeg, jack-pine budworm populations were light but general. Information on this area was obtained through aerial surveys supplemented by ground checks. In a number of cases jack-pine budworm larvae were collected from black spruce. The most northerly collections of budworm from jack-pine came from Bissett, but lack of air transportation prevented a more complete survey being made of areas farther north.

Jack-pine budworm was observed on black spruce in the following areas:

Bloodvein River	Bissett
Hole River	Maskwa Lake
Sasaginnigak Lake	Popler Lake
Long Lake	

Eleven jack-pine budworm population counts were made in 1951. The counts consisted of two 18" branches from each of 5 trees; one count of 10 trees was taken at Seddon's Corner. The branches were carefully examined and the number of larvae recorded. A supplementary sample was made by the standard beating method to determine the reliability of the former method of sampling.

TABLE "A"

Jack-pine Population Counts.

Date	Place	Sec.	Tp.	Rge	Mer.	No. of 18" Branches	Total No. of Larvae or Pupae	Supp. Count
June 11	Seddon's Corner	2	13	9	EPM	20	97	75
June 15	Seddon's Corner	29	12	10	EPM	10	4	5
June 29	Betula Lake	11	13	14	EPM	10	4	3
July 4	Rennie	19	10	15	EPM	10	0	2
July 4	West Hawk Lake	2	10	17	EPM	10	1	0
July 5	West Hawk Lake	16	9	17	EPM	10	0	0
July 9	Seddon's Corner	11	13	9	EPM	10	56	276
July 6	Rennie	29	10	14	EPM	10	2	2
July 10	Pointe du Bois	2	16	14	EPM	10	0	1
July 11	Pointe du Bois	35	15	12	EPM	10	2	2
July 12	Milner Ridge	32	13	10	EPM	10	215	648

Some parasitism was noted in several areas. Of the areas where it was recorded, Milner Ridge and Seddon's Corner seemed to support a higher parasitism. Diseased larvae were located at Lac du Bonnet and Milner Ridge; the disease was identified as *Beauveria globulifera* (Speg.)

(iv) Spruce budworm, *Choristoneura fumiferana* (Clem.). No severe infestations of the spruce budworm were encountered in the Eastern District in 1951. The status remained much the same as in 1950. The first larvae of the season were found on balsam fir at Black River.

During aerial surveys of the region east of Lake Winnipeg, spruce budworm was found in small numbers at several points. It was found on both white spruce and balsam fir, but occurred most commonly on the latter. Collections were made at Bissett, Bloodvein River, Sasaginnigak Lake, Hole River, Black River and Maskwa Lake.

In the Lac du Bonnet area budworm was light but general. The same applied to areas around Seven Sisters, Pointe du Bois, north of the Trans-Canada Highway between Seddon's Corner and Rennie, and in the Whiteshell Forest Reserve. Light populations were observed at Milner Ridge, south of Lac du Bonnet, in sec. 14, tp. 14, rge. 10, E.P. mer., but damage was light.

Six population counts were made in 1950. The procedure was identical to that employed for jack-pine budworm and confined to 5 tree counts on both white spruce and balsam fir. A standard beating sample was made at the same time as the population counts to serve as a check on the reliability of 18" branch sampling. Below are listed the areas where these counts were made.

Date	Place	Sec.	Tp.	Rge.	Mer.	No. of 18" Branches	Total No. of Larvae or Pupae	Supp. Count
June 12	Lac du Bonnet	14	14	10	EPM	10	2	0
June 12	Lac du Bonnet	14	14	10	EPM	10	0	1
June 29	Betula Lake	28	13	14	EPM	10	0	0
July 4	West Hawk Lake	2	10	17	EPM	10	0	0
July 5	Caddy Lake	7	10	17	EPM	10	1	0
July 7	Red Rock Lake	17	12	15	EPM	10	0	0

(v) Spruce Needleworm, *Dioryctria reniculella* (Grt.). The spruce needleworm was common through the Eastern District in 1951 but caused very little damage. It was generally associated with the spruce budworm. However, in some cases where budworm was not located, the spruce needleworm was present.

(vi) Grey willow leaf beetle, *Galerucella decora* (Say). This insect was common throughout the Eastern District during 1951. Willow stands were severely skeletonized in the northern section of the District. This includes areas north of Bird River to Bissett, the Poplar and Gammon rivers, and the areas around Island Lake, Beaverhill Lake, and God's Lake.

Moderate to severe skeletonizing was observed east of Great Falls and north to the Hole and Manigotagan rivers. Damage to willow in the Lac du Bonnet-Pointe du Bois area was light to moderate with occasional areas severely skeletonized. The same conditions existed at Seven Sisters and south and east through Whitemouth to Rennie. Willow leaf beetle damage varied from light to moderate throughout the Whiteshell Forest Reserve north to the Winnipeg River. Patches of severe skeletonizing were observed at Betula Lake, Heart Lake and the north end of Crow-Duck Lake in the Boundary Falls region. In the Stead-Belair area damage remained much the same as in 1950, light to moderate with occasional pockets of severe damage.

(vii) Forest tent caterpillar, *Malacosoma disstria* Hbn. In Eastern Manitoba, forest tent caterpillar populations increased considerably in 1951. A new and severe infestation of this insect occurred at the north eastern end of Big Whiteshell Lake near the Big Whiteshell-Crow-Duck portage in secs. 12 and 13, tp. 13, rge. 16, E.P. mer. The infestation covered approximately one half section.

A ground survey of the area was carried out on June 20. Defoliation averaged 90 to 100 per cent on all deciduous trees, decreasing to light along the outer fringes of the infestation. Stand composition was approximately 90 per cent white poplar, 5 per cent oak, and 5 per cent birch. The understory was composed of saskatoon, choke cherry, hazel, and pincherry, with willow along the lakeshore. An aerial survey showed that white poplar was limited in quantity, occurring in scattered blocks in the lower areas and along the streams and rivers. The dominant species north and south of Crow-Duck and Whiteshell lakes are mainly jack-pine along the rock ridges with spruce, balsam and tamarack in the lower areas. At the time the survey was conducted a large percentage of the larval populations had not attained full growth possibly due to the lack of foliage. Light feeding was observed on the fringes of the infestation, but for the most part the caterpillars were pupating in the grasses, ferns, and along the lakeshore in the bullrushes and reeds. Spot checks were made northwest of the infestation along the north shore of Big Whiteshell Lake. Tent caterpillar larvae were found on ash, oak, pop ar, chokecherry, and hazel, two to three miles from the main infestation.

The severe infestation recorded in 1949 on an island in Big Whiteshell Lake continued to decline except in the northern extremity where it remained light to moderate. East of Lake Winnipeg the infestations previously reported at Quesnel and Sasaginnigak continued to subside. The area round Family Lakes was severely infested in 1950. However, the lack of air travel prevented a survey of this area in 1951.

Other collections of this insect were made at the following points in Eastern Manitoba: Caddy Lake, Rennie, Lac du Bonnet and Pointe du Bois.

In order to predict the probable area and instensity of infestations of the forest tent caterpillar in the Eastern District in 1952, an egg survey was carried out in the infested and adjacent areas. The survey showed a fairly wide distribution of forest tent caterpillar in the district.

Results of the forest tent caterpillar egg survey in the Eastern District of Manitoba may be found under Section B of this report: Reports on special projects.

(viii) Large aspen tortrix, *Archips conflictana* (Wlk.). Scattered samples of this insect were collected in the Lac du Bonnet-Pointe du Bois area. Populations were extremely light and no damage was recorded.

(ix) American poplar beetle, *Phytodecta americana* Schffr. Populations of the american poplar leaf beetle were very light in the Eastern District. One small localized infestation involving approximately 200 trees was recorded on Milner Ridge in sec. 9, tp. 14, rge. 10, E.P. mer. Defoliation averaged 15 per cent in the area at time of examination.

(x) Ugly-Nest caterpillar, *Archips cerasivorana* (Fitch). This insect was general throughout Eastern Manitoba. It was found mainly on choke cherry, pincherry, rosebushes and occasionally on white poplar and willow.

Nests of the caterpillar were found in increasing numbers to the east along the Trans-Canada Highway from the heavily infested areas on the Seddon's Corner ridge.

The old infestations along the Lac du Bonnet highway and in the Stead-Belair areas were still active. Defoliation in these areas ranged from moderate to severe.

(xi) Aspen Blotch Miner, *Lithocolletis tremuloidiella* (Braun.). Damage caused by this species remained much the same as in 1950. The degree of attack ranged from moderate to severe. It was recorded in all areas sampled during the season. A slight decrease in intensity of attack was noticed south of the Winnipeg River.

(xii) A pine scale, *Toumeyella* sp. The old infestation of the pine scale located near Belair in secs. 4 and 5, tp. 19, rge. 17, E.P. mer., was still active but damage remained about the same. Other occasional trees infested with scale were observed in the Stead and Belair areas and at Seddon's Corner.

(xiii) Yellow-headed spruce sawfly, *Pikonema alaskensis* (Roh.). This sawfly caused light defoliation of white spruce at Caddy Lake, West Hawk Lake, Green Lake, Betula Lake and Rennie in the Whiteshell Forest Reserve. Small populations were also encountered at the Manitoba-Ontario Boundary and at Lac du Bonnet. One collection of the yellow-headed spruce sawfly was made from black spruce at Poplar Lake. In all cases larvae were found on only one or two trees and damage was negligible. Three samples of the green-headed spruce sawfly (*Pikonema dimmockii* (Cress.) were obtained from white spruce. One sample from each of the following points; Betula Lake, Red Rock Lake, and Pointe du Bois.

(xiv) A tent caterpillar, *Malacosoma lutescens* (N.&.D.). A few samples of this species were collected at Maskwa Lake. However, it was not abundant and was found only on pincherry and birch.

(xv) Striped alder sawfly, *Hemichroa crocea* (Fourc.). Only one small localized infestation of the striped alder sawfly was recorded during 1951. It was observed at the north end of Crow-Duck Lake (sec. 27, tp. 13, rge. 17, E.P. mer.), in the Whiteshell Forest Reserve.

(xvi) Spotless fall webworm, *Hyphantria textor*, Harr. A few samples of this insect were collected in 1951 in a small area east of Seven Sisters in the Dorothy Lake area. Other samples were obtained along the Betula Lake road in the Whiteshell Forest Reserve, at Lydiatt south of Beausejour, and at Jackfish Lake north of Stead.

(xvii) White pine weevil, *Pissodes strobi* (Peck.). An occasional jack-pine or white spruce occurring singly or in groups was attacked by this species. It was detected in the following areas: Hazel, Pointe du Bois, Stead and Telford, but damage was negligible.

(xviii) Pitch nodule maker, *Petrova albicapitana* (Busck.). This nodule maker was commonly found on jack-pine regeneration in the Eastern District. A few nodules were found in all areas examined, but these had caused no noticeable damage to jack-pine.

(xix) Bark beetles. No change in the status of bark beetles in the Eastern District was recorded in 1951. Attacks were generally confined to windfalls, skidways, and trees felled during land clearing operations. Light attacks were recorded on dying balsam-fir north of the Winnipeg River.

(c) Special Investigations

(i) Dying Conifers along the east shore of Lake Winnipeg. An examination of dying balsam-fir was made in the Black River area in sec. 21, tp. 21, rge. 9, E.P. mer. This area was also examined last year. There appears to be no change in the amount of dead and dying balsam occurring along the east shoreline of Lake Winnipeg north of Pine Falls to Manigotagan.

(ii) Mistletoe, *Arceuthobium americanum* Nutt. Little change was noted in the mistletoe infested areas i 1951. In the Belair district, damage was reduced somewhat through selective cutting but a more extensive operation is necessary to eliminate the infested trees which are for the most part, either mature, overmature, or stagnate. Mistletoe is now spreading to younger growth including regeneration as small as ½-inch d.b.h. In tp. 17, rge. 8, E.P. mer., the number of mistletoe infested trees is gradually increasing and it is becoming more abundant on the younger growth. This was particularly noticeable in secs. 22 and 27. In the northern part of the Stead infestation (sec. 16, tp. 18, rge. 8, E.P. mer.) only light traces of mistletoe remained after extensive cutting operations. (See Map).

In the Belair area, heavy mistletoe damage was concentrated in tp. 19, rge. 7, E.P. mer. Cutting operations were undertaken south of Belair in secs. 2 and 3, but much of the unmerchantable timber still remains. Although mistletoe was general throughout tp. 19, only the heavier areas were mapped. Heavy damage was also located north of Grand Beach along the shoreline of Lake Winnipeg in sec. 5, tp. 19, rge. 7, E.P. mer.

From reports received heavy damage occurred on Elk Island north of Victoria Beach. Light to moderate mistletoe damage was present, also on jack-pine and black spruce (see photographs), in tp. 14, rge. 10, E.P. mer., on Milner Ridge, along Eagle Nest Lake, and at the northern end of Crow-Duck Lake.

(iii) Larch sawfly cocoon collections. Mass collections of larch sawfly cocoons were made at seven widely separated areas in Eastern Manitoba. The locations are shown in the following table. These cocoons were stored at the Winnipeg Laboratory for dissection and examination to determine the distribution and incidence of parasites.

Date	Place	No. of Cocoons
Aug. 29	Telford sec. 24, tp. 10, rge. 15, E.P. mer.	250
Aug. 29	Telford sec. 17, tp. 10, rge. 16, E.P. mer.	250
Sept. 10	Pointe du Bois sec. 15, tp. 12, rge. 11, E.P. mer.	110
Sept. 14	Pointe du Bois sec. 2, tp. 16, rge. 14 E.P. mer.	100
Sept. 15 *	Seddon's Corner sec. 3, tp. 13, rge. 10 E.P. mer.	100
Sept. 18	Murray Hill sec. 24, tp. 17, rge. 8, E.P.mer.	192
Sept. 20	Pointe du Bois sec. 24, tp. 15, rge. 11, E.P. mer.	81

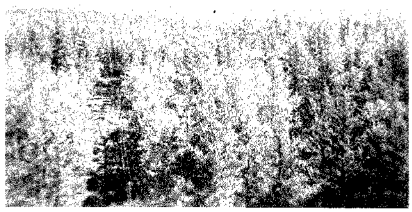
* In 1948, 14,000 parasites (Tripneptis klugii) were released at this location, 0.6 miles north of Seddon's Corner.

Jack-pine budworm defoliation
Stand, Sec.[illegible], tp.17, rge.8, W.4.
mer. Kodacolor reprint.

Jack-pine budworm defoliation
Stand, Sec.22, tp.17, rge.8, W.4.mer.
Aug.1/61, Kodacolor reprint

Jack-pine budworm infestation
Stand, Sec.22, tp.17, rge.8, W.4.mer.
July 27/61, Kodacolor reprint.

Jack-pine budworm defoliation
Seddon's Corner, Sec.[illegible], tp.12, rge.
9, W.4.mer., Kodacolor reprint



Jack-pine budworm
feeding on
terminals
Seddon's Corner
July 17, 1961

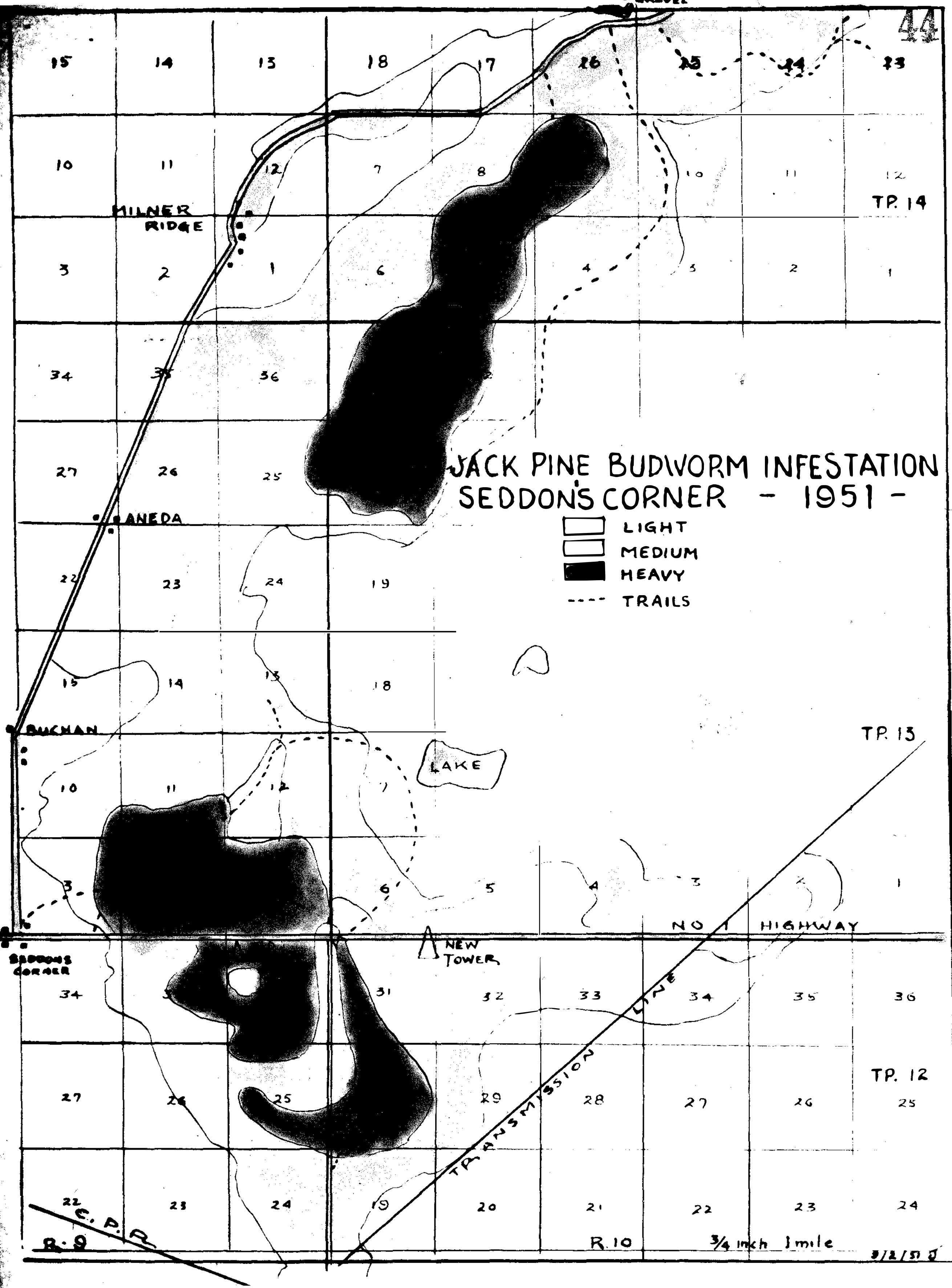
Forest Tent Caterpillar Defoliation Big Whiteshell Lake - June 20, 1951

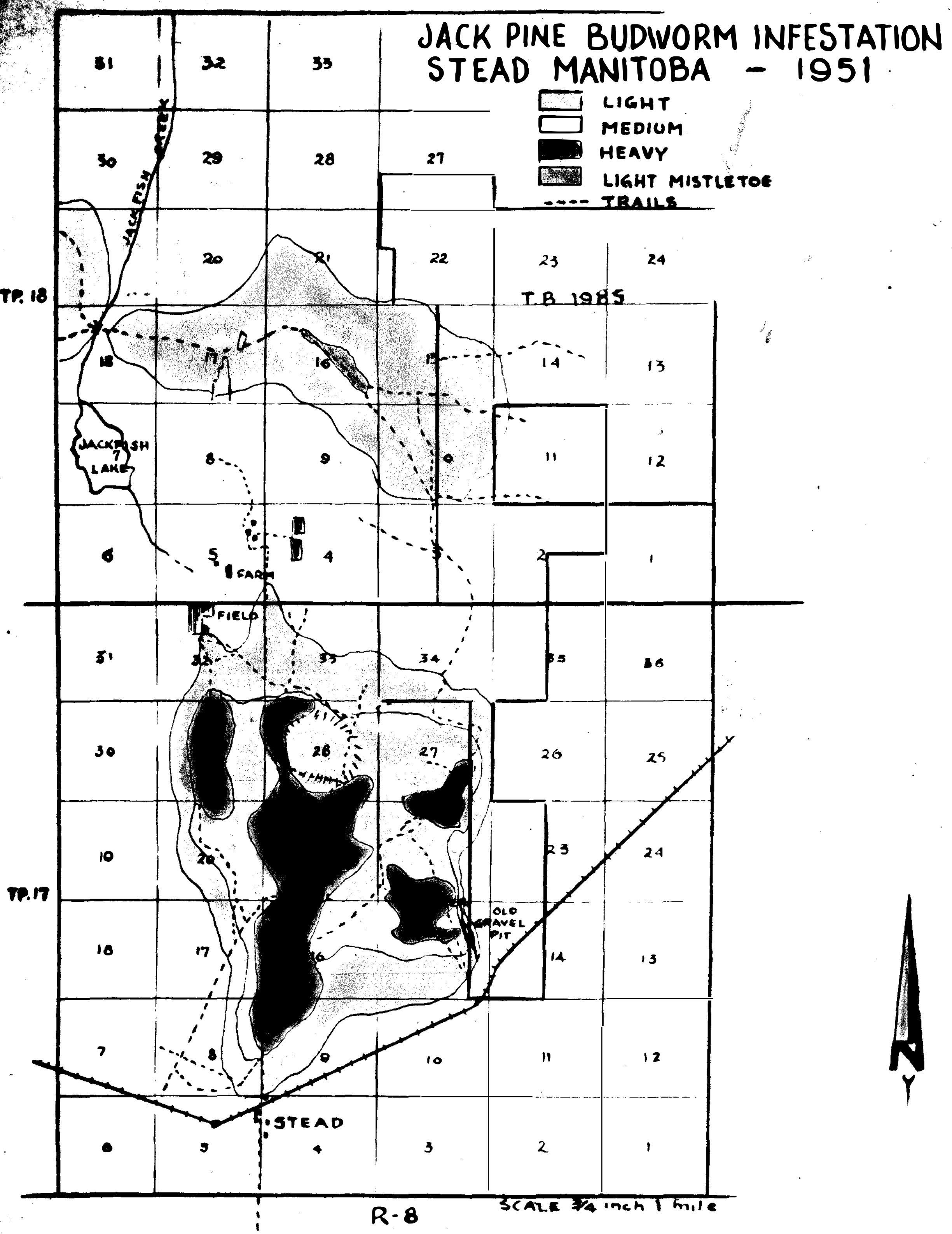
Forest Tent Caterpillar Defoliation Big Whiteshell Portage, June 20, 1951

Forest Tent Caterpillar pupating on Jack-pine foliage, W.F.R.

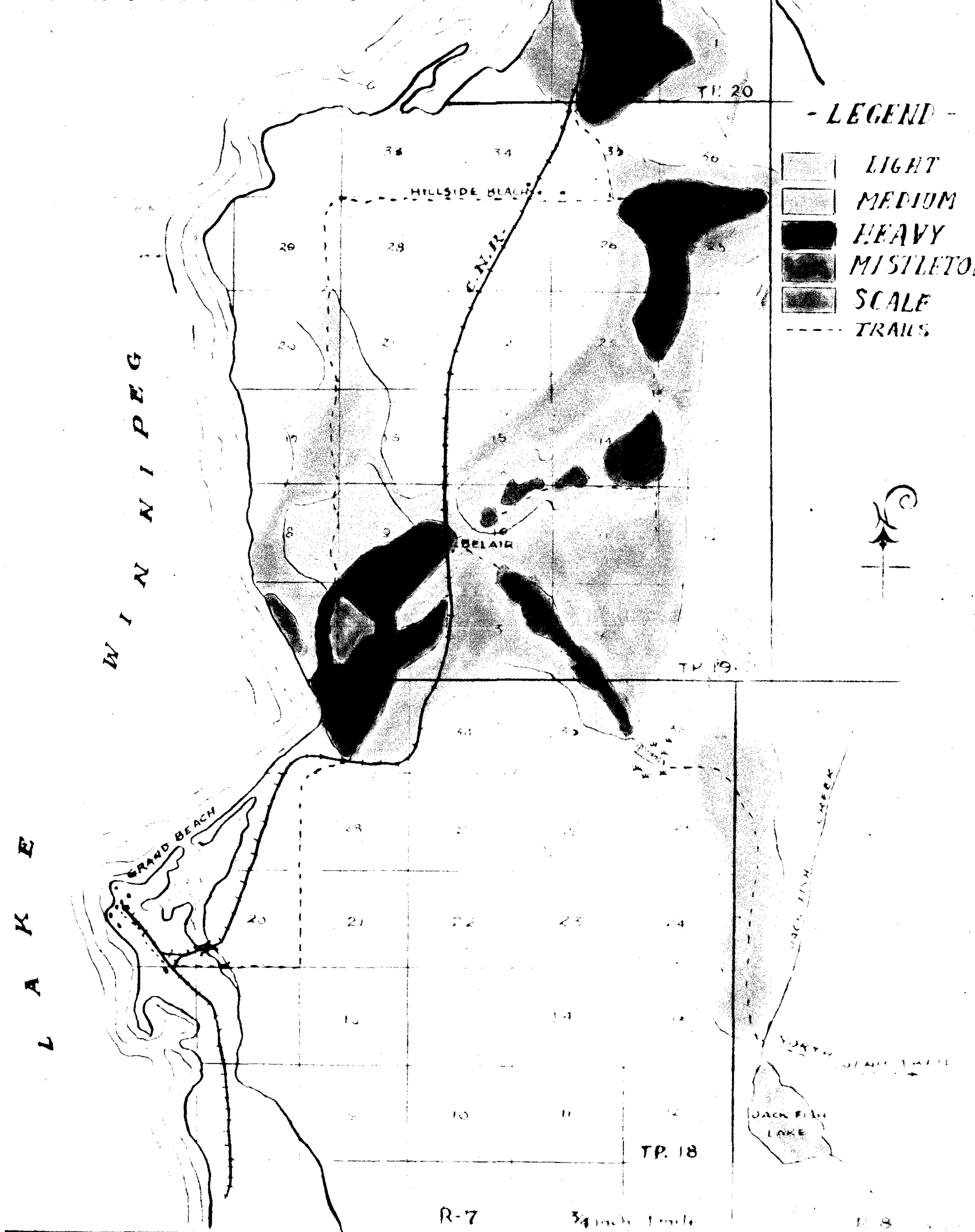
Forest Tent Caterpillar clusters Big Whiteshell Portage, June 20, 1951

Forest Tent Caterpillar defoliation and pupae W.F.R. June 20, 1951


JACK PINE BUDWORM INFESTATION
SEDDON'S CORNER - 1951 -
LIGHT
MEDIUM
HEAVY
TRAILS
MILNER RIDGE
ANEDA
BUCHAN
SEDDONS CORNER
LAKE
NEW TOWER
NO 1 HIGHWAY
TRANSMISSION LINE
C.P.R.
TP. 14
TP. 13
TP. 12
R. 9
R. 10
3/4 inch 1 mile
3/2/51 J


JACK PINE BUDWORM INFESTATION
STEAD MANITOBA - 1951
LIGHT
MEDIUM
HEAVY
LIGHT MISTLETOE
TRAILS
JACKFISH CREEK
JACKFISH LAKE
TP. 18
TP. 17
T.B 1985
FARM
FIELD
OLD GRAVEL PIT
STEAD
R-8
SCALE 3/4 inch 1 mile

JACK PINE BUDWORM - SCALE AND MISTLETOE INFESTATIONS BELAIR DISTRICT -1951-



(d) Personnel Contacted

Eastern District of Manitoba

Name	Rank	Address	Times Contacted
W. Shortinghuis	Projects Engineer	Winnipeg	5
T.B. Vermilyea	District Forester	Winnipeg	5
J.G. Sommers	Director, M.F.S.	Winnipeg	1
A.W. Brain	c/o Fire Protection	Winnipeg	1
W. Danyluk	Forest Management	Winnipeg	*
C.J. Ritchie	Forest Ranger	Rennie	*
J. Inkster	Forest Ranger	Rennie	*
C.H. Patterson	Sr. Forest Ranger	Lac du Bonnet	*
J. Nesper	Forest Ranger	Lac du Bonnet	*
J.D. McCarroll	H.Q. Ranger	Lac du Bonnet	*
G. Emberley	Forest Ranger	Stead	*
C. Goodman	Trainee	Lac du Bonnet	*
O. Meier	Stockman	Lac du Bonnet	*
D. Gretsinger	Trainee	Lac du Bonnet	*
R. Kemp	Forest Ranger	Lac du Bonnet	*
W. Tucker	Fire Ranger	Pointe du Bois	*
R. Klatt	Fire Ranger	Stead	*
J. Sveinson	Forest Ranger	Whitemouth	*
J. Harkness	Fire Ranger	Lac du Bonnet	*
D.H. Allan	Forest Ranger	Norway House	1
P. Fitzmaurice	Forest Ranger	Seven Sisters	3
J. Russell	Fire Ranger	Bissett	*
H. Taggesen	Fire Ranger	Bird River	*
P. Thomas	Game & Fisheries	Lac du Bonnet	*
B. Gobbert	Game & Fisheries	Lac du Bonnet	*
G. Edmunds	Forester	Rennie	2
E. Greene	For. Svce. Mechanic	Rennie	*
W. Marsh	Fire Ranger	Hole River	2
R. Davies	Fire Ranger	Sasaginnigak Lake	2
E. Polkowski	Forest Ranger	Woodridge	4
D. Wardrop	Forest Ranger	Pine Falls	*
D. Cooper	Forest Ranger	Marchand	1
W. Webster	I/c Southern District	Winnipeg	3
H. Wells	Game & Fisheries	Lac du Bonnet	*
C. Richmond	M.F.S. Carpenter	Rennie	*
G. Butler	Biologist, M.N.R.	Winnipeg	1
A. Morris	Fisheries	West Hawk Lake	3
T. Paddock	Fisheries Inspector	Winnipeg	1
B. Gilmore	Pulp Buyer M.P.Co.	Pine Falls	2
H. Larsen	Logging Operator	Lac du Bonnet	1
B.C. Enes	Forest Ranger	West Hawk Lake	2
H. McKinnon	Snr. Forest Ranger	Winnipeg	2
A. Bryan	Fire Ranger	Bissett	*
A. Raven	Fire Ranger	Hole River	*
S. Barker	Fire Ranger	Berens River	*
R. Barker	Fire Ranger	Hole River	*
F. Moore	Cruiser, M.F.S.	Winnipeg	*

J. Bottsford	Mining Engineer	Bissett	1
A. Nordhaven	Fire Ranger	Moose Lake	1
T. Brainerd	C.I.L. Div. Engineer	Winnipeg	1
R. Wenderborn	C.F.A. Unit	Winnipeg	1
T. Harrison	Snr. Ranger	Sprague	*
J.C. Uhlman	Director, M.G.A.S.	Lac du Bonnet	*
H. Smith	Flight Planner, M.G.A.S.	Lac du Bonnet	*
G. Donaldson	I/C/Radio Div., M.G.A.S.	Lac du Bonnet	*
F. Hanton	Pilot, M.G.A.S.	Lac du Bonnet	*
R. Rice	Pilot, M.G.A.S.	Lac du Bonnet	*
N. McCoy	Pilot, M.G.A.S.	Lac du Bonnet	*
K. Goodrich	Pilot, M.G.A.S.	Lac du Bonnet	*
R. Hunter	Pilot, M.G.A.S.	Lac du Bonnet	*
R. Percy	Pilot, M.G.A.S.	Lac du Bonnet	*
J. Blanchard	Radio Div., M.G.A.S.	Lac du Bonnet	*

<u>Manitoba Pulp & Paper Co.</u>

D. Naysmith	Forester	Pine Falls	5
T. Fortier	Logging Supt.	Pine Falls	1
C. Farmer	Cruiser	Pine Falls	1
G. Forsythe	Wood Buyer	Pine Falls	2
C. Miller	Supt. of Camps	Pine Falls	1
B. Gilmore	Wood Buyer	Pine Falls	2
J. Boulette	Camp Assistant	Black River	1
A. Chapel	Camp Manager	Black River	1

* Indicates everday contacts for a week or more during season.

(e) Negative Reports

Date	Host	Location
Sept. 4	White Poplar	Jack Pine Ridge Sec. 31, tp. 12, rge. 10, EPM
Sept. 4	White Poplar	Jack Pine Ridge Sec. 31, tp. 12, rge. 10, EPM
Sept. 12	White Poplar	Pointe du Bois Sec. 9, tp. 16, rge. 13, EPM
Sept. 14	White Poplar	Milner Ridge Sec. 9, tp. 14, rge. 10, EPM
Sept. 17	White Poplar	Stead Sec. 9, tp. 17, rge. 8, EPM
Sept. 18	White Poplar	Gull Lake Sec. 26, tp. 16, rge. 7, EPM
Sept. 18	White Poplar	Grand Marais Sec. 16, tp. 18, rge. 7, EPM
Sept. 18	White Poplar	Belair Sec. 9, tp. 19, rge. 7, EPM
Sept. 18	White Poplar	Hillside Sec. 28, tp. 19, rge. 7, EPM
Sept. 25	White Poplar	Marchand Sec. 32, tp. 5, rge. 9, EPM
Sept. 25	White Poplar	Marchand Sec. 11, tp. 6, rge. 8, EPM
Sept. 25	White Poplar	Marchand Sec. 35, tp. 5, rge. 9, EPM
Sept. 25	White Poplar	Marchand Sec. 35, tp. 5, rge. 9, EPM
Sept. 25	White Poplar	Marchand Sec. 32, tp. 5, rge. 9, EPM
Sept. 25	White Poplar	Marchand Sec. 11, tp. 6, rge. 8, EPM
Nov. 8	White Poplar	Stuartburn Sec. 1, tp. 2, rge. 6, EPM
Nov. 8	White Poplar	Piney Sec. 33, tp. 1, rge. 11, EPM

The above negative reports were obtained during forest tent caterpillar egg band surveys.

3. Western District of Manitoba - 1951

by

J. B. Martin

(a) Introduction

Forest Insect Survey sampling and observations were conducted throughout the Western Forest District of Manitoba from May 15 to September 26.

From May 15 to July 13 a survey was made of the Riding Mountain National Park and Duck Mountain and Porcupine Forest reserves. This survey was mainly to detect and estimate the damage caused by the American poplar beetle, *Phytodecta americana* Schffr., the large aspen tortrix, *Archips conflictana* (Wlk.), the spruce budworm, *Choristoneura fumiferana* (Clem.) and the jack-pine budworm, *Choristoneura* sp. Co-operators were contacted during this period in an effort to increase the quality and quantity of their samples. A trip was made by tractor-train into otherwise inaccessible portions of the Duck Mountain Forest Reserve on July 9 and 10. This trip was made possible by L. W. Mooers, a forest engineer with the Manitoba Forest Service.

From July 14 to August 15 a survey was carried out for the balsam-fir sawfly, *Neodiprion abietis* (Harr.). The three forest reserves were sampled and examined extensively for this insect. In 1949 and 1950 there was extensive defoliation of white spruce by the balsam-fir sawfly. In 1951 populations of this insect were so low that no defoliation could be detected. From August 7 to August 9 the northern part of Lake Winnipegosis was covered by a Manitoba Forest Service launch.

From July 14 to September 26 the main work was larch sawfly sampling, survey of defoliation, and mass collections of cocoons. Samples were taken from every larch swamp available. Twenty-five swamps were selected as permanent larch sawfly check points and were marked for continuous study. These swamps were sampled and infestation reports were prepared for each.

In addition mass collections of cocoons were taken from these locations for rearing and dissection. Mass collections of larch sawfly larvae were also made at weekly intervals and sent to J. Muldrew for study.

On October 10 a trip was made to the Spruce Woods Forest Reserve to set up plots for pitch nodule maker studies.

October 15 to 18 inclusive was spent with L. Warren collecting Hypomolyx larvae in Riding Mountain National Park.

November 7 and 8 were spent in the Whiteshell Forest Reserve with J. Lawrence surveying for forest tent caterpillar egg bands.

(b) Insect Conditions

(1) Larch sawfly, Pristiphora erichsonii (Htg.). The larch sawfly was present in every tamarack swamp with the exception of one, examined in the Western Forest District of Manitoba in 1951. Twenty-three stands were examined, sampled, reported on, and a mass collection of cocoons was obtained from each for further study. These stands were marked so that they could be examined each year.

The defoliation of tamarack by the larch sawfly was more severe than in 1950. It was severe in all parts of the District except the central portion of Riding Mountain National Park, where the tamarack growth was markedly retarded and the defoliation was light.

The defoliation in Riding Mountain National Park was severe in the western section of the Park, light in the Central section, and severe in the southern and eastern sections. Two tamarack stands reported on in 1950 in Riding Mountain National Park (13 miles north of Wasagaming, sec. 27, tp. 21, rge. 19, W.P. mer., and 5 miles north of Wasagaming, sec. 16, tp.20, rge. 19, W.P. mer.) again showed only light defoliation. Two additional stands nearby also showed very light defoliation this year. High water, thought to be the cause of high sawfly mortality in 1950, was not present in 1951. The writer now suspects that retarded growth presented the adult sawflies with insufficient tips on which to lay their eggs and so lessened the severity of the attack.

In the Duck Mountain Forest Reserve the defoliation was severe in all sections. Of 11 stands checked in this Reserve, in only one stand was the defoliation as low as 45 per cent. Defoliation for the Reserve averaged 85 per cent.

The defoliation in the Porcupine Forest Reserve was severe in all locations examined. In the eastern portion of this Reserve the tamarack growth was poor.

Larvae of the larch sawfly were first detected June 29 and some were still being found on September 15. In all areas examined small mammals were active predators of the sawfly cocoons. No area was found where these predators were not abundant. Two hundred and fifty larch sawfly cocoons were collected from each stand examined.

(ii) Large aspen tortrix, *Archips conflictana* (Wlk.). The large aspen tortrix was widely distributed throughout the Western District except Riding Mountain National Park where no specimens were found.

Defoliation was negligible in all cases where it was present. The first larvae of this species were found May 23 and the last on June 5.

(iii) American poplar beetle, *Phytodecta americana* Schffr. The American poplar beetle was found throughout the Western District in 1951 but caused less defoliation than it did in 1950. Defoliation was very light except for two areas in the Duck Mountain Forest Reserve. Approximately 15 per cent defoliation was noted near Garland in secs. 20, 24, and 27, tp. 30, rge. 25, W.P. mer., and in the Grandview area, sec. 18, tp. 28, rge. 25, W.P. mer., and sec. 13, tp. 27, rge. 24, W.P. mer.

(iv) Jack-pine budworm, *Choristoneura* sp. Jack-pine budworm was found near Cowan, Manitoba, and at one location in the central part of Riding Mountain National Park in 1951. Defoliation by this insect was very light at Cowan and nil in the Park. The infestation at Cowan was located in tps. 35, and 36, rge. 23, W.P. mer. Defoliation ranged from a trace to about 5 per cent.

Counts of budworm present on 10, 18? tips were made wherever budworm was found. The counts were positive in only 3 cases. The results of the positive counts are shown below:

July 11 Cowan, Man., sec.26, tp. 35, rge. 23, W.P. mer. 4 budworm
July 11 Cowan, Man., sec. 26, tp. 35, rge. 23, W.P. mer. 2 budworm
July 13 Cowan, Man., sec. 35, tp. 35, rge. 23, W.P. mer. 1 budworm

The other 11 counts were negative.

The first jack-pine budworm larva was collected July 11 and the last July 27. The first pupa was collected July 12 and the last July 13.

(v) Spruce budworm, *Choristoneura fumiferana* (Clem.). The spruce budworm was found from Range 17 to 27 and from Township 19 to 44. Only a few scattered larvae were found and defoliation by spruce budworm was very light. Ornamental spruce in the Town of Swan River, sec. 21, tp. 36, rge. 27, W.P. mer., were defoliated about 5 per cent.

Larvae were found from June 1 to July.17. Pupae were found from July 4 to July 17.

The spruce needleworm, *Dioryctria reniculella* (Grt.) was found in association with the spruce budworm in Riding Mountain National Park and in the Duck Mountain Forest Reserve. It was more abundant than in 1950 but population levels were still too low to cause noticeable damage.

(vi) Balsam-fir sawfly, *Neodiprion abietis* (Harr.). The balsam-fir sawfly decreased markedly in distribution in 1951 and caused much less defoliation where found, than it did in 1950.

This sawfly was detected only in the eastern and central portions of Riding Mountain National Park (tps. 20, 21, and 22, rges. 19 and 20, W.P. mer.). Defoliation averaged only about three per cent in this area.

The area of severe infestation in 1950, five miles northwest of Wasagaming (sec. 16, tp. 20, rge. 19, W.P. mer.) was free of the balsam-fir sawfly in 1951.

Larvae were found from June 22 to July 26.

(vii) Grey willow leaf beetle, *Galerucella decora* (Say). The grey willow leaf beetle was generally distributed throughout western Manitoba in 1951. It was not as abundant as in 1950. From two to five per cent of the willow foliage was skeletonized. The only place where more damage was noted was on Spruce Island, Lake Winnipegosis, sec. 10, tp. 47, rge. 22, W.P. mer., where ten per cent of the willow foliage was skeletonized.

Larvae were found from July 17 to August 18. Adults were found from May 18 to September 22.

(viii) White-pine weevil, *Pissodes strobi* (Peck). The white-pine weevil, while still active, was less prevalent in Riding Mountain National Park in 1951 than it was in 1950. Very few young spruce suffered new attack in 1951 from five to nineteen miles north of Wasagaming. White-pine weevil was also present in the northeast corner of the Duck Mountain Forest Reserve, near Cowan. This infestation was found on young jack-pine. White-pine weevil damage was again reported on plantation stock at Wasagaming, sec. 34, tp. 19, rge. 18, W.P. mer.

(ix) Pitch nodule maker, *Petrova albicapitana* (Busck). The pitch nodule maker was found in the Riding Mountain National Park and in the Duck Mountain and Porcupine Forest reserves in 1951, but no change from 1950's distribution or status was detected.

The central and eastern portions of the National Park were again the areas of most severe infestation. In tp. 19, rge. 17, W.P. mer., about six to eight per cent of the young jack-pine had nodules.

In the central part of the Duck Mountains and near Cowan nodules were seen on a few young jack-pine. In the Porcupine Forest Reserve, nodules were found near Birch River and Bowsman but damage caused by this insect was very light.

(x) A tent caterpillar, *Malacosoma lutescens* (N. & D.). Three tents of this caterpillar were found June 21, 1951 on willow near Ochre River, (sec. 34, tp. 24, rge. 16, W.P. mer.) but damage was negligible. This insect was found nowhere else in the Western District of Manitoba.

(xi) Ugly-nest caterpillar, *Archips cerasivorana* (Fitch). The ugly-nest caterpillar was generally distributed in western Manitoba. Usually only one or two tents were found in each location. In only one place was significant damage found. This was near Novra, (sec. 8,) tp. 40, rge. 26, W.P. mer.) where 45 tents were found in a one-half acre plot.

(xii) Red-pine sawfly, *Neodiprion nanulus* Schedl. The red-pine sawfly caused no appreciable damamge in the Western District. One larvae was found near Cowan, Manitoba (sec. 35, tp. 35, rge. 23, W.P. mer.) on July 11, 1951.

(xiii) Yellow-headed spruce sawfly, *Pikonema alaskensis* (Roh.). The yellow-headed spruce sawfly was found from Wasagaming to Mafeking. Very low populations of this insect were found in all parts of the Riding Mountain National Park, Duck Mountain and Porcupine Forest reserves, but in all cases damage caused by this insect was too light to be noticeable. No yellow-headed spruce sawfly were found in 1951 in the nursery at Birch River where in 1950 the defoliation was about two per cent.

The first larva was collected July 6, and the last September 14.

(xiv) Spotless fall webworm, *Hyphantria texter* Harr. The spotless fall webworm was less abundant than in 1950. Only one tree was found to be attacked by this webworm. This was at Spruce Island, Manitoba (sec. 10, tp. 47, rge. 22, W.P. mer.). Manitoba maple was the tree species attacked and it was defoliated about five per cent.

(xv) Green-headed spruce sawfly, *Pikonema dimmockii* (Cress.). The green-headed spruce sawfly was more abundant and more widespread in 1951 than in 1950. It was found throughout the entire Western District, usually with the yellow-headed spruce sawfly, but caused very light defoliation. Twenty-three samples containing this sawfly were obtained but an average of less than two sawfly were contained in each sample.

Larvae were found from June 23 to August 13.

(xvi) Aspen blotch miner, *Lithocolletis tremuloidiella* (Braun). The aspen blotch miner was again found in most poplar stands in western Manitoba. It was more abundant than in 1950 but damage by this insect was still light.

(xvii) Poplar vagabond gall aphid, *Mordwilkoja vagabunda* (Walsh). The poplar vagabond gall aphid decreased in western Manitoba in 1951. It was still found in every area but it was not as intense as in 1950. It caused no appreciable damage.

(xviii) Striped alder sawfly, *Hemichroa crocea* (Fourc.). The striped alder sawfly was found in northern Riding Mountain National Park in secs. 6 and 7, tp. 23, rge. 20, W.P. mer., and secs. 24, 25, and 36, tp. 22, rge. 21, W.P. mer.

Defoliation of alder here ranged from 40 to 99 per cent and averaged 70 per cent.

(xix) Black-headed budworm, *Acleris variana* (Fern.). The black-headed budworm was found in all parts of Riding Mountain National Park and in the Duck Mountain Forest Reserve near Garland and Durban. It caused no discernable defoliation. Larvae were found from June 12 to July 28.

(xx) Birch sawfly, *Arge pectoralis* (Leach); a round-headed borer, *Monochamus* sp.; a pine scale, *Toumeyella* sp.; forest tent caterpillar, *Malacosoma disstria* Hbn. None of these species was found in the Western Forest District of Manitoba in 1951.

(c) Special Investigations

(i) Larch sawfly cocoon collections. Mass collections of larch sawfly cocoons were made during August and September. These collections were made at the following points:

Place	Sec.	Tp.	Rge.	Mer.	No. Collected
Rossburn, Manitoba.	12	22	25	W.P.	395
Wasagaming, Manitoba.	15	20	19	W.P.	254
Wasagaming, Manitoba.	8	20	17	W.P.	280
Wasagaming, Manitoba.	32	19	16	W.P.	260
Wasagaming, Manitoba.	13	21	19	W.P.	260
Wasagaming, Manitoba.	15	21	21	W.P.	260
Rossburn, Manitoba.	1	22	25	W.P.	260
Wasagaming, Manitoba.	15	21	19	W.P.	260
Wasagaming, Manitoba.	5	22	19	W.P.	260
Durban, Manitoba.	24	33	28	W.P.	290
Cowan, Manitoba.	16	35	26	W.P.	260
Sclater, Manitoba.	28	34	22	W.P.	260
Garland, Manitoba.	33	30	24	W.P.	260
Garland, Manitoba.	10	31	23	W.P.	260
Garland, Manitoba.	21	30	25	W.P.	260
Grandview, Manitoba.	25	27	29	W.P.	270
Cowan, Manitoba.	14	35	23	W.P.	260
Minnitonas, Manitoba.	20	33	25	W.P.	260
Madge Lake, Manitoba.	11	30	29	W.P.	250
Bield, Manitoba.	22	26	26	W.P.	250
Boggy Creek, Manitoba.	28	30	28	W.P.	262
Mafeking, Manitoba.	7	41	25	W.P.	261
Birch River, Manitoba.	22	39	26	W.P.	30
Mafeking, Manitoba.	9	46	25	W.P.	262

(ii) Permanent sample stations. Nine permanent sample stations were established in 1951. They were located as follows:

District	Sec.	Tp.	Rge.	Mer.
Riding Mountain National Park	1	22	25	W.P.
Riding Mountain National Park	24	22	25	W.P.
Duck Mountain Forest Reserve	28	30	28	W.P.
Duck Mountain Forest Reserve	33	30	24	W.P.
Duck Mountain Forest Reserve	28	34	22	W.P.
Duck Mountain Forest Reserve	11	30	29	W.P.
Duck Mountain Forest Reserve	10	31	23	W.P.
Duck Mountain Forest Reserve	16	30	25	W.P.
Duck Mountain Forest Reserve	20	33	25	W.P.

There are now 47 sample stations in western Manitoba located as follows:

Riding Mountain National Park	-	21	stations
Duck Mountain Forest Reserve	-	23	stations
Porcupine Forest Reserve	-	3	stations

(iii) Larch sawfly larval collections. During the larch sawfly larva season, 500 larvae per week were collected. These were sent to the field camp at Red Rock Lake, Manitoba, for study by J. Muldrew of the Winnipeg Laboratory.

(iv) Pitch nodule maker. A survey was made of jack-pine in the Spruce Woods Forest Reserve on October 10, with W. Turnock. The survey was to determine the incidence of pitch pine nodule maker in selected stands.

(v) Hypomolyx investigations. A trip was made with L. Warren to Riding Mountain National Park, October 15 - 18 to collect *Hypomolyx* larvae.

(vi) Forest tent caterpillar egg survey. On November 7 and 8 a trip was made with J. Lawrence to the White-shell Forest Reserve to make a survey for forest tent caterpillar egg bands.

(d) Negative Reports

Date	Host	Location	Sec.	Tp.	Rge.	Mer.
May 17	Balsam fir	Garland, Man.	6	31	23	W.P.
May 25	W. Spruce	Minnitonas, Man.	16	33	25	W.P.
May 25	W. Spruce	Minnitonas, Man.	4	33	25	W.P.
July 19	W. Poplar	Birch River, Man.	16	39	26	W.P.
July 24	W. Spruce	Wasagaming, Man.	24	21	19	W.P.
July 27	B. Spruce	Wasagaming, Man.	34	19-	17	W.P.
July 27	B. Spruce	Wasagaming, Man.	30	19	17	W.P.
July 28	W. Poplar	Wasagaming, Man.	33	19	18	W.P.
Aug. 9	Balsam fir	Lake Winnipegosis, Man.	26	43	24	W.P.
Aug. 17	B. Spruse	Boggy Creek, Man.	28	30	28	W.P.

(d) Negative Reports - Cont'd

Date	Host	Location	Sec.	Tp.	Rge.	Mer.
Aug. 25	W. Poplar	Mafeking, Man.	22	43	26	W.P.
Aug. 27	B. Spruce	Singoosh Lake, Man.	33	30	24	W.P.
Sept. 21	Jack pine	Cowan, Man.	15	36	23	W.P.
Sept. 24	Jack pine	Novra, Man.	35	41	26	W.P.
Sept. 24	W. Poplar	Mafeking, Man.	23	42	26	W.P.
Sept. 24	Willow	Bellsite, Man.	2	42	26	W.P.
Sept. 24	W. Birch	Bellsite, Man.	2	42	26	W.P.

(e) Personnel Contacted

Name	Position	Address	No. of Contacts	Sampling Demonstr
J. Allan	Supervising Warden	Wasagaming	4	No
E.A. Koons	District Super.	Dauphin	4	No
J. Koke	Ass't.Dist.Supt.	Dauphin	7	Yes
A. Machuk	Forest Ranger	Garland	2	No
G. Palmer	Forest Ranger	Bield	3	Yes
W. Mawdsley	Forest Ranger	Grandview	4	Yes
C. Lintott	Forest Ranger	Winnipegosis	2	No
G. Bates	Snr. Ranger	Swan River	5	Yes
H. Krantz	Game Guardian	Swan River	1	Yes
C. Dowson	Forest Ranger	Minnitonas	4	Yes
W. Erlanson *	Forest Ranger	Minnitonas	1	No
M.T. Majure	Forest Ranger	Durban	5	Yes
J.V. Norman	Forest Ranger	Birch River	2	Yes
D. Hanley *	Forest Ranger	Baden	1	No
W. Presloski	Forest Ranger	Mafeking	6	No
F.W. McKelvey	Towerman	Cowan	2	Yes
W. Armstrong	Park Warden	Wasagaming	4	No
J.C. Goodison	For. Engineer	Wasagaming	1	No
J. Hyska	Park Warden	Rossburn	2	Yes
V. Patterson	For.Insect Rgr.	Indian Head, Sask.	1	No
D. Binkley	Park Warden	Elphinstone	1	No
A. Young	Park Warden	Dauphin	1	Yes
A. Lundy	Game Guardian	Pine River	1	No
M. Horochowuk	Wolf Hunter	Pine River	1	No

(e) Personnel Contacted (concl'd)

Name	Position	Address	No. of Contacts	Sampling Demonst
J. Heron	Field Officer	Madge Lake, Sask.	1	No
L.W. Mooers	Forest Engr.	Dauphin	2	Yes
R. McKinnon	Park Warden	Oatseed	1	No
B. Denby	Launch Capt.	Winnipegosis	1	Yes
R. Pike	Forest Techn.	Wasagaming	1	No
S. Rowe	Forest Techn.	Wasagaming	1	No

* Retired or transferred.

4. Northern District of Manitoba - 1951

by

G. T. Lalor

(a) Introduction

On April 17 G. Lalor in company with B. McLeod, left Winnipeg and arrived at The Pas on April 18. Between April 18 and April 27 clearing and burning operations on the Ranger Cabin lot were carried out.

On April 27, V. Hildahl and M. Pratt arrived and construction on the Ranger Cabin was commenced. Between that date and May 18 cabin construction work was carried on. Hildahl and Pratt left The Pas on May 11 and McLeod on May 14. During that period, large aspen tortrix investigations in the Wanless area were carried out by the writer. These investigations are described in detail under the heading "Special Investigations".

Between May 18 and May 29, a preliminary insect survey was made of the Clearwater Lake area. However, heavy rain and snowfall made work extremely difficult and so as an alternative, a road was cut from the highway to the cabin. A stretch of road ten chains in length was cleared between the Ranger Cabin and the Clearwater Highway and some gravel was laid. During that period some samples were taken from broadleaf trees but insect activity was limited.

On May 29 R. Prentice of the Forest Insect Laboratory in Winnipeg arrived at The Pas and between that date and June 1 the writer assisted him in large aspen tortrix investigations. Between June 1 and June 11 a preliminary survey was made of the area between Freshford (sec. 15, tp. 54, rge. 26, W.P. mer.) and Baker's Narrows (sec. 5, tp. 66, rge. 28, W.P. mer.). Bad weather, however, hampered this survey considerably and time which could not be spent in the field was devoted to constructing a pier and cutting fire-wood for the Ranger Cabin.

On June 12 the writer in company with Eldon Hood of the Manitoba Forest Service conducted a forest insect survey of the north shoreline of Clearwater Lake. Motor boat transportation was provided by the Manitoba Forest Service.

On June 13 the writer, in company with R. Gow, Manitoba Forest Service, and using gas car transportation, left The Pas for Cormorant Lake. The area between The Pas (sec. 15, tp. 54, rge. 26, W.P. mer.) and Cormorant (sec. 30, tp. 60, rge. 21, W.P. mer.) was systematically sampled. On arrival at Cormorant Lake the writer assisted members of the Manitoba Forest Service in fire fighting operations in the Cormorant Lake area, and on June 14 began an insect survey of the shorelines of the lake. During the survey, accommodation and transportation were provided by Lorne Meyers, timber operator. The writer returned to The Pas on June 15.

On June 19 the writer, with the assistance of Eldon Hood, built a road culvert at the Insect Ranger Cabin. Between June 19 and June 23 the area between Baker's Narrows (sec. 5, tp. 66, rge. 28, W.P. mer.) and Flin Flon (sec. 6, tp. 67, rge. 29, W.P. mer.) was surveyed. During this survey the writer, accompanied by R. McKeller, forest ranger for the Manitoba Forest Service, travelled the shorelines of Athapapuskow Lake as far southwest as Millwater (sec. 3, tp. 65, rge. 28, W.P. mer.). The area between Cranberry Portage (sec.6, tp. 65, rge. 26, W.P. mer.) and Sherridon (Grid 43-343) was also surveyed. During this survey the writer was assisted by W. Erlendson of the Manitoba Forest Service at Sherridon.

Between June 23 and July 1 adverse weather made field work extremely difficult but some samples were taken in the Clearwater area. The writer continued with the construction of the pier at the Ranger Cabin and some road work was carried out. On July 3 arrangements were made with the Manitoba Forest Service for air transportation to Wabowden for the purpose of conducting a forest insect survey along the Hudson Bay Railway line. During July 3, 4, and 5, while awaiting air transportation the writermsurveyed the area between Freshford (sec. 20, tp. 54, rge. 26, W.P. mer.) and Wanless (sec. 30, tp. 59, rge. 26, W.P. mer.). On July 6 the writer left The Pas by aircraft for Wabowden but owing to adverse weather the flight was forced to return to The Pas. On July 7 the writer again left The Pas for Wabowden by train and between that date and July 21 a forest insect survey was carried out along the Hudson Bay line between The Pas (sec.15, tp.54, rge. 26, W.P. mer.) and Kettle Rapids (lat. 56°24"N., Long. 94°35" N). Between July 7 and July 10, the area surrounding Wabowden (sec. 27, tp. 68, rge. 8, W.P. mer.) was sampled and a permanent sampling station established. Accommodation was provided by W. Hislop of the Manitoba Forest Service. From Wabowden the writer travelled to Thicket Portage (sec. 15, tp. 73, rge. 2, W.P. mer.) and commenced sampling in that area. Accommodation and meals were provided by G. Evans of the Manitoba Forest Service. Using a gas car provided by the Hudson Bay Railway, the writer travelled to Pikwitonei where some sampling was carried out and a sampling station established. On July 12 in company with two Cree Indians, Jacob Moose and Elijah Tobacco, the author left Thicket Portage by canoe. During this survey the area surrounding Landing Lake (sec. 23, tp. 72, rge. 1, E.P. mer.) Sabomin Lake (sec. 18, tp. 72, rge. 1, W.P. mer.) and Sipiwesk area (sec. 12, tp. 72, rge. 1, E.P. mer.) on the Nelson River were sampled. This survey was concluded on July 16. Transportation for this survey was provided by M. Kennedy of The Pas Lumber Company. On July 17 the writer left Thicket Portage for Gillam (Lat. 56° 21" N., Long. 94° 38") and on July 18 began a survey of the area. Using gas car transportation, a forest insect survey was conducted of the area as far north as Kettle Rapids (Lat. 56° 24" N., Long. 94° 35" W.). Sampling stations were also established in the area. On July 20 the writer left Gillam for The Pas, arriving on July 21.

On July 23 and July 24 the area around the Big Eddy Settlement north of The Pas was surveyed. On July 25 the writer in company with M. Gautier, left for Sturgeon Landing. They travelled by motor vehicle from The Pas to Goose Lake (sec. 31, tp. 62, rge. 28, W.P. mer.) and from there by canoe to Sturgeon Landing (sec. 13, tp. 61, rge. 30, W.P. mer.). A forest insect survey of the area was conducted after which the writer returned to The Pas.

From July 30 to August 5 the area between "The Bog" (sec. 28, tp. 48, rge. 24, W.P. mer.) and The Pas was re-examined for insect activity. This included a survey of the Halcrow Lake (sec. 4, tp. 56, rge. 26, W.P. mer.) area. On August 6, 7 and 8, a survey of the Amisk Lake area was carried out. The writer left The Pas on August 6 and arrived at Denare Beach (sec. 33, tp.65, rge. 1, W. 2nd mer.) on the same day. The area between Flin Flon (sec. 30, tp. 66, rge. 27, W.P. mer.) , Denare Beach (sec. 33, tp. 65, rge. 1, W. 2nd mer.) and south to sec. 6, tp. 63, rge. 2, W. 2nd mer., was surveyed. The writer returned to The Pas on August 8.

Between August 9 and August 15, although greatly hampered by motor vehicle breakdown, the writer re-sampled the area between The Pas (sec. 15, tp. 54, rge. 26, W.P. mer.) and Wanless (sec. 25, tp. 60, rge. 27, W.P. mer.).

On August 16, E. R. Lejeune, Officer-in-Charge of the Forest Insect Laboratory, Winnipeg, arrived at The Pas. From that date to August 18 the writer accompanied him on a tour of The Pas, Cranberry Portage, and Flin Flon areas looking into district problems and contacting Forest Service personnel.

Between August 22 and August 25 the writer, in company with R. Gow of the Manitoba Forest Service travelled to Cormorant by gas car and between that date and August 26 larch sawfly reports were made in the area. On August 28 and 29 larch sawfly reports were made in the Clearwater area. Between September 1 and September 4, survey work was temporarily discontinued because of transportation difficulties. Brush clearing at the Ranger Cabin was carried out. On September 6 L. Warren of the Forest Insect Laboratory, Winnipeg, L. Bartlett, and R. Whitney of the Forest Pathology Laboratory, Saskatoon, Saskatchewan, arrived and from September 6 to 8 they were assisted in their investigations.

On September 9 the writer left The Pas and travelled to Cranberry Portage, Flin Flon, and Amisk Lake for the purpose of making mass collections of larch sawfly cocoons and completing larch sawfly reports. On September 13 the writer's vehicle was taken to The Pas for further repairs and as a result no further field work could be carried out. However, more clearing was done at the Insect Ranger Cabin. Between September 21 and October 5, the writer devoted his time to contacting forest service personnel. On October 5 the writer left The Pas and arrived in Winnipeg on October 6.

(b) Insect Conditions

(i) Larch sawfly, *Pristiphora erichsonii* (Htg.). During the summer of 1951 damage to tamarack in the Northern District of Manitoba as a result of the larch sawfly was again widespread. Although there was a slight increase in defoliation and insect populations in areas previously lightly defoliated there appeared to be considerable lessening in areas that had been heavily defoliated. In these previously heavily populated areas there also appeared to be a sharp increase in parasitism of larvae and in predation of cocoons by mice. The feeding period was shorter than during 1950. The first larvae were observed on July 3 and feeding was over by the end of August. The short feeding period gave the trees a better chance to refoliate.

After the first sample of larch sawfly larvae had been found (July 3) at Clearwater Lake (sec. 4, tp. 54, rge. 25, W.P. mer.), a preliminary survey of the area south of The Pas was begun. Samples were taken at Freshford (sec. 15, tp. 55, rge. 26, W.P. mer.) and at Westray (sec. 2, tp. 54, rge. 17, W.P. mer.). Although numerous curled tips and young larvae were observed, defoliation had not yet become apparent. The area was again visited between July 30 and August 3 and feeding was at that time well advanced. Samples were taken between The Pas and the Overflowing River and defoliation appeared to be less than at the same time in 1950. At Freshford (sec. 20, tp. 54, rge. 26, W.P. mer.) insect populations were high and defoliation was 65 per cent. Farther south in the area known as "The Bog" defoliation was severe ranging from 50 to 90 per cent. Samples were made in sec. 32, tp. 49, rge. 25, W.P. mer., and sec. 1, tp. 51, rge. 26, W.P. mer.

North of The Pas in the Big Eddy, Prospector, and Clearwater areas, the preliminary survey made during early July showed heavy insect populations and promise of severe defoliation of tamarack. At that time, samples were made at the following points:

Clearwater Lake	sec. 4,	tp. 54,	rge. 25,	W.P.	mer.
Clearwater Lake	sec.10,	tp. 58,	rge. 24,	W.P.	mer.
Clearwater Lake	sec.35,	tp. 57,	rge. 26,	W.P.	mer.
Prospector	sec.20,	tp. 54,	rge. 26,	W.P.	mer.
Prospector	sec. 9,	tp. 54,	rge. 26,	W.P.	mer.
Big Eddy	sec.19,	tp. 56,	rge. 26,	W.P.	mer.

The above points were re-inspected during late July and early August and defoliation ranged from 60 to 80 per cent.

From July 7 to July 20 a survey was conducted of the area along the Hudson Bay line as far north as Kettle Rapids. Larvae of the larch sawfly were found at all points inspected. Insect populations were generally less than the more southerly areas and at that time severe defoliation was observed at only two points: Thicket Portage (sec. 11, tp. 73, rge. 2, W.P. mer.) and at Long Portage on the Nelson River (sec. 12, tp. 72, rge. 1, W.P. mer.). Points sampled during this survey were as follows:

Cormorant	sec. 30, tp. 60, rge. 21, W.P. mer.
Wabowden	sec. 20, tp. 68, rge. 8, W.P. mer.
Wabowden	sec. 27, tp. 68, rge. 8, W.P. mer.
Bowden Lake	sec. 34, tp. 68, rge. 8, W.P. mer.
Bowden Lake	sec. 34, tp. 68, rge. 8, W.P. mer.
Thicket Portage	ses. 13, tp. 73, rge. 2, E.P. mer.
Landing Lake	sec. 23, tp. 72, rge. 1, E.P. mer.
Sabomin Lake	sec. 23, tp. 72, rge. 2, E.P. mer.
Thicket Portage	sec. 15, tp. 73, rge. 2, E.P. mer.
Pikwitonei	sec. 11, tp. 76, rge. 2, E.P. mer.

The area from Cormorant to Thicket Portage on the Hudson Bay Railway line and south to Norway House was found to be severely defoliated in a later report by R. Ross of the Manitoba Forest Service.

The most northerly point sampled was at Kettle Rapids (Lat. 56° 20", Long. 94° 42". This latitude may be considered the northern boundary of the defoliated area. Although some larvae were observed at that point they were very few in numbers and defoliation was negligible. The general condition of the trees would indicate that there had been no serious infestation during recent years.

Between July 25 and July 27 a survey of the area around Sturgeon Landing in Saskatchewan was carried out. In this area tamarack was sparse but samples were taken at two points; one at Sturgeon Landing (sec. 13, tp. 61, rge. 30, W.P. mer.) and the other on the Goose River in Manitoba (sec. 31, tp. 61, rge. 29, W.P. mer.). Defoliation at these points averaged about 90 per cent.

At Cranberry Portage (sec. 36, tp. 64, rge. 28, W.P. mer.) defoliation was 50 per cent. In the area surrounding Flin Flon defoliation was generally light to moderate with an occasional tree severely defoliated. At Cuprus Mine (sec. 24, tp. 66, rge. 29, W.P. mer.) defoliation was light. Small isolated stands of tamarack in the Amisk Lake area of Saskatchewan were more severely defoliated this year than they were in 1950. Defoliation in that area averaged 40 per cent. From Cranberry Portage north to Lynn Lake tamarack stands were reported to be moderately defoliated, by R. Rose.

At one point along the south shore of Clearwater Lake, between sec. 4, tp. 54, rge 25, W.P. mer., and Orak Siding (sec. 33, tp. 57, rge. 25, W.P. mer.) it was noted that open-growing tamarack had not refoliated.

(ii) Yellow-headed spruce sawfly, *Pikonema alaskensis* (Roh.). Green-headed spruce sawfly, *Pikonema dimmockii* (Cress.).

These two species were widely distributed through the Northern District of Manitoba in 1951 but damage was extremely light or negligible in all cases. It was also noted that in most cases the two insects were found together.

Samples were made at The Pas in sec. 2, tp. 55, rge. 26, W.P. mer. and sec. 16, tp. 56, rge. 26, W.P. mer. South of The Pas insects were found at Halcrow Lake (sec. 4, tp. 56, rge. 26, W.P. mer.) and Freshford (sec. 20, tp. 54, rge. 26, W.P. mer.) At these points populations were very low and showed no increase over 1950.

In the Clearwater area north of The Pas samples were made at the following points:

Readers Lake	sec. 11, tp. 57, rge. 26, W.P. mer.
Readers Lake	sec. 30, tp. 56, rge. 26, W.P. mer.
Readers Creek	sec. 19, tp. 56, rge. 26, W.P. mer.
Prospector	sec. 9, tp. 54, rge. 26, W.P. mer.
Clearwater Lake	sec. 10, tp. 58, rge. 24, W.P. mer.
Orak Siding	sec. 33, tp. 57, rge. 25, W.P. mer.
Big Eddy Settlement	sec. 36, tp. 56, rge. 27, W.P. mer.

At all these points of inspection defoliation was negligible and only a limited number of larvae were found.

In the Wabowden area, on the Hudson Bay line, three samples of yellow-headed and green-headed spruce sawflies were taken. One sample was collected at each of the following points: Wabowden (sec. 20, tp. 68, rge. 8, W.P. mer.); Bowden Lake (sec. 20, tp. 68, rge. 8, W.P. mer.); and Bucko Lake (sec. 18, tp. 68, rge. 8, W.P. mer.).

These insects were also present at Sipiwesk Lake (sec. 9, tp. 72, rge. 2, W.P. mer.) and Sabomin Lake (sec. 33, tp. 72, rge. 2, W.P. mer.) in the Nelson River area. Samples were taken at Thicket Portage (sec. 15, tp. 72, rge. 2, W.P. mer.), Landing Lake (sec. 10, tp. 73, rge. 2, W.P. mer.), and east of Thicket Portage at Wintering Lake (sec. 22, tp. 73, rge. 2, W.P. mer.). The most northerly point of inspection was at Pikwitonei (sec. 11, tp. 72, rge. 4, E.P. mer.).

One sample containing the two species was taken at Wanless (sec. 12, tp. 60, rge. 27, W.P. mer.

At Denare Beach (sec. 33, tp. 65, rge. 1, W. 2nd mer.) in the Amisk Lake area of Saskatchewan, larvae were found in small numbers and there was no defoliation. Farther south in the Sturgeon Landing and Goose River areas, samples were taken at sec. 13, tp. 61, rge. 30, W.P. mer., and sec. 31, tp. 61, rge. 29, W.P. mer.

(iii) Balsam-fir sawfly, *Neodiprion abietis* (Harr.). This insect was found at Gillam (Lat. 56°20", Long. 94°42") during a survey of the Hudson Bay Railway line between July 7 and July 20. The sample was taken from stunted black spruce growing on the fringe of a jack-pine stand. Defoliation at that time was light. The only other sample of balsam-fir sawfly was taken at Goose River (sec. 10, tp. 62, rge. 29, W.P. mer.). At this point defoliation was also light.

(iv) Birch sawfly, *Arge pectoralis* (Leach.). One sample of the birch sawfly was taken in the Northern District of Manitoba during the 1951 season. Open-growing birch at Prospector (sec. 33, tp. 57, rge. 26, W.P. mer.) was sampled and a few larvae obtained. There was no noticeable defoliation. Light defoliation to alder as a result of birch sawfly feeding was observed at Amisk Lake, Saskatchewan (sec. 21, tp. 65, rge. 1, W. 2nd mer.).

(v) Forest tent caterpillar, *Malacosoma disstria* Hbn. This insect was found at one point in the Northern District of Manitoba in 1951. A sample was taken from white poplar at Reader's Lake (sec. 11, tp. 57, rge. 26, W.P. mer.) but no damage was apparent. At Sturgeon Landing in Saskatchewan (sec. 13, tp. 61, rge. 30, W.P. mer.) several adults were found in the vicinity of a stand of white poplar.

(vi) Western tent caterpillar, Malacosoma pluviale (Dyar). One sample of this insect was taken on birch at Cranberry Portage (sec. 31, tp. 64, rge. 27, W.P. mer.). This sample was taken by H. Gill, Manitoba Forest Service, and was the only one taken in the Northern District during 1951.

(vii) Pitch nodule maker, Petrova albicapitana (Busck). This insect was found in most areas in the Northern District of Manitoba in 1951

Samples were taken at the following points surrounding The Pas:

sec. 35, tp. 61, rge. 27, W.P. mer.
sec. 14, tp. 62, rge. 27, W.P. mer.
sec. 3, tp. 58, rge. 24, W.P. mer.
sec. 4, tp. 56, rge. 26, W.P. mer.
sec. 8, tp. 53, rge. 27, W.P. mer.

At these points 20 per cent of the young jack-pine was found to be affected.

South of The Pas in the Freshford, Westray and "Bog" areas young open-growing jack-pine were examined. At Freshford (sec. 28, tp. 54, rge. 26, W.P. mer., and sec. 20, tp. 54, rge. 26, W.P. mer.) 80 per cent of the trees were affected while in sec. 20, tp. 53, rge. 27, W.P. mer. and sec. 9, tp. 51, rge. 26, W.P. mer., only 20 per cent of growth showed signs of the presence of this insect.

The most heavily infested area was around Clearwater Lake and Radio Range. This area was burnt-over several years ago and now contains vast stands of jack-pine regeneration. In secs. 32, and 35, tp. 57, rge. 25, W.P. mer., 20 to 30 per cent of young jack-pine growth was affected. In secs. 2 and 15, tp. 57, rge. 26, W.P. mer., nodules were found on 80 per cent of the trees.

In the area surrounding Reader's Lake samples were taken in secs. 19, and 31, tp. 56, rge. 26, W.P. mer., and secs. 11, and 20, tp. 57, rge. 26, W.P. mer. At these points 20 per cent of trees were affected. Deformed trees were numerous also.

A large portion of the area previously severely infested around Rocky Lake west of Wanless has now been burned and turned into agricultural land. Samples were taken in sec. 5, tp. 59, rge. 26, W.P. mer., sec. 10, tp. 60, rge. 27, W.P. mer., and sec. 13, tp. 60, rge.26, W.P. mer. At these points between 10 and 30 per cent of the young growth was affected.

Samples were taken at Cranberry Portage (sec. 31, tp. 64, rge. 26, W.P. mer.) and Mistik Lake (sec. 29, tp. 65, rge. 27, W.P. mer.), but the degree of infestation was negligible.

Samples were taken at Channing (sec. 3, tp. 65, rge. 28, W.P. mer., and sec. 31, tp. 64, rge. 26, W.P. mer.), but nodules were very scarce. Father west at Denare Beach (Amisk Lake - sec. 33, tp. 65, rge. 1, W. 2nd mer.) 40 per cent of the young growth in a stand of jack-pine was found to be affected.

The most northerly point sampled for this insect was Gillam, 150 miles south of Churchill. Although an occasional tree showed signs of pitch nodule maker, damage was negligible.

(viii) Spruce budworm, *Choristoneura fumiferana* (Clem.). Although white spruce in most parts of the Northern District of Manitoba was carefully examined for spruce budworm none wa found.

A number of empty pupal cases were found July 25 on white spruce and balsam fir at Sturgeon Landing (sec. 13, tp. 61, rge. 30, W.P. mer.) in Saskatchewan. The empty pupal cases were later identified as those of the spruce budworm. Damage to both white spruce and balsam fir in the area examined was quite extensive. The damage may have been caused by the spruce budworm.

(ix) Large aspen tortrix, *Archips conflictana* (Wlk.). As in 1950 an extensive area in the Northern District of Manitoba was infested with large aspen tortrix. Although the 1951 survey showed some spread of the infestation, damage was considerably less and insect populations appeared to be on the decline.

In 1950 the southern boundary of the infestation was established at Westray (sec. 31, tp. 53, rge. 26, W.P. mer.). In 1951 samples of this insect were made eight miles father south of this point. The most northerly point of infestation was, as in 1950, at Lynn Lake, 48 minutes north of the 56th Parallel of Latitude. In 1950 the eastern boundary was at Wabowden (sec. 6, tp. 65, rge. 26, W.P. mer.). In 1951 the infestation had spread eastward to the Principal Meridian. The western boundary was established at the Saskatchewan border. Although occasional small "islands" of severe defoliation were observed through the District, there was only one point where damage was heavy. In the area surrounding Sherridon, Grid 43-343, defoliation was severe. At Mistik Lake (sec. 29, tp. 65, rge. 27, W. P. mer.) defoliation was moderate.

Although most samples of large aspen tortrix were taken from white poplar, larvae were also found on black poplar, birch, willow, and alder. Samples were taken in 1951 at the following locations:

Westray and Freshford Areas

Location	Sec.	Tp.	Rge.	Mer.	Tree Species	Defoliation
Halcrow Lake	4	56	26	W.P.	W. Poplar	Light
Regina Lake	3	56	25	W.P.	W. Poplar	Nil
Raoul's Island	13	56	26	W.P.	W. Poplar	Light

The Pas, Big Eddy, and Clearwater Areas

Location	Sec.	Tp.	Rge.	Mer.	Tree Species	Defoliation
The Pas	3	56	26	W.P.	---	---
The Pas	32	64	26	W.P.	Willow	---
The Pas	1	65	26	W.P.	Willow	Nil
Radio Range	2	57	26	W.P.	Choke Cherry	Nil
Radio Range	2	57	26	W.P.	Choke Cherry	Nil
Radio Range	2	57	26	W.P.	Choke Cherry	Nil
The Pas	10	60	27	W.P.	W. Poplar	Light
The Pas	19	56	26	W.P.	W. Poplar	Nil
The Pas	32	58	26	W.P.	W. Poplar	Nil
The Pas	31	56	26	W.P.	W. Poplar	Light
The Pas	23	59	26	W.P.	W. Poplar	Light
The Pas	31	56	26	W.P.	W. Poplar	Nil
rospector	23	57	26	W.P.	W. Poplar	Nil
The Pas	18	56	26	W.P.	W. Poplar	Nil
The Pas	19	56	26	W.P.	---	Light
The Pas	24	60	28	W.P.	---	Light
The Pas	20	57	26	W.P.	---	Nil
The Pas	15	65	27	W.P.	Birch	Nil
The Pas	34	65	28	W.P.	B. Poplar	Nil
The Pas	18	59	25	W.P.	W. Poplar	Light
The Pas	3	58	24	W.P.	W. Poplar	Light

Wanless, and Cranberry Portage Areas

Location	Sec.	Tp.	Rge.	Mer.	Tree Species	Defoliation
Cranberry Portage	32	64	26	W.P.	W. Poplar	Nil
Cranberry Portage	1	65	26	W.P.	W. Poplar	Nil
Cranberry Portage	1	65	26	W.P.	W. Poplar	Nil

Wanless and Cranberry Portage Areas (cont'd)

Location	Sec.	Tp.	Rge.	Mer.	Tree Species	Defoliation
Wanless	--	--	--	--	W. Poplar	Nil
Wanless	--	--	--	--	W. Poplar	Nil
Wanless	--	--	--	--	W. Poplar	Nil
Wanless	--	--	--	--	W. Poplar	Nil
Root Lake	7	58	26	W.P.	W. Poplar	Light
Rocky Lake	10	60	27	W.P.	W. Poplar	Light
Wanless	11	60	27	W.P.	Willow	Nil
Egg Lake	14	62	27	W.P.	W. Poplar	Light
Cranberry Portage	31	64	26	W.P.	W. Poplar	Light
Cranberry Portage	18	64	26	W.P.	W. Poplar	Light
Cranberry Portage	34	65	28	W.P.	W. Poplar	Light
Cranberry Portage	31	64	26	W.P.	Birch	Nil
Cranberry Portage	18	64	26	W.P.	Birch	Light
Cranberry Portage	31	64	26	W.P.	Willow	Light
Cranberry Portage	34	65	28	W.P.	Willow	Light
Atik Tower	35	61	27	W.P.	W. Poplar	Light
Cranberry Portage	31	64	26	W.P.	B. Poplar	Light
Egg Lake	14	62	27	W.P.	W. Poplar	Light
Bond Lake	15	65	27	W.P.	W. Poplar	Light
Wanless	25	60	27	W.P.	Willow	Nil
Wanless	25	60	27	W.P.	W. Poplar	Nil
Cranberry Portage	31	64	26	W.P.	W. Poplar	Light
Wanless	23	61	27	W.P.	W. Poplar	Light
Flin Flon, and Amisk Lake Areas						
Mistik Lake	29	65	27	W.P.	W. Poplar	Moderate
Channing	3	65	28	W.P.	W. Poplar	Light
Neso	30	65	27	W.P.	W. Poplar	Light
Channing	15	65	28	W.P.	W. Poplar	Nil
Channing	18	65	28	W.P.	W. Poplar	Nil
Channing	3	65	28	W.P.	W. Poplar	Light
Channing	15	65	28	W.P.	W. Poplar	Light
Baker's Narrows	5	66	28	W.P.	W. Poplar	Light
Neso Lake	30	65	27	W.P.	W. Poplar	Nil
Amisk Lake	21	65	1	W2nd	W. Poplar	Light

Sherridon Area

Location	Grid	Tree Species	Defol.
Cold Lake	43 - 343	W. Poplar	Mod.
Cold Lake	43 - 343	W. Poplar	Severe
Cold Lake	43 - 343	Willow	Light
Sherridon	43 - 343	W. Poplar	Light
Cold Lake	43 - 343	Alder	Light
Cold Lake	43 - 343	B. Poplar	Light
Sherridon	43 - 343	W. Poplar	Severe
Cold Lake	N.W.1/4 43-343	W. Poplar	Severe
Cold Lake	S.E.1/4 43-343	W. Poplar	Severe

(x) Grey willow leaf beetle, *Galerucella decora* (Say) The grey willow leaf beetle was present at many points in the Northern District of Manitoba and showed a slight increase over 1950. The most southerly point from which samples were taken was Westray (sec. 2, tp. 24, rge. 27, W.P. mer.) and the most northerly at Flin Flon (sec. 20, tp. 66, rge. 30, W.P. mer.). One sample was taken at Cormorant (sec. 21, tp. 61, rge. 23, W.P. mer.). This was the most easterly point where a collection was obtained. Although the infestation may have extended farther west, Goose River (sec. 31, tp. 61, rge. 29, W.P. mer.) was the most westerly point sampled.

Although damage caused by this insect was more apparent than in 1950 and insect populations appeared to be on the increase, severe skeletonizing of willow foliage was observed at only two points. At Halcrow Lake (sec. 4, tp. 56, rge. 26, W.P. mer.) willow growing along the Lake shore was severely skeletonized and damage was estimated at 75 per cent. At Prospector (sec. 33, tp. 57, rge. 26, W.P. mer.) willow growing along the roadside also showed 75 per cent of the leaves skeletonized. At all other points of inspection damage to willow was light.

(c) Special Investigations

(i) Large aspen tortrix. In order to determine where the second instar larvae of the large aspen tortrix overwinter a number of white poplar trees of different diameters were banded with tanglefoot at Wanless. Tanglefoot bands were placed at various levels on the trunks and branches.

On May 10 larvae were found in the bands on three trees in the 6-7 inch diameter class. Two of these trees were smooth barked. On these, larvae were observed moving up from the roots and were trapped in the first bands at the base of the trees. Larvae could not be found on any other bands of these trees. On the third tree, where the bark was rough and creviced, larvae were observed in the second band four feet from the base of the tree and none were found on the band at the base. This indicates that on rough-barked trees the young larvae prefer to overwinter in the rough bark rather than around the roots.

At the time these active larvae were observed there was no foliage on the trees and the buds had just begun to swell.

Cheesecloth bands were used to trap larvae for experimental work. The cheesecloth was rolled to a diameter of two inches and wrapped around the trunk in the area where larvae had been caught in the tanglefoot. Larvae were trapped in the cheesecloth and shipped to R.M. Prentice of the Winnipeg Laboratory.

On May 29, R. Prentice arrived at The Pas and the writer accompanied him through the infestation area assisting him in laying out plots and experimenting with sampling methods. Mass larval collections were made from time to time through the feeding period and shipped to R. M. Prentice in Winnipeg.

(ii) Larch sawfly cocoon collections. Mass collections of larch sawfly cocoons were made in 1951 in areas listed below:

Location	Sec.	Tp.	Rge.	Mer.	No. Collected
Channing	30	66	29	W.P.	150
Amisk Lake	25	66	30	W.P.	200
Cranberry Portage	8	65	26	W.P.	200

(iii) Permanent Sampling Stations. Several permanent sampling stations were established in the Northern District in 1951. The exact locations are listed below:

Location	Sec.	Tp.	Rge.	Mer.	Tree Species
Wabowden	20	68	8	W.P.	W. Poplar
Thicket Portage	15	73	2	W.P.	W. Spruce
Thicket Portage	15	73	2	W.P.	W. Poplar
Gillam	Lat. 56°20",			Long. 94°42"	
Kettle Rapids	Lat. 56°24",			Long. 94°35"W	

(d) Personnel Contacted

Name	Address	Title	Demonstr. Given	No. Times Contacted
Manitoba Forest Service				
R. Harvey	The Pas	District Forester	No	10
R. Ross	The Pas	Chief Ranger	No	15
R. Gow	The Pas	Forest Ranger	Yes	5
W. McLean	The Pas	District Engineer	No	2
W. Shipley	The Pas	Forest Ranger	No	3
E. Hood	The Pas	Fire Ranger	Yes	8
H. Gill	Cranberry Portage	Forest Ranger	Yes	3
R. McKeller	Baker's Narrows	Fire Ranger	Yes	2
D. McKinnon	Channing	Forest Ranger	No	2
W. Oatway	Denare Beach	Field Officer	Yes	2
W. Erlendson	Sherridon	Forest Ranger	Yes	2
F. Fenner	Cormorant	Fire Ranger	Yes	2
E. Jorgenson	The Pas	Fire Ranger	No	4
T. Fenner	Grace Lake	Fire Ranger	No	2
W. Hislop	Wabowden	Forest Ranger	Yes	1
G. Evans	Thicket Portage	Fire Ranger	Yes	1
J. Somers	Winnipeg	Provincial Forester	No	1
W. Kennedy	The Pas	Logging Supt.	Yes	1
W. Krivda	The Pas	Naturalist	Yes	3
Fr. Major	The Pas	Parish Priest	Yes	1
M. Gautier	The Pas	Steam Engineer	No	1
J. Smythe	The Pas	Airport Engineer	No	2
R. Parkins	The Pas	Pilot	No	2
L. Bartlett	Saskatoon	Forest Pathologist	No	3
R. Whitney	Saskatoon	Forest Pathologist	No	3

5. Hudson Bay District of Saskatchewan - 1951

by

M. R. Pratt

(a) Introduction

The following report outlines the activities carried out by Insect Ranger M. Pratt during the 1951 insect survey season in the Hudson Bay and Nipawin Forest districts.

The period between April 26 and May 11 was spent at The Pas, Manitoba, assisting with the construction of a Forest Insect Ranger cabin.

Field activities commenced on May 22 in the Madge Lake Provincial Park. General sampling and survey for the presence of the large aspen tortrix were carried out through this area. Collections and observations at that time showed little insect defoliation on any tree species. The same conditions existed in the Pelly area where observations and sampling were carried out on May 29 and 30.

On May 31 headquarters for the ranger work in the Hudson Bay area were transferred to Hudson Bay, Saskatchewan, and during the period between June 1 and June 17 extensive sampling and observations were carried out in the Pasquia Provincial Forest. All accessible stands of timber in the area bounded by Usherville in the south, Armit in the east, Otosquin in the north, and Peesane in the west, were examined and sampled. During this period large aspen tortrix defoliation throughout this area was surveyed. Damage to poplar was very light with the exception of one area 2½ miles north of Usherville that was moderately defoliated. The infested area was approximately 5 miles long and covered secs. 21, 28, 33, and 34, tp. 38, rge. 5, and secs. 3, 10, and 15, tp. 39, rge. 5, W. 2nd mer. In the infested area approximately five per cent of the white poplar was totally defoliated; 50 per cent was 40 per cent defoliated, and the remainder of the stand was 25 per cent defoliated. This area was marked as a permanent sampling station and will be used for obtaining further information on the large aspen tortrix.

A survey was also made of white-spruce stands in the Hudson Bay area for the detection of spruce budworm. Three samples were found in an isolated patch of white spruce 3½ miles north of Veillardville in the Pasquia Provincial Forest. Although stands were extensively sampled no more spruce or jack-pine budworm were found in the Hudson Bay District during the remainder of the season.

The period from June 18 to July 9 was spent in the forest areas listed below:

Carrot River
Fort a la Corne Provincial Forest (eastern half)
Torch River Provincial Forest and
Nipawin Provincial Forest.

In these areas general sampling and observations were carried out. A survey of spruce and jack-pine stands was made also for the detection of budworm. All accessible poplar stands were examined and sampled for large aspen tortrix defoliation.

During the first week of July, tamarack swamps were examined in the above mentioned areas. Samples and observations were recorded and forwarded to the Winnipeg Laboratory.

July 10, 11, and 12, were spent in the Chelan and Greenwater Lake areas where general sampling and observations were carried out and the larch sawfly survey continued.

From July 13 to August 16, general sampling and larch sawfly survey and observations, were intensified in the Pasquia Provincial Forest Reserve. All accessible tamarack swamps were sampled and the mass collections of larch sawfly cocoons were begun. These cocoons will be dissected during the winter to determine the incidence of larch sawfly parasites.

On August 6, and 7, larch sawfly survey and general sampling were carried out in the Pelly, Aran, and Madge Lake areas.

The period between August 13 and September 3 was spent in the western part of the Hudson Bay District where the larch sawfly survey, cocoon collecting, and general sampling and observations were continued. Permanent sampling stations were established also during this period in western portion of the Hudson Bay District.

The last three weeks of the 1951 field season were spent in the eastern part of the Hudson Bay District. Larch sawfly cocoons were collected, sampling stations established and general sampling carried out.

The field work in the Hudson Bay District was completed on September 25, and the writer returned to the Winnipeg Laboratory on September 26.

(b) Insect Conditions

(i) Larch sawfly, *Pristiphora erichsonii* (Htg.). All accessible tamarack stands throughout the Hudson Bay District were sampled to determine larch sawfly defoliation for 1951. Tamarack stands in the Nipawin Provincial Park, Torch River Forest Reserve, Fort a la Corne east of Range 18, and Pasquia and Porcupine Provincial Forest reserves were examined. The first larch sawfly sample was collected on June 29 north of Nipawin, Saskatchewan, in sec. 9, tp. 51, rge. 14, W. 2nd mer.

Tamarack stands in the Nipawin Provincial Forest Reserve were moderately defoliated. Some small isolated patches of tamarack examined toward the end of the season showed only light defoliation; however, the larger swamps showed 45 to 75 per cent defoliation.

Tamarack stands were sampled as far as sec. 34, tp. 54, rge. 10, W. 2nd mer. or a distance of 37 miles along the Flin Flon Highway north and east of White Fox. In this area most tamarack stands were moderately defoliated, defoliation ranging from 40 to 50 per cent. A large black-spruce swamp, 1½ miles north and east of White Fox Tower in sec. 34, tp. 53, rge. 12, W. 2nd mer., containing approximately 20 per cent tamarack, was 80 per cent defoliated. A few trees showed 100 per cent defoliation but these were restricted to smaller growth ranging up to 4" d.b.h. and from 12 to 20 feet high.

In the Grassy Lake area north of Lowe, several small and scattered stands of tamarack were examined. Defoliation was moderate and ranged from 30 to 50 per cent. In one small swamp north of Grassy Lake Tower in sec. 35, tp. 54, rge. 15, W. 2nd mer., defoliation ranged from 50 to 80 per cent, but this was an exception in this area.

Tamarack swamps east of Range 18, W. 2nd mer., in the Fort a la Corne Provincial Forest were examined. Defoliation in this area was moderate to severe in most swamps. The defoliation on smaller growth ranged up to 80 per cent with the occasional tree completely defoliated. Isolated patches of larger growth, however, showed only 40 to 60 per cent defoliation. Generally speaking the larch sawfly defoliation to tamarack could be classified as severe through this area. In the Carrot River area larch sawfly samples were found on isolated patches of tamarack. Heavy defoliation was noted on tamarack trees in tp. 50, rge. 12, W. 2nd mer., bordering the trail leading to Summit Tower. Defoliation was noted as 75 per cent in a small swamp east of Connel Creek. Approximately 1½ miles northeast of Carrot River along the old Battle Heights Trail tamarack swamps were sampled and defoliation varied between 60 and 75 per cent. For the most part, damage to tamarack foliage in the Carrot River district was severe and many curled tips were noted during the collecting season.

All accessible swamps were examined from Crooked River east to Prairie River in the Pasquia Provincial Forest. Most of the tamarack in this area is scattered throughout black-spruce swamps and comprises approximately 20 per cent of the stand. At Peesane in sec. 17, tp. 45, rge. 10, W. 2nd mer., defoliation ranged from 50 to 75 per cent. In a large black-spruce swamp south of Orley, containing approximately 15 per cent tamarack, defoliation ranging from 50 to 75 per cent was observed on August 28. Small "islands" of tamarack ranging from 5 to 7 inches d.b.h. and 24 to 30 feet high showed less defoliation (40 to 50 per cent). Only two small "islands" of tamarack such as these were observed. In the area between Mistatum and Bannock in secs. 7, 8, and 9, tp. 45, rge. 9, W. 2nd mer., defoliation ranged from 50 to 75 per cent.

Toward the end of the season the trees put forth a new growth of needles. Larch sawfly defoliation ranged from 50 to 80 per cent in scattered tamarack examined between Bannock and Prairie River. New foliage was observed on the trees in this area also.

Fifty per cent defoliation was recorded in a swamp in sec. 33, tp. 43, rge. 12, W. 2nd mer. This swamp is in an agricultural area north of Bjorkdale. Defoliation ranged from 60 to 70 per cent in another swamp in the same district. This swamp also is on private land and is located in sec. 9, tp. 42, rge. 11, W. 2nd mer., south of Chelan. Sixty five per cent defoliation at the end of the larch sawfly feeding season was recorded in a small tamarack stand in sec. 9, tp. 41, rge. 10, W. 2nd mer., in the Greenwater Lake Provincial Forest. This stand was small, very wet and the trees were open-grown and appeared to be stagnated.

South of Somme, in sec. 21, tp. 41, rge. 7, W. 2nd mer., in the Porcupine Provincial Forest, 25 per cent defoliation was observed in a tamarack stand examined on July 27. This stand was examined again on September 3, and defoliation was noted between 65 and 70 per cent.

Tamarack stands from Usherville, north to Hudson Bay were examined and sampled during the season. These stands, at the termination of the larch sawfly feeding season, showed more than 50 per cent defoliation. Defoliation ranged from 70 to 80 per cent in small "islands" of tamarack in black-spruce swamps between Usherville and Reserve. Swamps were checked and larch sawfly samples found from Reserve to McBride Lake along the old logging trail. Defoliation averaged 70 per cent in this area. Small trees up to 3½ inches d.b.h. were 80 to 100 per cent defoliated. Cocoons were collected in a swamp in sec. 27, tp. 40, rge. 4, W. 2nd mer.

East of Bertwell, in sec. 31, tp. 41, rge. 4, W. 2nd mer., an isolated stand of tamarack covering approximately 4 acres showed moderate defoliation. It was also noted that this stand was growing on well-drained land and consisted of 90 per cent tamarack ranging in size from five to seven inches d.b.h. Tamarack swamps in the Dillabough and Clemenceau areas were moderately defoliated.

All swamps east of Hudson Bay along the Armit Road as far as the Manitoba border, were examined. Severe defoliation was noted by the end of the larch sawfly feeding season. In sec. 11, tp. 44, rge. 32, W.P. mer., 21 miles east of Hudson Bay, defoliation was noted as 80 per cent. On September 17 a swamp in tp. 44, rge. 31, W.P. mer., 27.5 miles east of Hudson Bay along the Armit Road, was examined and defoliation recorded as 85 to 90 per cent. New growth of needles was observed in this stand at the end of the season.

In sec. 17, tp. 44, rge. 2, W. 2nd mer., 11½ miles east of Hudson Bay along the Armit Road, defoliation on August 11 was observed as 65 to 75 per cent. This swamp was re-checked on September 17, and defoliation had increased ranging from 75 to 90 per cent and only a few new needles were present.

In sharp contrast with the above mentioned swamps was a small swamp in sec. 13, tp. 44, rge. 2, W. 2nd mer., 6 miles south of Erwood. This swamp consisted mainly of large trees averaging 6 inches d.b.h. The defoliation in this swamp did not exceed 40 per cent and averaged only 20 to 25 per cent.

All accessible swamps were checked north of Hudson Bay. Defoliation west of Chemong in sec. 7, tp. 49, rge. 1, W. 2nd mer., averaged 80 per cent on September 17. Tamarack swamps between Chemong and Wachee were checked at the termination of the larch sawfly feeding season and between 70 and 80 per cent defoliation was recorded. Two small swamps in secs. 15, and 21, tp. 46, rge. 3, W. 2nd mer., were moderately attacked and defoliation averaged only 50 per cent. Each swamp covered about 4 acres and consisted of pure tamarack ranging in size from 5 to 6 inches d.b.h.

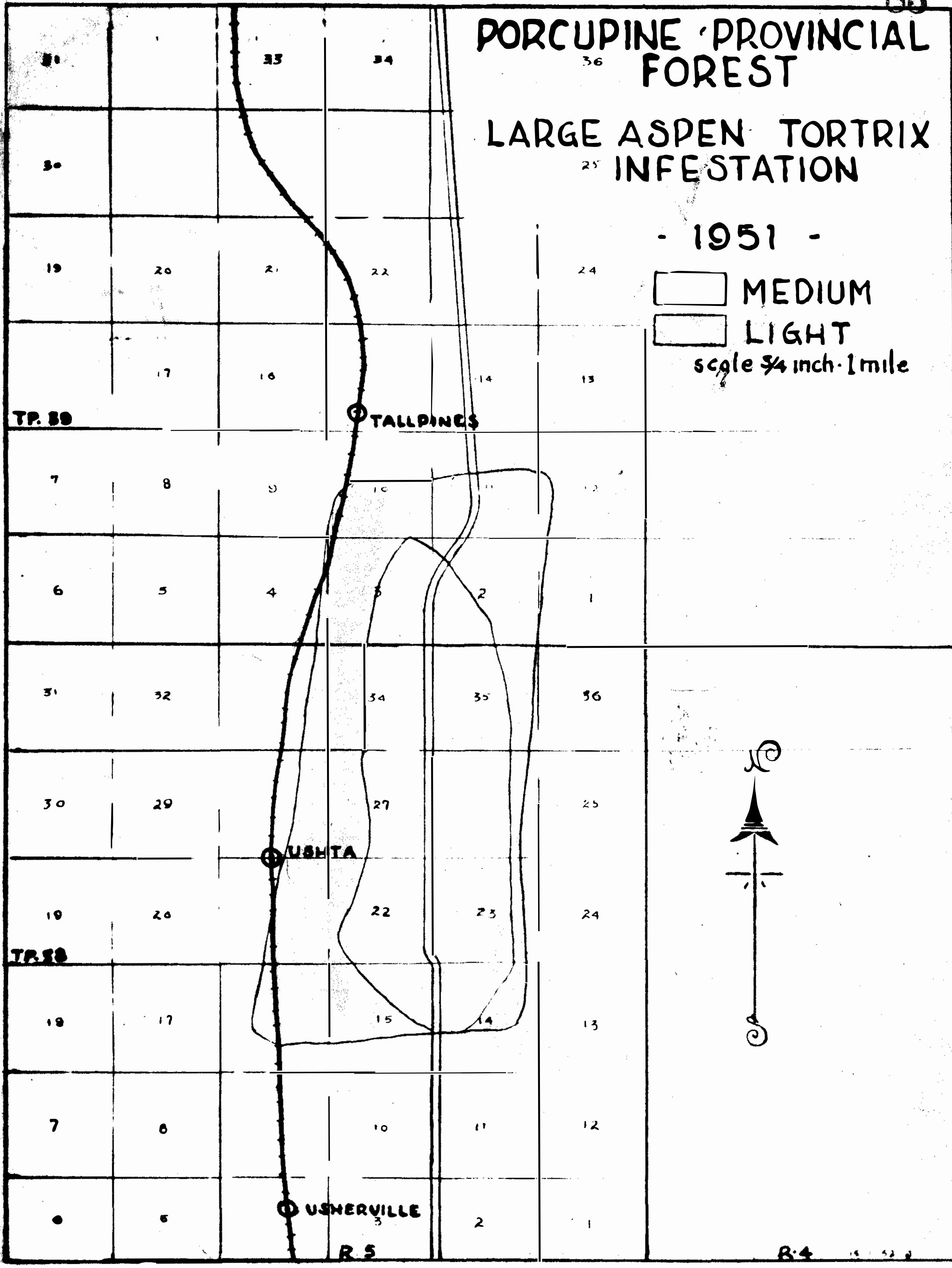
A large black-spruce swamp immediately north and east of Hudson Bay consisting of approximately 20 per cent tamarack was sampled and checked at various points. Defoliation of tamarack was noted between 80 and 90 per cent with about five per cent of the tamarack completely defoliated.

Swamps west of Hudson Bay along the Greenbush trail and north of Veillardville on the Spruce Products Trail were checked and sampled. In a swamp 2½ miles west of Veillardville on the Pasquia Provincial Forest boundary defoliation was recorded as 75 per cent at the end of the larch sawfly feeding period. A tamarack swamp in sec. 22, tp. 45, rge. 5, W. 2nd mer., was about 75 per cent defoliated.

A swamp in sec. 6, tp. 45, rge. 4, W. 2nd mer., five miles north of Veillardville, was from 60 to 75 per cent defoliated. A tamarack swamp 1½ miles north of Mile 15 fire tower (sec. 36, tp. 46, rge. 5, W. 2nd mer.) and covering 80 acres, was 75 per cent defoliated. This particular swamp was covered to a depth of 8 inches with water and cocoons were hard to find. D. G. Pond, Department of Natural Resources, reported only light defoliation, ranging from 15 to 25 per cent, in tps. 48, 49, and 50, rges. 4, and 5, W. 2nd mer., in the Pasquia Provincial Forest.

(ii) Large aspen tortrix, *Archips conflictana* (Wlk.). In the Madge Lake area, defoliation to white poplar caused by large aspen tortrix feeding was negligible and damage was noted at less than five per cent. In the Porcupine Provincial Forest, the large aspen tortrix population for the most part was very low and damage to poplar foliage was negligible. However, a small infestation was noted north of Usherville in a white-poplar stand with trees ranging from 2½ inches to 12 inches d.b.h. This infestation extended along No. 9 Highway for a distance of 5 miles (See Map). Both extremeties of the infestation were marked by permanent collection plots in order to obtain continuous records of intensity and rate of spread of the large aspen tortrix. The most severely defoliated area occurred in secs. 23, 33, and 34, tp. 38, rge. 5, W. 2nd mer., where approximately 40 per cent of the trees were 50 per cent defoliated. Average defoliation for the entire infested area was estimated between 30 and 40 per cent. This defoliation was confined mainly to large mature trees. Regeneration in the area showed only light defoliation.

North of Hudson Bay in the Pasquia Provincial Forest, the large aspen tortrix was present in only small numbers and in stands sampled, defoliation was hardly noticeable. West of Hudson Bay in the Pasquia Provincial Forest, the large aspen tortrix was found in all white-poplar stands. However, only one or two larvae were obtained from a standard five-tree sample, and very little defoliation resulted.


PORCUPINE PROVINCIAL FOREST
LARGE ASPEN TORTRIX INFESTATION
- 1951 -
MEDIUM
LIGHT
scale 3/4 inch - 1 mile
TP. 39
TP. 38
TALLPINES
USHTA
USHERVILLE
R. 5
R. 4
N
S

(iii) Jack-pine budworm, Choristoneura sp. Although jack-pine stands in the Hudson Bay District were extensively sampled for the jack-pine budworm, no evidence of the insect's presence was obtained.

(iv) Spruce budworm, Choristoneura fumiferana (Clem.). Three samples of this insect, comprising six larvae, were found in sec. 28, tp. 45, rge. 4, W. 2nd mer., four miles north of Veillardville in the Pasquia Provincial Forest. An intensive survey was made for this insect throughout the remainder of the Hudson Bay District but no other samples were collected and no spruce budworm defoliation was evident.

A permanent sample station was established at the exact spot where larvae were found in order to detect any increased activity of the spruce budworm during the following seasons.

(v) Forest tent caterpillar, Malacosoma disstria Hbn. No collections of this insect were made in the Hudson Bay District during the 1951 season.

(vi) A pine scale, Toumeyella sp. This scale was not found on jack-pine stands in the Hudson Bay District in 1951.

(vii) Pitch nodule maker, Petrova albicapitana (Busck) Samples of this insect were found throughout all jack-pine stands in the Pasquia, Fort a la Corne, Nipawin, and Torch River Provincial forests.

Although no serious infestations were recorded, a standard five tree sample from jack-pine would usually yield two to three new nodules. Samples were found south of Hudson Bay in sec. 15, tp. 48, rge. 2, W. 2nd mer., and at Nipawin in sec. 9, tp. 51, rge. 14, W. 2nd mer. In the Fort a la Corne Provincial Forest, the pitch nodule maker was observed on most young jack-pine stands but occurred in only limited numbers.

The more mature jack-pine was less susceptible to attack by this insect. Very few nodules were observed on trees raning from 5 to 10 inches d.b.h.

(viii) American poplar beetle, *Phytodecta americana* Schffr. This insect was widely distributed throughout the Hudson Bay District. Damage by this insect was evident from Madge Lake in the Duck Mountain Provincial Forest north through Pelly, Usherville, east to Armit and west to the Greenwater Provincial Park south to Chelan. Samples were also collected north of Hudson Bay in the Pasquia Provincial Forest and also in the Nipawin and Torch River areas north of White Fox.

In the Madge Lake area, defoliation in sec. 31, tp. 31, rge. 31, W. 2nd mer., averaged about five per cent on immature and reproduction poplar. Larvae were also found on more mature poplar but defoliation was very light. In the area around Pelly, Saskatchewan, samples of the poplar beetle were taken from small stands. They were more abundant in reproduction and immature stands than in the more mature stands. Defoliation through the area was observed at less than five per cent.

In the Porcupine Provincial Forest, between Usherville and Tallpines, a light infestation was observed on second growth and reproduction poplar. Very few larvae were found on the more mature poplar and the over-all defoliation for this area was negligible. The same conditions existed along the trail leading into McBride Lake.

From Reserve to Hudson Bay, very little poplar beetle damage was observed. From Hudson Bay east to Armit, poplar beetle was observed feeding on immature and reproduction poplar but defoliation was very light. South of Roscoe in sec. 7, tp. 44, rge. 31, W. 2nd mer., defoliation by the poplar beetle was light.

In the area north of Hudson Bay in the Pasquia Provincial Forest, the poplar beetle was observed at Ceba in sec. 33, tp. 47, rge. 2, W. 2nd mer., and north of Veillardville in sec. 28, tp. 45, rge. 4, W. 2nd mer. Some defoliation to immature and young poplar stands was noted, but it did not exceed five per cent.

The American poplar beetle was lightly distributed west of Hudson Bay through Prairie River to Peesane and from Clemenceau west to Greenwater Lake. Defoliation was light in these areas excepting south to Chelan in the Greenwater Lake area in sec. 2, tp. 41, rge. 11, and in sec. 6, tp. 41, rge. 10, where defoliation to reproduction and immature poplar ranged from five to twenty-five per cent.

North of White Fox in sec. 12, tp. 54, rge. 11, W. 2nd mer., in the Torch River Provincial Forest the poplar beetle was observed on June 20, feeding on white poplar. Defoliation averaged about 5 per cent. Most of the damage was confined to reproduction and small poplar growth throughout this area.

(ix) Grey willow leaf beetle, *Galerucella decora* (Say)
This insect was generally distributed throughout forested and agricultural areas of the Hudson Bay District. It was found mainly on small soft-leaf willow. The glossy sharp-leaf willows were not skeletonized to any extent. The first adult of this insect was found on May 25 at Madge Lake in the Duck Mountain Provincial Forest. A survey of the Hudson Bay District was made after August 15 to determine the amount of damage caused by the grey willow leaf beetle.

In the area surrounding Madge Lake skeletonizing was moderate. North to Pelly damage was moderate and ranged up to 50 per cent in some clumps. Severe damage to soft-leaf willow was observed north of Hudson Bay to Chemong. Some clumps in this area were completely skeletonized. North of Veillardville in sec. 28, tp. 45, rge. 4, W. 2nd mer., a few willow bushes were observed to be completely skeletonized by the grey willow leaf beetle. From Hudson Bay east to the Manitoba border moderate damage occurred on most willow and an occasional clump was completely skeletonized. Light to moderate damage occurred in the Somme, Prairie River, and Chelan areas. Moderate damage was observed in the Carrot River area. Small patches of soft-leaf willow in the above mentioned areas were occasionally severely damaged by the grey willow leaf beetle. All the foliage was rusty brown in color and appeared dead.

Willow throughout the Fort a la Corne, Nipawin, and Torch River areas was moderately attacked. Damage ranged from five to twenty-five per cent with an occasional clump being totally skeletonized.

(x) Balsam-fir sawfly, *Neodiprion abietis* (Harr.)
Only seven collections of the balsam-fir sawfly were obtained in the Hudson Bay District during the 1951 season. In all instances damage was negligible. One sample was obtained near Usherville in the Porcupine Provincial Forest; four samples in sec. 29, tp. 45, rge. 4, W. 2nd mer., and sec. 4, tp. 46, rge. 3, W. 2nd mer., in the Veillardville area, and two samples in sec. 20, tp. 5, rge. 15, W. 2nd mer., in the eastern part of the Fort a la Corne Provincial Forest.

(xi) Yellow-headed spruce sawfly, *Pikonema alaskensis* (Roh.).
This insect was widely distributed throughout the Hudson Bay District, but populations were low and caused little defoliation. Heavy populations of the yellow-headed spruce sawfly were noted on an isolated farm shelter belt. This stand was located in sec. 8, tp. 42, rge. 17, W. 2nd mer.; 1½ miles west of Somme, Saskatchewan. The shelter belt was later sprayed and insect activity checked.

(xii) Green-headed spruce sawfly, *Pikonema dimmockii* (Cress.).
Twenty-two samples of this insect were collected in the Hudson Bay District in 1951. In all cases populations were very low and defoliation negligible. During the peak of its feeding period only one or two larvae of this insect were obtained per standard five-tree sample.

(xiii) Black-headed budworm, *Acleris variana* (Fern.).
Four samples of this insect were collected in the Hudson Bay District in 1951. One larvae was found at Reserve, in sec. 1, tp. 41, rge. 5, W. 2nd mer., Another larva was found near Greenwater Lake, in sec. 8, tp. 41, rge. 10, W. 2nd mer., and two collections were made north of White Fox, along the Flin Flon Highway on June 21, in sec. 34, tp. 45, rge. 10, W. 2nd mer. Only one larva was found in each of the latter two samples.

(xiv) A tent caterpillar, *Malacosoma lutescens* (N.& D.).
Four nests of this insect were found on choke cherry between Pelly and Kamsack in the Hudson Bay District. This insect was confined to this area and no other samples of the tent caterpillar were found throughout the remainder of the District.

(xv) Spruce gall aphid, *Adelges abietis* L. Galls of this insect were commonly found on spruce in the Hudson Bay District, but it caused no noticeable damage.

(xvi) Ugly-nest caterpillar, *Archips cerasivorana* (Fitch.). This insect was commonly found throughout the Hudson Bay District but occurred mainly on choke cherry. Under natural forest conditions defoliation to choke cherry and associated shrubs due to ugly-nest caterpillar feeding was light and in most cases did not exceed 15 per cent.

The ugly-nest caterpillar severely defoliated scattered choke cherry bushes immediately south of the town of Chelan, sec. 9, tp. 42, rge. 10, W. 2nd mer. Scattered choke cherry bushes bordering a cultivated field west of Nipawin (sec. 34, tp. 50, rge. 15, W. 2nd mer.) were defoliated about 80 per cent. A few choke cherry bushes were totally stripped through the remainder of the area.

(xvii) Aspen blotch miner, *Lithocolletis tremuloidiella* (Braun)
This insect discoloured some foliage in the Hudson Bay and Nipawin areas. However, damage to the white-poplar stands on which this insect was found was negligible.

(xviii) White-pine weevil, *Pissodes strobi* (Peck.). Scattered samples of the white-pine weevil were found in the Hudson Bay area, but caused little damage to spruce and jack-pine stands.

(xix) Birch sawfly, *Arge pectoralis* (Leach) One sample of the birch sawfly was collected in the Hudson Bay District in 1951. It was found on August 31 west of Nipawin, in sec. 26, tp. 50, rge. 15, W. 2nd mer.

(xx) The sawfly, *Trichiosoma triangulum* Kby. Sixteen samples of this insect were taken from willow in the Hudson Bay area but little or no defoliation was observed owing to very low populations. Collections of this insect were made at the following places:

Madge Lake, Sask., sec. 16, tp. 45, rge. 11, W. P mer.
Clemenceau, Sask., sec. 10, tp. 43, rge. 3, W. 2nd mer.
McBride Lake, Sask. sec. 14, tp. 40, rge. 4, W. 2nd mer.
Mistatum, Sask., sec. 16, tp. 45, rge. 11, W. 2nd mer.
Beaver House, Sask., sec. 36, tp. 50, rge. 15, W. 2nd mer.

All the collections of *Trichiosoma triangulum* Kby. larvae were made between August 1 and 15.

(xxi) Alder sawfly, *Arge clavicornis* (Fabr.). Very little damage was caused by this insect in the Hudson Bay District. Six samples of the alder sawfly were collected in the district, each sample containing only one alder sawfly larva.

(xxii) Striped alder sawfly, *Hemichroa crocea* (Fourc.). Only one larva of this insect was found in the Hudson Bay District in 1951. It was found at Madge Lake in the Duck Mountain Provincial Park (sec. 23, tp. 30, rge. 31, W. 1st mer.).

(xxiii) Red-pine sawfly, *Neodiprion nanulus* Schedl. This insect was not found in the Hudson Bay District during the 1951 season.

(xxiv) A rust, *Chrysomyxa* sp. This rust lightly touched most spruce stands throughout the Hudson Bay District.

(xxv) Poplar Vagabond gall aphid, *Mordwilkoja vagabunda* Walsh. Deformed poplar leaf clusters caused by the poplar vagabond gall aphid were observed on widely scattered reproduction white poplar, throughout the entire Hudson Bay District. In all cases little or no visible damage to these trees resulted.

(c) Special Investigations

(i) Permanent sampling stations. Twelve permanent sample stations were established in the Hudson Bay District during the 1951 season. The following table gives their exact location.

Permanent Sampling Stations - 1951.

Date	Host	Place	Sec.	Tp.	Rge.	Mer.
Aug. 16	W.Spruce	White Fox, Flin Flon Highway	21	55	10	W.2nd
Aug. 21	J.Pine	½ mile north of White Fox	34	53	12	W.2nd
Sept. 4	J.Pine	3½ miles north of Veillardville	33	45	4	W.2nd
Sept. 5	B.Poplar	Spruce Products Trail	19	46	4	W.2nd
Sept. 6	W.Spruce	Wachee, Saskatchewan.	15	46	3	W.2nd
Sept. 9	W.Poplar	Dillabough, Saskatchewan	25	41	6	W.2nd
Sept. 9	W.Poplar	Dillabough, Saskatchewan	23	41	6	W.2nd
Sept.12	W.Poplar	Wachee, Saskatchewan	1	47	3	W.2nd
Sept.10	W.Spruce	Clemenceau, Saskatchewan	32	42	1	W.2nd
Sept.18	W.Poplar	Usherville, Saskatchewan	15	38	5	W.2nd
Sept.18	W.Poplar	Usherville, Saskatchewan	22	38	5	W.2nd
Sept.18	W.Poplar	Tallpines, Saskatchewan	2	39	3	W.2nd

(ii) Larch sawfly cocoon collections. Mass collections of larch sawfly cocoons were made in 19 widely separated areas of the Hudson Bay District in 1951. These cocoons will be dissected during the winter to determine the effect of larch sawfly parasite liberations on sawfly populations.

Larch Sawfly Cocoon Collections - 1951
Hudson Bay District Saskatchewan

Date	Place	Sec.	Tp.	Rge.	Mer.	Number of Cocoons	Check or Release Pt.
Sept. 6	Hudson Bay	21	45	3	W2nd	250	check
Sept.77	Veillardville	55	46	4	W2nd	250	check
Sept.17	Armit Road	14	44	31	W.P.	250	release
Sept.25	Madge Lake	27	30	30	W.P.	250	check
Aug.10	Armit Road	17	44	1	W2nd	250	check
Sept. 9	Chemong	7	49	1	W2nd	250	check
Sept. 8	Ruby Lake	10	46	2	W2nd	250	check
Sept.25	Pelly	15	34	2	W2nd	250	check
Aug. 9	McBride Lake	25	40	4	W2nd	250	check
Sept. 4	Wachee	2	46	3	W2nd	250	check
Sept.16	Veillardville	18	46	3	W2nd	250	check
Sept.14	1 mi. N. of Mile 15 Tower	35	45	4	W2nd	250	check

Date	Place	Sec.	Tp.	Rge.	Mer.	Number of Cocoons	Check or Release Pt.
Aug.21	Orley	12	48	11	W2nd	250	check
Aug.17	Ft. a la Corne	29	30	17	W2nd	250	check
Aug.11	Armit Road	11	44	32	W2nd	250	check
Aug.24	Nipawin F.F.	11	56	18	W2nd	250	check
Aug.29	White Fox	34	53	12	W2nd	250	check
Aug.13	Ruby Lake	16	46	3	W2nd	250	check
Sept.15	Greenbush Trail	23	45	5	W2nd	250	check

(d) Negative Reports

Hudson Bay District - 1951

Date	Host	Location	Sec.	Tp.	Rge.	Mer.
June 7	W.Spruce	16 miles south of Hudson Bay	19	42	3	W2nd
June 8	W.Spruce	5 miles north of Veillardville	32	45	4	W2nd
June 8	Tamarack	5½ miles north of Veillardville	31	45	4	W2nd
June 10	Tamarack	McBride Lake	25	40	4	W2nd
June 19	Balsam	Reserve	14	40	5	W2nd
July 24	W.Birch	Wachee	9	46	3	W2nd

(e) Personnel Contacted

Name	Position	Address	Sampling Demon.	No.of Contacts
C. Schell	District Superintendent	Hudson Bay	No	8
D.G. Pond	Forester	Hudson Bay	Yes	7
P. Pierse	Equipment Officer	Hudson Bay	No	4
W. Harper	Pilot	Hudson Bay	Yes	8
J.C.Cockwell	Field Officer	Hudson Bay	No	10
H. Randall	Field Officer	Hudson Bay	Yes	5
C. Furgusson	Asst. Forester	Hudson Bay	Yes	4
A. Feusi	Field Officer	Madge Lake	Yes	2
J. Heron	Field Officer	Madge Lake	Yes	4
F. Bryson	Field Officer	Usherville	No	4
F.J. Hawkens	Field Officer	Chelan	Yes	6
A.J. Watt	Sask.Timber Board	Prairie River	No	1
L. Beedle	Field Officer	Carrot River	No	4
J.M. Bacon	Field Officer	Somme	Yes	5
K.A. Smith	Asst. Forester	Carrot River	No	1
L. Reznechenko	Field Officer	Pessane	Yes	3
C. Otterbien	Fire Control Officer	Nipawin	No	2
C.T. Bell	Towerman	Nipawin	Yes	6
R.E. Brocker	Field Officer	Grassy Lake	Yes	2

(e) Personnel Contacted (Cont'd)

Name	Position	Address	Sampling Demon.	No. of Contacts
W.A. Macdonald	Field Officer	Beaverhouse	No	3
N. Mcinnes	Towerman	Beaverhouse	Yes	5
L. Bartlett	Lab. Assistant	(Forest Path-	No	1
R.D. Whitney	Technical Officer	(ology Lab.	No	1
		(Saskatoon		

6. Prince Albert, Meadow Lake, and Northern Districts of Saskatchewan - 1951

by

J. J. Lawrence and B. B. McLeod

(a) Introduction

The following report outlines the field activities carried out by J. J. Lawrence and B. B. McLeod, during the 1951 survey season (mid-April to mid-October) in the Prince Albert, Meadow Lake, and Northern districts of Saskatchewan. B. McLeod joined J. Lawrence at Prince Albert in mid-May, after working for almost a month on the construction of the Forest Insect Ranger Cabin at The Pas, Manitoba. During this period the writer had been working on the cabin at Prince Albert. Three days, May 15 to 18, were spent collecting larch sawfly cocoons for the Dominion Parasite Laboratory at Belleville, Ontario.

Field work commenced the third week of May. General sampling and a survey for the detection of spruce and jack-pine budworm was carried out between the time field work started and the end of June. Also during this period a survey was made of the large aspen tortrix and forest tent caterpillar infestations at Glaslyn.

The jack-pine budworm survey was continued throughout most of July. General sampling was also carried out as well as a preliminary larch sawfly survey. Two days, July 11 and July 24, were spent on an aerial survey mapping forest tent caterpillar infestations.

During August the larch sawfly survey was continued. An aerial survey was made of the large aspen tortrix infestations at Glaslyn in the Meadow Lake District. A forest tent caterpillar egg survey was started during this period. Several days were spent checking permanent sample plots for defoliation records and making mass collections of larch sawfly cocoons for determining the incidence of parasites. General sampling was also carried out.

During September the forest tent caterpillar egg survey was completed and several permanent sample plots were established in poplar to determine tree mortality caused by this insect. Permanent sample plots were also established in tamarack and further larch sawfly cocoon collections were made. General sampling was also carried out as well as a survey of birch stands for birch-die back.

The first week of October was spent establishing permanent sample plots in poplar, collecting larch sawfly cocoons, checking permanent sample plots, and preparing for return trip to Headquarters in Winnipeg.

Details of insect conditions in the areas covered by the writer are found in the following pages.

(b) Insect Conditions

(i) Larch sawfly, *Pristiphora erichsonii* (Htg.). The larch sawfly again caused severe defoliation of tamarack in the southern portion of the Prince Albert District. Throughout the Nisbet Provincial Forest and the various blocks that make up this forest, such as the Home Block, Red Rock Block, Steep Creek Block, Holbein Block, Round Lake Block, MacDowall Block and Canwood Block, defoliation of tamarack was severe. In a small area in the MacDowall Block (sec. 1, tp. 47, rge. 2, W. 3rd mer.) high tree mortality was observed. The majority of the trees were dying from the top down. At the time of writing no definite cause of mortality had been determined.

In the Fort a la Corne Provincial Forest several tamarack stands were examined between the western boundry and English Cabin. Larch sawfly populations were high and complete defoliation of tamarack was common.

In the Candle Lake Provincial Forest defoliation increased in 1951. Though water levels were higher than usual defoliation in sec. 13, tp. 56, rge. 24, W. 2nd mer., was about 75 to 80 per cent. Some of the foliage was discoloured on trees that had been standing in water for the past two years.

Two areas of severe defoliation were recorded in the Emma Lake Provincial Forest, one in sec. 20, tp. 53, rge. 27, W. 2nd mer., and the other in sec. 25, tp. 53, rge. 29, W. 2nd mer. North of these locations to the boundary of Prince Albert National Park damage was light.

Larch sawfly larvae were present in all tamarack stands examined in Prince Albert National Park. The most severe defoliation occurred in sec. 24, tp. 53, rge. 2, W. 3rd mer., along the Mayview Road. Defoliation in this area averaged about 75 per cent. Between the Park Gate and the townsite of Waskesiu only moderate defoliation was recorded. In and around the townsite of Waskesiu defoliation was light. Along No. 2 Highway between the Park and Lac la Ronge several larvae were collected but only very light feeding was noted. A moderate infestation was observed in sec. 32, tp. 70, rge. 18, W. 2nd mer., on the east side of Lac la Ronge.

North and west of Prince Albert, along No. 3 Highway, an area of moderate defoliation occurred in sec. 33, tp. 54, rge. 7, W. 3rd mer. Except for a very small area of moderate defoliation (35-40 per cent) between Green Lake and Meadow Lake the former location appeared to be the northwestern boundary of moderate to severe defoliation.

A few larch sawfly larvae were collected in the Waterhen Provincial Forest. Moderate defoliation occurred on a few small regeneration tamarack in sec. 6, tp. 63, rge. 18, W. 3rd mer. Through the remainder of the Waterhen Provincial Forest damage was nil to very light.

West of Meadow Lake to the Alberta border and throughout the Bronson Provincial Forest a few larvae were collected but damage was negligible.

Larch sawfly populations were somewhat higher in 1951 than they were in 1950, in the southern portion of the Meadow Lake Provincial Forest, but defoliation was still light.

(ii) Spruce budworm, *Choristoneura fumiferana* (Clem.). Only one collection of spruce budworm was made throughout the Meadow Lake, Prince Albert, and Northern districts of Saskatchewan during the 1951 season. This collection was made in sec. 1, tp. 58, rge. 2, W. 3rd mer., in Prince Albert National Park. Populations were very low and no damage to foliage was observed.

(iii) Jack-pine budworm, *Choristoneura* sp. A light infestation of the jack-pine budworm was present in the Home Block of the Nisbet Provincial Forest in 1951. The infestation, covering roughly 50 square miles, was bounded on the east by the Shell River, on the south by the Canadian National Railway to Crutwell, and the west and north by the boundary of the Home Block. The heaviest concentration occurred in sec. 24, tp. 49, rge. 1, W. 3rd mer., where in one case five budworm larvae were found on a 20-inch branch. No defoliation was noted and only one tree infested to this extent was found. Through the remainder of the area surveyed, damage was negligible.

Light concentrations of the jack-pine budworm were found also in the Round Lake and Red Rock blocks of the Nisbet Provincial Forest, but no defoliation was noted.

Two collections of this insect were made in the Fort a la Corne Provincial Forest: one in sec. 14, tp. 50, rge. 22, W. 2nd mer., and the other in sec. 28, tp. 50, rge. 21, W. 2nd mer. In each instance, several trees were examined but only two or three larvae were found at each location.

The most northerly collection of this insect was made in tp. 73, rge. 12, W. 3rd mer., by W. MacNeill. No mention was made of defoliation.

(iv) Large aspen tortrix, *Archips conflictana* (Wlk.). This insect was widely distributed through central and western Saskatchewan and was present in most collections from white poplar. It was found in relatively small numbers from the MacDowall Block south of Prince Albert north to Lac la Ronge. The same condition prevailed in an east-west direction extending from Big River to English Cabin in the Fort a la Corne Provincial Forest. In all areas, where detected, it caused no appreciable defoliation.

The large aspen tortrix infestation at Glaslyn in the Meadow Lake District continued to flourish and appeared more widespread. However, the fact that the infestation seemed more widespread than in previous years may have been due to attaining more complete aerial coverage of the infested area through more flying time made available by the Department of Natural Resources.

The southern boundary of the Glaslyn infestation was approximately 5 miles north of Cochin and ran in a northwesterly direction past Daysville and Hartwell and along the west shore of Brightsand Lake, then north and east across the northern end of Turtle Lake to a point 27 miles north of Glaslyn. From there it extended southeast to a point 4 miles east of Junor, thence south between Cater and Belbutte, and past Meadstead to the starting point north of Cochin.

"Islands" of severe defoliation were noted in the following areas: northwest of Helene Lake, tp. 53, rge. 16, W. 3rd mer., covering approximately 12 sections; north in tp. 54, rge. 15, W. 3rd mer., covering about the same area as the former; along the east shore of Helene Lake, tp. 52, rge. 15, W. 3rd mer., covering an area 4 miles long by 3 miles wide; at the south end of Turtle Lake, tp. 52, rges. 18 and 19, W. 3rd mer., the infestation extending about 5 miles north and south by 6 miles east and west; and along the east, west, and south shores of Brightsand Lake, the infestation extending inland for 2 miles on the west and 5 miles on the south and east shore lines. Another small area of severe defoliation was observed in sec. 11, tp. 53, rge. 17, W. 3rd mer.

Moderate to severe defoliation occurred along No. 4 Highway south of Glaslyn for a distance of 11 miles, west to Turtle Lake, and northeast to Birch Lake. North of Glaslyn for 11 miles damage was light. From 11 to 18 miles north of Glaslyn on No. 4 Highway defoliation was moderate. Northwest of Turtle Lake damage was light to moderate. A small area of moderate to severe defoliation occurred north of Helene Lake (tp. 54, rges. 14, 15, and 16, W. 3rd mer.). In the remainder of the infested area damage was nil to light.

Several collections of this insect were made also in the Meadow Lake District but defoliation was either absent or very light.

(v) American poplar beetle, *Phytodecta americana* Schffr. This insect continued to infest poplar stands in the Prince Albert District during 1951. For the most part defoliation was light with occasional "pockets" of moderate or severe damage. A small area of severe defoliation occurred in sec. 26, tp. 48, rge. 23, W. 2nd mer., in the Steep Creek Block of the Nisbet

Provincial Forest. Another small area of moderate defoliation occurred in sec. 29, tp. 48, rge. 2, W. 3rd mer., in the Holbein Block. Poplar stands in secs. 24 and 29, tp. 49, rge. 27, W. 2nd mer., west of Prince Albert in the Home Block suffered 50 to 60 per cent defoliation. The infestation through the remainder of the Nisbet Provincial Forest was very light.

In the Fort a la Corne and Candle Lake Provincial forests this insect was present but damage was very light.

Several collections of this insect were made in Prince Albert National Park but it was found mostly on regeneration poplar. The most severe infestation occurred in sec. 1, tp. 57, rge. 2, W. 3rd mer., where defoliation ranged from 75 to 80 per cent.

The most northerly point where this insect was found was along No. 2 Highway in sec. 1, tp. 69, rge. 23, W. 2nd mer., south of Lac la Ronge. Defoliation at this location was light.

Two moderate infestations were recorded in the Big River Provincial Forest; one in sec. 32, tp. 56, rge. 9, W. 3rd mer., and the other in sec. 9, tp. 57, rge. 9, W. 3rd mer. These infestations were on reproduction poplar and defoliation averaged about 40 per cent.

Between Big River and Green Lake a small area of severe defoliation was noted in sec. 11, tp. 58, rge. 9, W. 3rd mer. From Green Lake west to Meadow Lake this insect was present but caused little or no damage. Several collections were made throughout the Waterhen Provincial Forest. The most severe defoliation occurred in sec. 17, tp. 64, rge. 17, W. 3rd mer., where damage was light to moderate with occasional pockets of severe defoliation. The remainder of the area, where collections were made, was only lightly defoliated. Two collections were made in the Meadow Lake Provincial Forest but defoliation was very light.

(vi) Grey willow leaf beetle, *Galerucella decora* (Say). Activity by this insect occurred mainly in the Meadow Lake District during the 1951 season. Early in June adults of this insect were found causing light damage

(15 to 20 per cent) to poplar stands in sec. 33, tp. 59, rge. 23, W. 3rd mer., in the Bronson Provincial Forest. Only a few trees were infested but adults were quite numerous. Later in the season damage ranged from 40 to 60 per cent near Green Lake in sec. 17, tp. 60, rge. 15, W. 3rd mer. At this point the infestation was confined to a small area.

A light infestation was recorded in Prince Albert National Park in sec. 17, tp. 57, rge. 25, W. 2nd mer. This was the only collection made in the Prince Albert District in 1951.

(vii) Balsam-fir sawfly, *Neodiprion abietis* (Harr.). Balsam-fir sawfly caused little or no damage to white spruce in the Prince Albert or Meadow Lake districts in 1951. Collections were made in secs. 26, and 36, tp. 49, rge. 26, W. 2nd mer., northeast of Prince Albert along the Little Red River. One collection was made in sec. 21, tp. 49, rge. 26, W. 2nd mer., in the Home Block of the Nisbet Provincial Forest. At these locations populations were low and defoliation was very light.

One collection was made in each of the Emma Lake and Candle Lake Provincial Forests but no defoliation was recorded.

Only one collection was made in the Meadow Lake District. It was taken in sec. 1, tp. 58, rge. 17, W. 3rd mer., in the Meadow Lake Provincial Forest and only very light defoliation was recorded.

(viii) Yellow headed spruce sawfly, *Pikonema alaskensis* (Roh.). Green-headed spruce sawfly, *Pikonema dimmockii* (Cress.). Numerous collections of these species were made during the 1951 season. They were found mainly on regeneration white spruce. Although they seemed more widespread than in previous years, very little damage was observed, and at no place was the green-headed spruce sawfly found in large enough numbers to cause any defoliation.

The damage caused by the first collection was made in the Holbein Block of the Nisbet Provincial Forest, (sec. 15, tp. 49, rge. 2, W. 3rd mer.). At the time of collecting the larvae were quite small. This area was examined again at a later date and defoliation was very light. Moderate defoliation was recorded in a shelter belt of Norway spruce in sec. 21, tp. 49, rge. 26, W. 2nd mer. About 50 per cent of the current year's growth had been damaged in this stand. In the Red Rock Block (sec. 26, tp. 49, rge. 25, W. 2nd mer.) small regeneration spruce was defoliated from 50 to 60 per cent. Light defoliation occurred in sec. 14, tp. 45, rge. 1, W. 3rd mer., in the MacDowall Block. Most of this stand was over mature white spruce. A few collections were made in the Round Lake Block. The most severe defoliation occurred in sec. 23, tp. 50, rge. 28, W. 2nd mer., but it was recorded as only light.

Two areas of light defoliation were found in the Fort a la Corne Provincial Forest; one in sec. 9, tp. 50, rge. 20, W. 2nd mer., and the other in sec. 9, tp. 50, rge. 19, W. 2nd mer. Several more collections were made in this area but there was no damage at these points.

Light defoliation occurred in sec. 15, tp. 57, rge. 24, W. 2nd mer., in the Candle Lake Provincial Forest. Other spruce stands were examined in this area but damage was negligible.

This insect was present in most spruce stands examined throughout the Emma Lake Provincial Forest but populations were generally low. Defoliation in secs. 11, 13, 17, and 20, tp. 53, rge. 27, W. 2nd mer., was approximately 10 to 15 per cent.

The infestation previously reported in sec. 23, tp. 49, rge. 26, W. 2nd mer., along the Little Red River continued to flourish. The stand consists of scattered white and black spruce, jack pine and a few birch trees. In this area 80 to 85 per cent of the new foliage was stripped off white spruce.

No larvae were found in Prince Albert National Park, the Northern District of Saskatchewan, or the Big River Provincial Forest. This probably was due to the time of the season when this area was surveyed (June 1 - 15).

North of Goodsoil (sec. 13, tp. 63, rge. 23, W. 3rd mer.) was the most northerly point where this insect was found in 1951. Only one collection was made in this area and defoliation was absent. Larvae were collected west of Pierceland in sec. 8, tp. 62, rge. 27, W. 3rd mer., but there was no defoliation.

Light damage was recorded in sec. 15, tp. 55, rge. 17, W. 3rd mer., in the Meadow Lake Provincial Forest. Several more collections were made in this area but defoliation at these collection points was nil.

The last larvae were collected September 1, in sec. 14, tp. 45, rge. 1, W. 3rd mer., in the MacDowall Block of the Nisbet Provincial Forest.

(ix) Ugly-nest caterpillar, *Archips cerasivorana* (Fitch). The status of this insect did not change to any extent over the past year. It was still confined mainly to the Nisbet Provincial Forest and east to the Fort a la Corne Provincial Forest. Small areas of severe defoliation were recorded in sec. 4, tp. 49, rge. 23, W. 2nd mer., in the Steep Creek Block and sec. 21, tp. 49, rge. 26, W. 2nd mer., in the Home Block. These infestations were on regeneration choke cherry. Another small area in sec. 8, tp. 50, rge. 25, W. 2nd mer., northeast of Prince Albert was moderately infested.

In sec. 18, tp. 50, rge. 20, W. 2nd mer., in the Fort a la Corne Provincial Forest, alder, poplar, willow, and choke cherry were infested by this insect, but in all cases defoliation was light.

(x) White-pine weevil, *Pissodes strobi* (Peck). Although numerous collections of this insect were made during the 1951 season, little or no damage was recorded. Collections were made in the Home Block in secs. 17, 26, and 34, tp. 49, rge. 1, W. 3rd mer., and in the Holbein Block in sec. 10, tp. 49, rge. 1, W. 3rd mer. In the areas where collections were made, damage was very light.

In the Fort a la Corne Provincial Forest a very light infestation was noted in a small stand of regeneration jack pine in sec. 24, tp. 50, rge. 21, W. 2nd mer. Regeneration jack pine in sec. 6, tp. 57, rge. 11, W. 3rd mer., in the Big River Provincial Forest was also infested by white-pine weevil but damage was very light.

One collection of this insect was made on white spruce in sec. 6, tp. 55, rge. 22, W. 2nd mer., in the Candle Lake Provincial Forest but damage was very light.

Another collection was made on white spruce in the Meadow Lake Provincial Forest (sec. 12, tp. 57, rge. 17, W. 3rd mer). Damage was very light.

North of Dorintosh along No. 4 Highway in sec. 6, tp. 63, rge. 17, W. 3rd mer., and in sec. 24, tp. 62, rge. 18, W. 3rd mer., damage to jack pine was very light.

Two collections were made in secs. 8, and 9, tp. 58, rge. 22, W. 3rd mer., in the Bronson Provincial Forest but in both instances damage was very light.

(xi) Pitch nodule maker, *Petrova albicapitana* (Busck). The pitch nodule maker, though found to some extent in most jack-pine stands examined in the Prince Albert District, caused very little damage. Very little damage was recorded throughout the Nisbet Provincial Forest, except in the following three locations: sec. 10, tp. 49, rge. 2, W. 3rd mer., and sec. 7, tp. 49, rge. 1, W. 3rd mer., in the Holbein Block; and in sec. 18, tp. 49, rge. 23, W. 2nd mer., in the Steep Creek Block where damage was light.

Three collections were made in the Fort a la Corne Provincial Forest (sec. 14, tp. 50, rge. 22, W. 2nd mer.; sec. 24, tp. 50, rge. 21, W. 2nd mer.; and sec. 5, tp. 50, rge. 19, W. 2nd mer.) but again the infestations were very light.

Throughout the Big River and Emma Lake Provincial forests, very light damage was recorded. The most northerly collection of the pitch nodule maker was made south of Lac la Ronge along No. 2 Highway in sec. 35, tp. 67, rge. 23, W. 2nd mer. Damage in this area was light.

In the Prince Albert National Park a very light infestation was recorded in sec. 18, tp. 57, rge. 1, W. 3rd mer.

Two collections of this insect were made north of Dorintosh; one in sec. 30, tp. 64, rge. 17, W. 3rd mer., and the other in sec. 6, tp. 63, rge. 17, W. 3rd mer. Two other collections were made in the Meadow Lake District; one in sec. 13, tp. 61, rge. 12, W. 3rd mer., and one in sec. 21, tp. 49, rge. 26, W. 3rd mer. At all the above locations damage was very light.

(xii) Forest Tent caterpillar, Malacosoma disstria Hbn. Activity by this insect increased considerably during the 1951 season. Aerial and ground surveys were carried out to determine the extent and severity of the infestations. An egg survey was made during late August and September to determine the areas of probably infestation in 1952.

A small outbreak of this insect was recorded along No. 2 Highway north of Prince Albert National Park. This infestation covered a portion of five sections. Poplar stands in the west half of sec. 31, and the northwest 1/4 of sec. 30, tp. 57, rge. 26, W. 2nd mer., were lightly to moderately defoliated. In sec. 25, tp. 57, rge. 27, W. 2nd mer., and sec. 1, tp. 58, rge. 27, W. 2nd mer., damage was light. Severe defoliation occurred in the east half of sec. 36, tp. 57, rge. 27, W. 2nd mer.

A few larvae were collected in secs. 4, and 10, tp. 57, rge. 1, W. 3rd mer., in Prince Albert National Park but no damage to poplar was recorded.

Another infestation occurred in the Dore Lake area north of Big River. Forest tent caterpillar was found in an area bounded on the south by the north end of Cowan Lake and on the west by Green Lake. The infestation boundary then runs north and east from Green Lake, to the north end of Sled Lake, thence east to Beaupre Lake and south and west along the south side of Sled Lake to the north end of Cowan Lake. "Islands" of severe defoliation in mature stands of poplar occurred throughout this area. Large portions of this territory have been burnt-over in the past. Some of the more severely infested areas are described in detail as follows: North of Appleby Bay in secs. 16 to 22, and 26, tp. 63, rge. 9, W. 3rd mer., damage by this insect was severe. South of Sled Lake in secs. 25 to 36, tp. 62, rge. 10, W. 3rd mer., poplar stands were also severely defoliated. A large area of moderate defoliation was noted in secs. 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, and 36, tp. 62, rge. 10, W. 3rd mer., and secs. 30, 31, and 32, tp. 62, rge. 9, W. 3rd mer. West of Sled Lake a "pocket" of severe defoliation occurred in secs. 23, 24, 25, tp. 62, rge. 12, W. 3rd mer., and in sec. 30, tp. 62, rge. 11, W. 3rd mer. Another "pocket", 6 miles east of Green Lake, in secs. 4, 12, 13, 23, 24, and 25, tp. 61, rge. 12, W. 3rd mer., and secs. 7, 17, 18, 19, 20, and 30, tp. 61, rge. 11, W. 3rd mer., was severely defoliated. In this area larvae were found feeding on black poplar, and alder, but causing very little defoliation of these two tree species. Four miles east of this location, an area extending 5 miles north and south was moderately defoliated. Through the remainder of the area outlined above, damage was generally light to nil with only occasional trees being partly stripped.

The infestation north of Glaslyn along No. 4 Highway in the Meadow Lake Provincial Forest was still causing severe defoliation but showed no apparent sign of having spread. Severe defoliation occurred in the east half of sec. 13, tp. 54, rge. 17, W. 3rd mer., and the west half of sec. 7, tp. 54, rge. 16, W. 3rd mer. Large aspen tortrix was also abundant in this area and appeared to be causing as much defoliation as the forest tent caterpillar. A light to moderate infestation prevailed in the remainder of the area where forest tent caterpillar was found. This area included secs. 12, 13, and 24, tp. 54, rge. 17, W. 3rd mer., and secs. 6, 7, and 18, tp. 54, rge. 16, W. 3rd mer.

(xiii) <u>European alder leaf miner, *Fenusa dohrnii* (Tisch.).</u> This insect was not as abundant during 1951 season as it was in 1950. One collection was made during the summer. A moderate infestation was recorded in sec. 1, tp. 62, rge. 13, W. 3rd mer., near Green Lake. Two other collections were sent in by W. MacNeill from the Meadow Lake District, but in both cases damage was light.

(xiv) Birch sawfly, Arge pectoralis (Leach). This insect was found at three widely separate points in the Meadow Lake and Prince Albert districts in 1951. One collection was made in sec. 6, tp. 70, rge. 22, W. 2nd mer., south of Lac la Ronge and another in sec. 30, tp. 53, rge. 26, W. 2nd mer., in the Emma Lake Provincial Forest. In both cases defoliation was very light.

The other collection was made in the M adow Lake Provincial Forest, sec. 1, tp. 54, rge. 17, W. 3rd mer.). At this point the birch sawfly was found feeding on alder and causing severe defoliation.

(xv) A pine scale, Toumeyella sp. The pine scale was more widespread in 1951 than in previous years, but in all cases the infestation was very light and confined to only a few trees. Collections were made in sec. 7, tp. 49, rge. 1, W. 3rd mer., in the Holbein Block and sec. 21, tp. 49, rge. 26, W. 2nd mer.; sec. 14, tp. 49, rge. 1, W. 3rd mer.; sec. 35, tp. 49, rge. 1, W. 3rd mer.; and sec. 35, tp. 49, rge. 28, W. 2nd mer., in the Hene Block. All of the above locations are in the Nisbet Provincial Forest.

(xvi) Red-pine sawfly, Neodiprion nanulus Schedl. The first collection of this insect was made June 26 in sec. 29, tp. 48, rge. 23, W. 2nd mer., in the Steep Creek Block. Damage in this area was very light.

A light infestation was noted in secs. 1 to 24, tp. 49, rge. 1, W. 3rd mer., secs. 5 and 9, tp. 49, rge. 27, W. 2nd mer., and sec. 1, tp. 49, rge. 28, W. 2nd mer., in the Home Block. Populations in these locations were low and damage was nil to very light.

Three collections were made in the Fort a la Corne Provincial Forest. In all cases only a few larvae were found and defoliation was very light.

The last larvae was collected July 20 in sec. 1, tp. 56, rge. 24, W. 2nd mer., in the Candle Lake Provincial Forest. Only one tree was infested and damage was very light.

(c) Special Reports

(i) Permanent sample plots. The following table gives the locations of the permanent sample plots established in tamarack and poplar stands in the Prince Albert and Meadow Lake districts in 1951.

Date	Host	Place	Sec.	Tp.	Rge.	Mer.
Sept. 5	Larch	Loon Lake	16	59	22	W3rd
Sept. 10	Larch	Pierceland	14	62	26	W3rd
Sept. 12	Larch	Green Lake	5	61	12	W3rd
Sept. 24	W. Poplar	Glaslyn	13	54	17	W3rd
Sept. 25	W. Poplar	Glaslyn	12	54	17	W3rd
Sept. 25	W. Poplar	Glaslyn	24	54	17	W3rd
Sept. 26	W. Poplar	Green Lake	13	61	12	W3rd
Sept. 26	W. Poplar	Green Lake	12	61	12	W3rd
Sept. 29	W. Poplar	Waskesiu	35	57	27	W2nd
Oct. 3	W. Poplar	Sled Lake	8	63	8	W3rd
Oct. 3	W. Poplar	Sled Lake	25	62	10	W3rd
Oct. 3	W. Poplar	Sled Lake	23	62	10	W3rd

(ii) Parasite liberations. A shipment of parasites Drino bohemica Mesl., was received from the Dominion Parasite Laboratory, Belleville, Ontario. These parasites were liberated 1 mile east of Christopher Lake along No. 2 Highway in the S.E. 1/4 sec. 4, tp. 53, rge. 26, W. 2nd mer., by H. A. McKinnon.

(iii) Larch sawfly cocoon collections. Mass collection of larch sawfly cocoons were made during August, September, and October. These cocoons will be used for the purpose of obtaining information on parasite distribution. Cocoons were collected from the following locations:

Date	Place	Sec.	Tp.	Rge.	Mer.	No.	Release or Check Pt.
Aug. 14	Steep Creek Block	28	48	23	W2nd	250	check
Aug. 13	Fort a la Corne P.F.	4	50	20	W2nd	250	check
Aug. 16	Big River P.F.	30	56	8	W3rd	250	check
Aug. 16	Big River P.F.	26	56	9	W3rd	200	check
Aug. 16	Big River	8	56	10	W3rd	100	check
Aug. 16	Big River P.F.	32	55	7	W3rd	250	check
Aug. 17	Dumble	33	54	7	W3rd	250	check
Aug. 11	Canwood	33	50	4	W3rd	250	check
Aug. 18	Red Rock Block	9	49	25	W2nd	250	check
Aug. 21	Lac la Ronge	32	70	18	W2nd	250	check

Date	Place	Sec.	Tp.	Rge.	Mer.	No.	Release or Check Pt.
Aug. 22	Lac la Ronge	2	65	24	W2nd	250	check
Aug. 22	Molanosa	11	62	24	W2nd	250	check
Aug. 27	Red Rock Block	5	50	25	W2nd	250	check
Aug. 28	Home Block	22	49	1	W3rd	250	Parasite release
Aug. 28	Holbein Block	13	49	2	W3rd	250	check
Aug. 28	Home Block	15	49	1	W3rd	250	check
Aug. 29	Emma Lake P.F.	25	53	27	W3rd	250	check
Aug. 31	Home Block	8	49	26	W2nd	250	Disease release area
Aug. 31	Home Block	13	49	26	W2nd	250	check
Sept. 5	Turtle Lake	34	53	18	W3rd	200	check
Sept. 1	MacDowall Block	21	46	1	W3rd	250	check
Sept. 6	Bronson P.F.	6	58	22	W3rd	60	check
Sept. 21	Fort a la Corne	9	50	22	W2nd	250	check
Sept. 21	Fort a la Corne	33	50	19	W2nd	250	check
Sept. 22	Candle Lake P.F.	13	56	24	W2nd	250	check
Oct. 2	Mayview	24	53	2	W2nd	250	check
Aug. 27	Red Rock Block	27	49	25	W2nd	250	check

(iv) <u>Forest tent caterpillar surveys.</u> Sled Lake Infestation: An aerial survey was made July 13, 1951, of the forest tent caterpillar infestation east of Green Lake and north as far as Beaupre Lake (see map). Only scattered "islands" of moderately and severely defoliated poplar were encountered. Generally only lightly defoliated trees were scattered throughout the area surveyed.

A small area where mature poplar was severely defoliated was noted in secs. 12, 13, 14, 23, 24, 25, tp. 61, rge. 12, W. 3rd mer. The severe defoliation extended into secs. 7, 17, 18, 19, 20, and 30, tp. 61, rge. 11, W. 3rd mer. Four miles east of this location, an area extending 5 miles north and south was light to moderately defoliated.

South of Sled Lake in secs. 25, 35, and 36, tp. 62, rge. 10, W. 3rd mer., and secs. 3, 4, 5, 8, 9, and 10, tp. 63, rge. 9, W. 3rd mer., and in secs. 32 and 33, tp. 62, rge. 9, W. 3rd mer., defoliation was severe. Moderate defoliation was noted in secs. 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, and 36, tp. 62, rge. 10, W. 3rd mer., and secs. 30, 31, and 32, tp. 62, rge. 9, W. 3rd mer.

North of Appleby Bay in secs. 16, 22, 26, tp. 63, rge. 9, W. 3rd mer., and west of Sled Lake in secs. 23, 24, and 25, tp. 62, rge. 12, W. 3rd mer., and sec. 30, tp. 62, rge. 11, W. 3rd mer., damage to poplar was severe. North of the last location in secs. 31, tp. 62, rge. 11, W. 3rd mer., secs. 26, 35, and 36, tp. 62, rge. 12, W. 3rd mer., secs. 6 and 7, tp. 63, rge. 11, W. 3rd mer., and secs. 1, 2, 11, and 12, tp. 63, rge. 12, W. 3rd mer., defoliation was light to moderate. In the remainder of the area observed from the air the infestation was nil to very light.

Glaslyn Infestation:- A ground survey was made of the large aspen tortrix and forest tent caterpillar infestations north of Glaslyn along No. 4 Highway in the Meadow Lake Provincial Forest (see map). The two species caused severe defoliation to poplar in the east half of sec. 13, tp. 54, rge. 17, W. 3rd mer., and the west half of sec. 7, tp. 54, rge. 16, W. 3rd mer. Light to moderate defoliation occurred in secs. 12 to 24, the west half of sec. 13, tp. 54, rge. 17, W. 3rd mer., and secs. 6 to 18, and the east half of sec. 7, tp. 54, rge. 16, W. 3rd mer. Other collections of the forest tent caterpillar were made in the locality but larvae were not plentiful enough to cause any damage.

Bittern Creek Infestation: - On July 24, the forest tent caterpillar outbreak near Bittern Creek north of Prince Albert National Park was mapped from the air (see map). The infestation was quite small and covered parts of five sections. Severe defoliation occurred along Highway No. 2 in sec. 36, tp. 57, rge. 27, W. 2nd mer. In secs. 30, and 31, tp. 57, rge. 27, W. 2nd mer., where the infestation borders a swamp it was light to moderate. In sec. 24, tp. 57 and sec. 1, tp. 58, rge. 27, W. 2nd mer., it was light to absent. A ground survey was carried out the same day to check defoliation and samples were taken from the infested area.

(v) <u>Large aspen tortrix.</u> An aerial survey of the large aspen tortrix infestation in the Glaslyn area was made on August 2, 1951. A similar survey was carried out in 1950 to determine the approximate boundaries of this infestation (see map). Several collections of this insect were made early in the season but the appearance of the defoliation had changed from the time the collections were made and the time of the aerial survey.

The southern boundary of the infestation was approximately 5 miles north of Cochin and extended in a northwesterly direction past Daysville and Hartwell and along the west short of Brightsand Lake, then north and east across the northern end of Turtle Lake to a point 27 miles north of Glaslyn. From there it ran east-southeast to a point 4 miles east of Junor, thence south between Cater and Belbutte where it turned southwest past Meadstead to the starting point north of Cochin.

"Islands" of severe defoliation were noted in the following areas: northwest of Helene Lake in tp. 53, rge. 16, W. 3rd mer., covering approximately 12 sections; north in tp. 54, rge. 15, W. 3rd mer., covering about the same area; along the east shore of Helene Lake in tp. 53, rge. 15, W. 3rd mer., in an area about 4 miles long by 3 miles wide; at the south end of Turtle Lake tp. 52, rges. 18, and 19, in an area extending about 5 miles north and south by 6 miles east and west; along the east, west, and south shores of Brightsand Lake, extending inland for 2 miles on the west side and 5 miles on the south and east shore lines. Another small area of severe defoliation was noted in sec. 1, tp. 53, rge. 17, W. 3rd mer.

Moderate to severe defoliation occurred from Glaslyn to 11 miles south along No. 4 Highway, northwest to Turtle Lake and northeast almost to Birch Lake. North of Glaslyn for 11 miles damage was light. From 11 miles north to 18 miles north of Glaslyn along No. 4 Highway defoliation was moderate. Northwest of Turtle Lake damage was light to moderate. A small area of moderate to severe defoliation occurred north of Helene Lake in tp. 54, rges. 14, 15, and 16, W. 3rd mer. In the remainder of the area surveyed defoliation was light or absent.

(vi) Forest tent caterpillar egg survey. During the latter part of the 1951 season a forest tent caterpillar egg survey was made of poplar stands to determine the probably areas of infestation in 1952. This survey was quite extensive and covered areas in the Prince Albert, Northern, and Meadow Lake districts of Saskatchewan.

At each collection point three trees were cut down, and a tally made of egg-bands found on each tree. Height and d.b.h. of the trees were recorded. In the known infestations, collections were made at fairly close intervals and extended into the stand up to half-a-mile from the roads. After the accessible portions of these areas had been completely covered, collections were made at approximately five-mile intervals north and south and wherever possible east and west from the 1951 infestation until at least two consecutive negative reports were made. To simplify the recording of data, three general locations were chosen: Glaslyn, Sled Lake, and Bittern Creek.

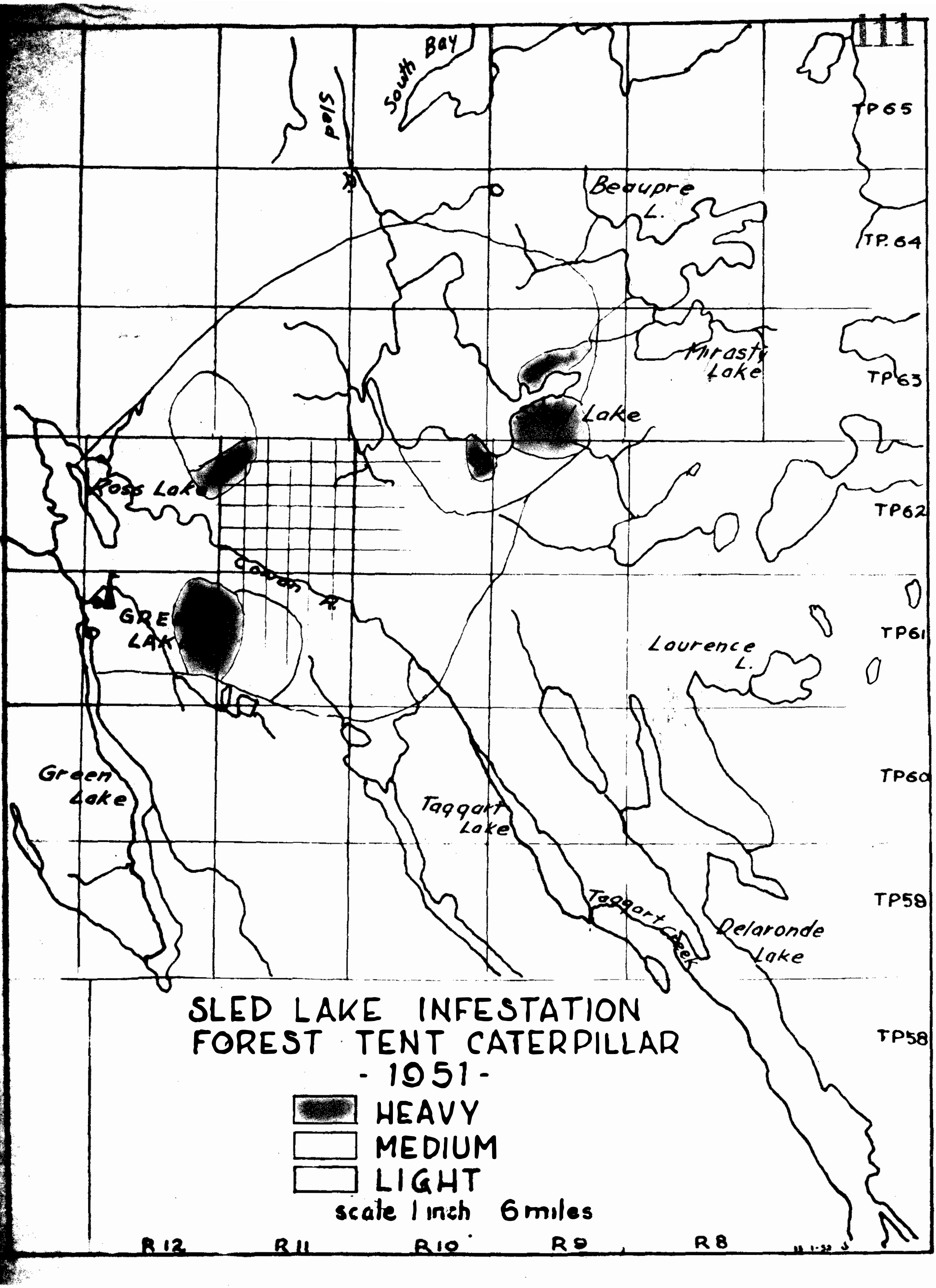
The 1951 infestation at Glaslyn was quite small and was centred about 17 miles north of the townsite along No. 4 Highway. Egg counts were made south of this area to Glaslyn and north of the infestation to Dorintosh. A total of 24 collections was made in this area.

The survey at Sled Lake commenced at Meadow Lake and ran east to Green Lake, then south and east through Big River to Dumble. It also continued north of the forks past Sled Lake, Beaupre Lake, to Dore Lake. In the area outlined 36 collection points were examined for forest tent caterpillar eggs.

At Bittern Creek the survey ran north along No. 2 Highway to Lac la Ronge and south from Bittern Creek through Prince Albert National Park to the South Gate. In this area 31 points were examined.

Permanent sample plots were established in these areas for determining tree mortality caused by the forest tent caterpillar. The plots were 5 chains long by ½ chain wide. All trees in the plot were tallied and 10 trees, selected at random, were tagged permanently. The exact d.b.h. was recorded of the tagged trees.

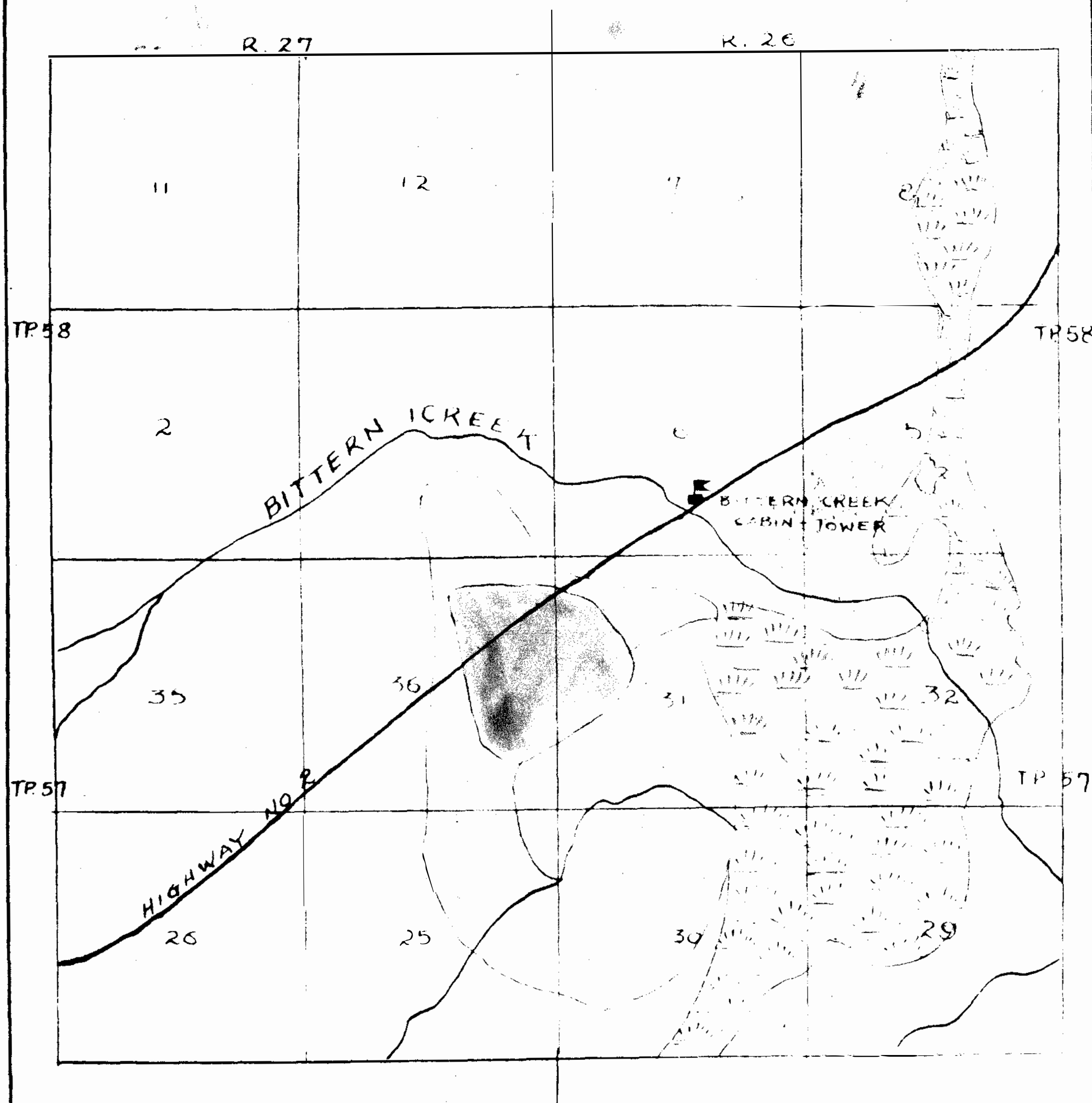
A total of 9 plots was established; 3 each in the Glaslyn and Sled Lake areas, 2 at Green Lake, and 1 at Bittern Creek. The majority of these were established in stands that had been severely defoliation in 1951.



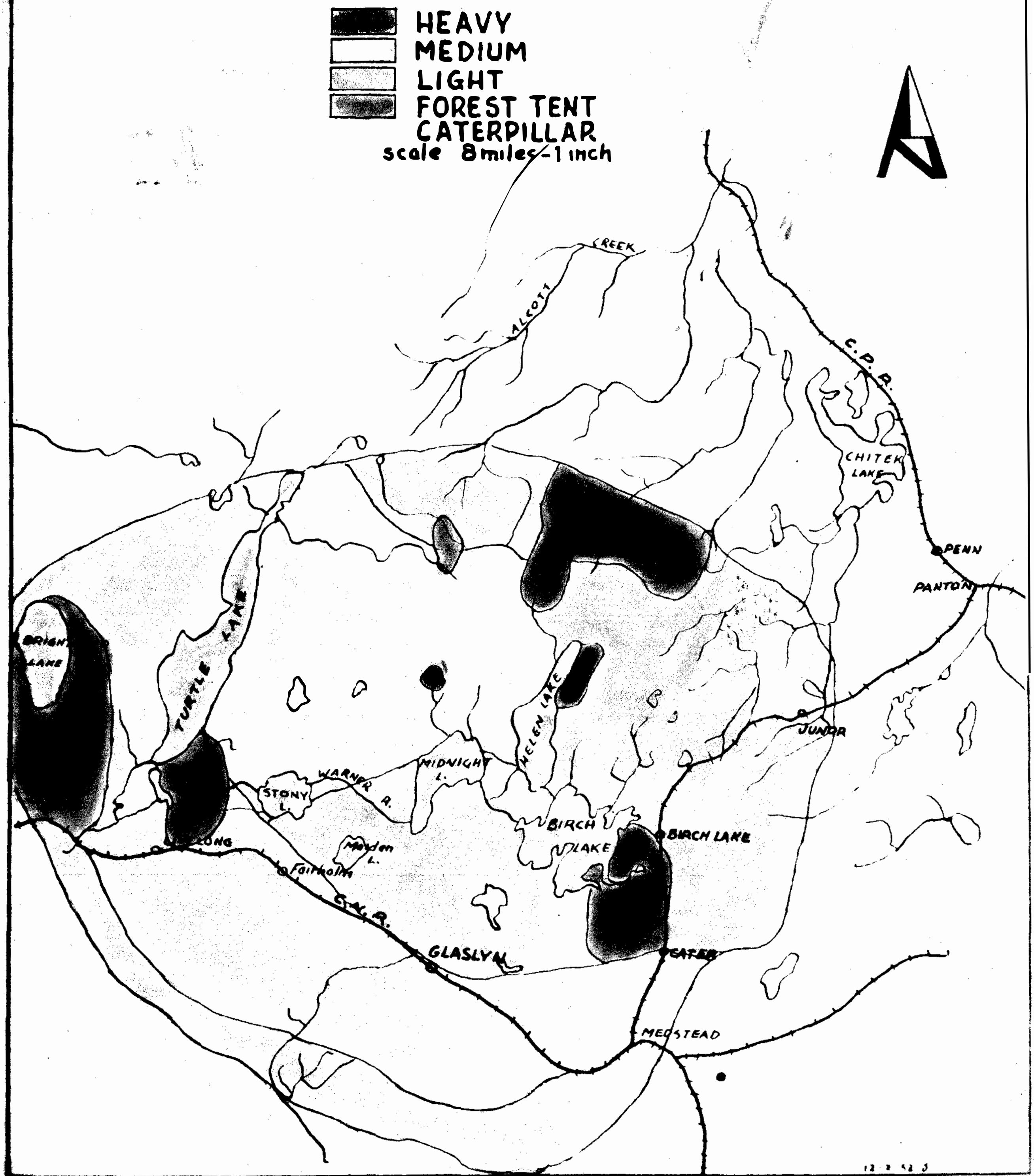
South Bay
TP65
Beaupre L.
TP.64
Mirasty Lake
TP63
Lake
Ross Lake
TP62
Cowan R.
TP61
Laurence L.
Green Lake
TP60
Taggart Lake
TP58
Taggart Creek
Delaronde Lake
TP58
SLED LAKE INFESTATION
FOREST TENT CATERPILLAR
- 1951 -
HEAVY
MEDIUM
LIGHT
scale 1 inch 6 miles
R12
R11
R10
R9
R8

BITTERN CREEK INFESTATION
FOREST TENT CATERPILLAR
- 1951 -

HEAVY
MEDIUM
LIGHT
scale 1½ inch-6miles



INFESTATION MAP OF THE LARGE ASPEN TORTRIX AND FOREST TENT CATERPILLAR AT GLASLYN - 1951 -



(d) Personnel Contacted

Name	Position	Address	Dem. of Sampling	No. of Contacts
E.J. Marshall	Director of Forests	Prince Albert	No	3
B.A. Matheson	Dist. Supt.	Prince Albert	No	7
P. Masarach	Field Officer	Holbein	No	1
A.C. Towell	Field Officer	MacDowall	Yes	4
F.J. Arnold	Field Officer	Prince Albert	No	4
W. Crothers	Field Officer	Glaslyn	No	3
D.W. Pegg	Field Officer	Loon Lake	Yes	6
A. May	Field Officer	Dorintosh	No	1
B. Shannon	Field Officer	Green Lake	No	5
E. Over	Field Officer	Big River	No	5
T. Arsenault	Field Officer	Beaupre Lake	Yes	6
B.I.M. Strong	Park Supt.	Waskesiu	No	1
W. Riese	Field Officer	Lac la Ronge	No	4
V.P. Honig	Field Officer	St. Walburg	No	1
H.P. Michaud	Field Officer	Goodsoil	Yes	2
E.H. Sharman	Field Officer	Pierceland	Yes	5
A. Freemont	Field Officer	Montreal North End	No	1
G. Beck	Jr. Field Officer	Meadow Lake	Yes	2
A. Stark	Field Supervisor	Meadow Lake	No	6
W. MacNeill	Forester	Meadow Lake	Yes	4
A. Hanson	Dist. Supt.	Meadow Lake	No	6
J. Cowie	Head of Nursery	Big River	No	2
F. Warburton	Fire Control Officer	Prince Albert	No	1
J. Johnson	Field Supervisor	Prince Albert	No	3
N. Masarach	Towerman	English Cabin	No	1
M. Pally	Forester	Prince Albert	No	1
R. Christie	Forester	Prince Albert	No	1
W. McInnis	Patrolman	Nipawin	Yes	1
H. Barton	Patrolman	MacDowall	No	2
G.L. Holden	Warden	Waskesiu	No	1
S. Pocock	Warden	Waskesiu	No	3
F. Jarvis	Warden	Waskesiu	No	1
E.L. Millard	Warden	Waskesiu	No	1
C. Annistasiou	Student Assistant	Saskatoon	Yes	3
T. Leia	Asst. Forester	Meadow Lake	Yes	3
L.S. Horne	Field Officer	Smeaton	No	1
W.A. MacDonald	Field Officer	Nipawin	No	1

III FOREST INSECT SURVEY

B. Reports on special projects.

I. LARCH SAWFLY, *Pristiphora erichsonii* (Htg.)

by

V. Hildahl and L. McDowall

(a) Introduction.

This report contains complete information on the status and distribution of the larch sawfly in 1951 in tamarack stands throughout the forested areas of Manitoba and Saskatchewan. Much of the data were derived from surveys and special stand inspections. Special inspections were made of ninety-nine stands, 53 stands in Manitoba and 46 stands in Saskatchewan. Distribution of the larch sawfly was obtained from ground surveys, supplemented by aerial surveys of inaccessible areas. A complete aerial survey of the northern areas of the two provinces was not attempted owing to limited air transportation.

The report also contains a summary of the distribution and incidence of larch sawfly parasites in Manitoba and Saskatchewan. Mass collections of larch sawfly cocoons were made in individual tamarack swamps in Manitoba and in Saskatchewan. The cocoons were collected during August and September 1951 and were subsequently dissected and reared to determine the kind and number of parasites. *Mesoleius tenthredinis* and *Bessa harveyi* were the two main parasites recovered. *Tritneptis klugii* was also present in some areas, but since all of the cocoons collected from each area were stored in the same containers prior to treatment, it was impossible to determine the number of cocoons actually destroyed by this insect because of possible contamination.

(b) Larch Sawfly Distribution.

Distribution of the larch sawfly in 1951 remained much the same as in 1950, but some recessions in populations were noted in parts of Eastern Manitoba and in the central portions of Riding Mountain National Park, where it appeared to be less abundant. On the other hand, increased populations were recorded in the Meadow Lake district of Western Saskatchewan, although defoliation remained light.

In south-eastern Manitoba, light to moderate defoliation was recorded from Middlebro, near the United States boundary west to Sprague and South Junction. The most severe defoliation in this area occurred in a large tamarack and black spruce swamp located in sec. 15, tp. 1, rge. 13, E.P.M., one quarter of a mile north-west of South Junction. North of Sprague in the Moose Lake area defoliation was heavy. From Moose Lake west to Whitemouth Lake moderate to heavy defoliation occurred. Stands of tamarack south of Whitemouth Lake to Vassar were lightly defoliated. Moderate to heavy defoliation was recorded in a large swamp in the vicinity of Wampum. Swamps from Vassar west to Piney and Menisino suffered light to moderate defoliation. North of Piney to Badger, Carrick, and Woodridge, sawfly populations were very light and no serious defoliation resulted. In the southern part of the Sandilands Forest Reserve defoliation was light. Tamarack along the road between the Forest Reserve Headquarters and the Town of Marchand suffered moderate to severe defoliation. Sawfly populations remained about the same as in 1950 in the northern part of the Sandilands Forest Reserve. Light to moderate defoliation still prevailed from Dawson Cabin to the west boundary of the Reserve. From Dawson Cabin north-east to Hadashville moderate to severe defoliation was recorded in all swamps examined. East of Hadashville to McMunn and East Braintree, defoliation ranged from light to moderate. Stands between East Braintree and Waugh, along the G.W.W.D. railroad, showed moderate to severe defoliation. Moderate to heavy defoliation occurred in stands between East Braintree and Falcon Lake.

Only one area of severe defoliation occurred throughout the Interlake District. This heavily defoliated area was located approximately two miles north of Riverton. Light to moderate defoliation was recorded in the area north of Riverton to Sugar Creek along the east side of Washow Bay. From Riverton west to Arborg and north to Rosenburg light to moderate defoliation prevailed. Light defoliation was recorded in stands from Broadvalley north to Hodgson and Red Rose. In the vicinity of Ashern and north to Moosehorn, Spearhill, Grahamdale, Fairford, and Gypsumville defoliation was light. One small area of light to moderate defoliation was encountered north-east of Gypsumville, but it showed no increase over 1950.

In eastern Manitoba in the vicinity of Seven Sisters, light to moderate defoliation was recorded. Light defoliation occurred east to Pointe du Bois and north to Bird River. From Lac du Bonnet north to Great Falls and Pine Falls, defoliation remained light to moderate. The same condition existed in the Traverse Bay area. Severe defoliation was recorded in the area between Wood Siding and Murray Hill. Tamarack stands along the shore of Lake Winnipeg between Beaconia and Scanterbury were only lightly defoliated. Along the east shoreline of Lake Winnipeg, between the O'Hanley and Black Rivers, and to the Manigotagan River area, defoliation ranged from light to moderate. North to the Poplar and Mukutawa Rivers and to Montreal Point, stands suffered light defoliation. Severe defoliation was recorded in the Norway House area and also east and north of Norway House to Holton Lake. At Touchwood Lake tamarack stands were lightly defoliated. Severe defoliation was recorded in stands south of Wanless Lake and at the north end of Vermilyea Lake. At God's Lake defoliation was severe. South of God's Lake to the Murray and Beaverhill Lakes, and on the west side of Gosse Lake, stands were severely defoliated. Stands in the vicinity of Island and Cordeau Lakes and south to Hudwin Lake were also severely defoliated. Defoliation was lighter south of the Cobham River to Family and Sasaginnigak Lakes. Some heavy damage was recorded north of the Bloodvein River, along the north and south sides of Rice Lake and along the Gunnar Road in the Bissett area.

Defoliation varied from light to moderate along the Trans-Canada Highway, excepting at Telford, where severe defoliation was recorded. North of Rennie through the Whiteshell Forest Reserve to Crow-Duck Lake, tamarack suffered light to moderate defoliation.

In western Manitoba defoliation of tamarack by the larch sawfly was more severe than in 1950. Defoliation in Riding Mountain National Park was severe in the western section of the Park, light in the central sections, and severe in the southern and eastern sections. Defoliation was severe in all areas that were examined in the Duck Mountain and Porcupine Forest Reserves.

Defoliation of tamarack by the larch sawfly was again widespread in northern Manitoba. South of The Pas to the Overflowing River defoliation ranged from moderate to severe. In the area known as "The Bog" defoliation was severe. North of The Pas in the Big Eddy, Prospector, and Clearwater areas moderate to severe defoliation occurred.

Severe defoliation was recorded in the area from Cormorant to Thicket Portage on the Hudson Bay Railway line and south to Norway House. The most northerly point sampled was at Kettle Rapids, but defoliation in this area was generally light. Severe defoliation of tamarack was recorded in the vicinity of Sturgeon Landing in Saskatchewan. At Cranberry Portage and Flin Flon defoliation was generally light to moderate. Tamarack between Cranberry Portage and Lynn Lake suffered only light to moderate defoliation.

In Saskatchewan moderate to severe defoliation was recorded from Usherville north to Reserve and Hudson Bay. Tamarack east of Hudson Bay along the Armit Road to the Manitoba border was severely defoliated. From Hudson Bay north to Chemong and Wachee defoliation ranged from moderate to severe. Tamarack stands west of Hudson Bay along the Greenbush Trail, and in the vicinity of Veillardville, showed moderate to severe defoliation. Moderate to severe defoliation of tamarack was recorded in all areas examined from Crooked River east to Prairie River. In the area between Mistatum and Bannock, moderate to severe defoliation occurred. Severe defoliation prevailed in most tamarack stands examined in the Carrot River area. North-east of White Fox, along the Flin Flon highway, defoliation ranged from light to moderate. In the Grassy Lake area, north of Love, tamarack stands suffered light to moderate defoliation. Severe defoliation was recorded in the Fort a la Corne Provincial Forest. In the Candle Lake Provincial Forest moderate to severe defoliation occurred. In the Emma Lake Provincial Forest and north through Prince Albert National Park, defoliation for the most part was light to moderate. North and west of Prince Albert to Big River light to moderate defoliation was recorded. Tamarack stands in the Big River Provincial Forest and west to Green Lake and Meadow Lake were only lightly defoliated. In the Meadow Lake Provincial Forest defoliation ranged from light to very light. Tamarack stands west and north of Meadow Lake to the Alberta border were generally infested by the larch sawfly, but only very light damage was observed. Samples of the larch sawfly were obtained in western Saskatchewan as far north as township 73.

(c) Special Reports.

Ninety-nine special reports on larch sawfly defoliation to tamarack stands in Manitoba and Saskatchewan were received in 1951. The reports were obtained through special examinations of individual stands during July, August and September by Insect Rangers. They contained information on size of stand, d.b.h. and height of trees, stand composition, stand density, defoliation and occurrence of curled tips. About 39 per cent of the stands examined consisted of 80 per cent or more tamarack. The remainder were mixed stands varying from 5 to 79 per cent tamarack.

The data contained in the special reports were summarized and the results are shown in Tables A, B. C. and D under the following headings:

Relation Between Composition and Defoliation
Relation Between Diameter and Defoliation
Relation Between Stand Density and Defoliation
Relation Between Curled Tips and Defoliation.

(i) Summary of Reports

Number of Reports submitted	99
Number of Reports showing defoliation	99
Approximate acreage involved	10,777 acres
Average d.b.h. of trees	4"
Range d.b.h.	1/2" - 10"
Average height of trees	24'

Relation Between Composition and Defoliation

TABLE A

No. of Reports	Stand Composition %	Average Defoliation
40	80-100 Tamarack	57.3
31	50-79 Tamarack	50.9
21	20-49 Tamarack	39.5
7	20 Tamarack	47.1

The stands were all grouped and divided into four main composition classes (i.e. stands containing 80 to 100 per cent tamarack; 50 to 79 per cent tamarack; 20 to 49 per cent tamarack; and less than 20 per cent tamarack) and the average defoliation calculated for each class.

Relation Between Diameter and Defoliation

TABLE B.

Diameter Class	Average Defoliation	Diameter Class	Average Defoliation
0-3"	50.5	6.1" - 9"	51.2
3.1"-6"	51.4	9" +	48.2

To determine the relationship between diameter and defoliation the trees examined were divided into four diameter classes, (i.e. 0-3" d.b.h.; 3.1 to 6" d.b.h.; 6.1 to 9" d.b.h.; and over 9" d.b.h.) and the average defoliation calculated for each class.

Relation Between Stand Density and Defoliation

TABLE C

Density Class	Average Defoliation
Heavy	50.1
Medium	51.4
Light	41.8

Under this heading, the stands falling in each category were grouped and the average defoliation calculated for each density class. Stand density was determined visually and was classified as light, medium or heavy.

Relation Between Curled Tips and Defoliation

TABLE D

Curled Tips	No. of Stands	Average Defoliation
Many	9	89.2
Common	42	59.9
Occasional	44	36.7

A record was kept of curled tips observed on the trees examined. They were classified according to abundance and the average defoliation calculated for each class. Three classifications were used for this category (i.e. occasional, curled tip on 15-20 branches; common 2-4 curled tips on 15-20 branches; and Many, five or more curled tips on 15-20 branches).

Conclusions.

The data contained in Tables A, B. and C would indicate that there are no significant relationships between the intensity of infestation and the composition of the stand, the diameter of the tree s attacked, or the density of the stand. However it will be noted in Table D that there is a certain degree of correlation between the number of curled tips and the severity of the infestation.

(d) Larch Sawfly Larval Dissections.

About 8400 larch sawfly larvae were dissected during December 1951 and January 1952, in continuation of the long term project, the object of which is to estimate the yearly fluctuations in parasitism and disease of the larch sawfly. The cocoons were collected from 39 localities in Manitoba and 46 in Saskatchewan.

Dissecting was done under the low power lens of binocular microscopes. The larvae were decapitated, inverted with blunt needle and forceps and the viscera scraped from the exoskeleton. The viscera and exoskeleton were then carefully examined for parasite larvae, parasite eggs and disease.

Recording was done under the following headings (see Tables)

Origin of Cocoons: gives the location from which the cocoons were collected.

Parasitism Determined by Dissections: The number of cocoons dissected from each location, the number of cocoons that contained apparently sound larch sawfly larvae, the number of larch sawfly larvae that contained *Mesoleius* eggs only, the number of sawfly larvae that contained either *Mesoleius* larvae or *Bessa* larvae, the effective parasitism or the number of sawfly larvae that contained either *Mesoleius* larvae or *Bessa* larvae, and the number of sawfly larvae that were parasitized by *Tritneptis klugii*.

Dead Larvae: the number of larvae that were affected with fungus, the number of apparently diseased larvae, the number of sawfly larvae that were dead from miscellaneous causes, i.e. mechanical damage, predators, etc., and the number of sawfly larvae that had died from unknown causes.

TABLE A

Results of Larch Sawfly Larval Dissections - 1951
Southern and Eastern District of Manitoba

Origin of Cocoons					Parasitism Determined by Dissection					Effective Parasitism		Dead Larvae			
Place	Sec.	Tp.	Rge.	Mer.	No. Cocoons Dissected	Living Larvae	Mesoleius Eggs Only	Mesoleius Larvae	Dipterous Larvae	Diptera & Mesoleius	Tritneptis	Fungus	Misc.	Cause Unknown	Total Dead
Murray Hill	24	17	8	E.P.	79	56	7	5	35	40	0	4	19	0	23
Telford	24	10	15	E.P.	100	79	5	3	39	42	0	15	6	0	21
Telford	17	10	16	E.P.	100	22	9	1	39	40	0	14	14	0	28
Seddon's Corner	3	13	9	E.P.	100	71	0	0	31	31	0		29		29
Sandilands F.R.	31	7	11	E.P.	100	85	3	0	22	22	0	3	0	12	15
Sandilands F.R.	34	5	9	E.P.	100	79	0	0	25	25	0	5	6	0	11
Sandilands F.R.	5	8	10	E.P.	100	83	1	2	22	24	0	9	8	0	17
Piney	3	2	11	E.P.	100	93	1	0	14	14	0	7	0	0	7
Sprague	8	1	14	E.P.	90	81	3	6	4	10	0	4	5	0	9
Falcon Lake	9	8	16	E.P.	100	97	0	1	23	24	0	3	0	0	3
East Braintree	33	7	14	E.P.	95	93	1	1	9	10	0	2	0	0	2
Riverton	32	23	4	E.P.	100	82	0	1	27	28	0	7	11	0	18
Gypsumville	25	32	9	W.P.	100	84	0	0	8	8	0	14	2	0	16
Channing					100	34	0	2	3	5	4	61	1	0	66
Amisk Lake					100	83	2	1	17	18	1	17	0	0	17
Cranberry Portage					100	95	1	0	11	11	27	3	1	1	5

TABLE B

Results of Larch Sawfly Larval Dissections - 1951

Western Manitoba

Origin of Cocoons					Parasitism Determined by Dissections					Effective Parasitism		Dead Larvae			
Place	Sec.	Tp.	Rge.	Mer.	No. Cocoons Dissected	Living Larvae	Mesoleius Eggs Only	Mesoleius Larvae	Diptera Larvae	Diptera & Mesoleius	Tritneptis	Fungus	Misc.	Cause Unknown	Total Dead
Riding Mt.Nat. Park	15	20	19	W.P.	100	99	0	2	4	6	0	0	0	1	1
Riding Mt.Nat. Park	8	20	17	W.P.	100	97	1	3	34	37	0	1	0	2	3
Riding Mt. Nat.Park	5	22	19	W.P.	100	100	6	3	9	12	0	0	0	0	0
Riding Mt. Nat.Park	32	19	16	W.P.	100	98	5	5	13	18	0	2	0	0	2
Wasagaming R.M.N.P.	13	21	19	W.P.	100	98	5	3	5	8	0	0	2	0	2
Wasagaming R.M.N.P.	15	21	19	W.P.	100	98	3	2	29	31	0	2	0	0	2
Wasagaming R.M.N.P.	15	21	21	W.P.	100	97	2	2	2	4	0	0	0	3	3
Rossburn	12	22	25	W.P.	100	99	5	3	8	11	0	0	0	1	1
Rossburn	1	22	25	W.P.	100	98	3	2	11	13	0	2	0	0	2
Grandview	25	27	29	W.P.	100	90	2	3	10	13	0	6	1	3	10
Boggy Creek	28	30	28	W.P.	100	95	3	0	9	9	0	5	0	0	5
Bield	22	26	26	W.P.	100	76	1	0	3	3	0	15	3	6	24
Madge Lake	11	30	29	W.P.	100	93	3	2	2	4	0	4	1	2	7
Durban	24	33	28	W.P.	100	90	0	3	25	28	0	4	1	5	10
Garland	33	30	24	W.P.	100	99	3	1	10	11	0	1	0	0	1
Garland	21	30	25	W.P.	100	93	10	4	12	16	0	3	2	2	7
Garland	10	31	23	W.P.	100	88	14	7	11	18	0	7	0	5	12
Sclater	28	34	22	W.P.	100	99	0	0	4	4	0	0	0	1	99
Cowan	14	35	23	W.P.	100	89	2	2	18	20	0	4	2	5	11
Cowan	16	36	23	W.P.	100	93	10	6	15	21	0	3	1	3	7
Minnitonas	20	33	25	W.P.	100	91	3	1	28	29	0	1	5	3	9
Mafeking	7	41	25	W.P.	100	77	13	8	21	29	0	12	1	10	23
Mafeking	9	46	25	W.P.	100	68	8	5	25	30	0	14	4	14	32

TABLE C

Results of Larch Sawfly Larval Dissections - 1951

Hudson Bay District - Saskatchewan

Origin of Cocoons					Parasitism Determined by Dissections					Effective Parasitism		Dead Larvae			
Place	Sec.	Tp.	Rge.	Mer.	No. Cocoons Dissected	Living Larvae	Mesoleius Eggs Only	Mesoleius Larvae	Diptera Larvae	Diptera & Mesoleius	Tritneptis	Fungus	Misc.	Cause Unknown	Total Dead
Madge Lake	27	30	30	W.P.	100	74	1	5	21	26	0	0	20	6	26
Pelly	16	34	32	W.P.	100	83	3	0	18	18	0	0	0	17	17
McBride Lake	25	40	4	W.2nd	100	97	0	0	16	16	0	0	0	3	3
Armit Road	17	44	1	W.2nd	100	78	7	3	20	23	0	0	10	12	22
Armit Road	14	44	31	W.P.	100	77	1	3	18	21	0	0	13	10	23
Armit Road	11	44	32	W.P.	100	71	0	7	14	21	0	0	0	29	29
Chemong	7	49	1	W.2nd	100	86	1	0	16	16	1	0	4	10	14
Wachee	2	46	3	W.2nd	100	86	0	5	14	19	1	0	0	14	14
Ruby Lake	10	46	2	W.2nd	100	91	2	4	15	19	5	0	0	9	9
Ruby Lake	16	46	3	W.2nd	100	91	0	0	10	10	0	0	1	8	9
Hudson Bay	29	45	3	W.2nd	100	79	1	3	18	21	0	5	7	10	22
Veillardville	18	46	4	W.2nd	100	75	1	4	4	8	7	0	11	14	25
Veillardville	5	45	4	W.2nd	100	87	0	2	13	15	2	0	6	7	13
Hudson Bay	35	46	5	W.2nd	100	85	1	4	6	10	2	0	3	12	15
Greenbush	23	45	5	W.2nd	100	91	0	2	11	13	0	0	2	7	9
Orley	12	48	11	W.2nd	100	88	2	0	13	13	0	1	7	4	12
Nipawin	11	53	18	W.2nd	100	72	0	4	14	18	0	0	0	28	28
White Fox Tower	34	53	12	W.2nd	100	92	4	0	8	8	0	0	2	6	8
Fort a la Corne	29	30	11	W.2nd	100	81	12	5	2	7	0	0	0	19	19

TABLE D

Results of Larch Sawfly Larval Dissections - 1951

Prince Albert, Meadow Lake and Northern Districts - Saskatchewan

Origin of Cocoons					Parasitism Determined by Dissections					Effective Parasitism		Dead Larvae			
Place	Sec.	Tp.	Rge.	Mer.	No. Cocoons Dissected	Living Larvae	Mesoleius Eggs Only	Mesoleius Larvae	Diptera Larvae	Diptera & Mesoleius	Tritneptis	Fungus	Misc.	Cause Unknown	Total Dead
Fort a la Corne	4	50	20	W.2nd	100	89	21	9	0	9	0	11	0	0	11
Fort a la Corne	33	50	19	W.2nd	100	94	1	3	0	3	0	5	0	1	6
Fort a la Corne	9	50	22	W.2nd	100	83	4	2	0	2	0	11	1	5	17
Steep Creek Blk.	28	48	23	W.2nd	100	72	14	11	0	11	0	25	3	0	28
Home Blk.	8	49	26	W.2nd	100	77	38	6	3	9	0	19	4	0	23
Home Blk.	13	49	26	W.2nd	100	93	31	9	0	9	1	6	1	0	7
Red Rock Blk.	9	49	25	W.2nd	100	88	5	3	0	3	0	11	1	0	12
Red Rock Blk.	27	49	25	W.2nd	100	92	2	5	0	5	8	6	1	1	8
Red Rock Blk.	5	50	25	W.2nd	100	86	13	3	0	3	0	12	1	1	14
Holbein Blk.	13	49	2	W.3rd	100	90	8	15	0	15	2	8	2	0	10
MacDowall	21	46	1	W.3rd	100	74	23	7	0	7	3	25	1	0	26
Crutwell Corner	22	49	1	W.3rd	100	83	3	4	0	4	0	13	3	1	17
Crutwell Corner	15	49	1	W.3rd	100	78	6	8	0	8	0	18	1	3	22
Candle Lake	13	56	24	W.2nd	100	98	1	3	0	3	0	2	0	0	2
Emma Lake	25	53	27	W.2nd	100	89	4	3	0	3	0	4	6	1	11
Mayview	24	53	2	W.3rd	100	89	7	3	0	3	0	11	0	0	11
Canwood	33	50	4	W.3rd	100	69	16	12	0	12	0	31	0	0	31
Dumble	33	54	7	W.3rd	100	78	8	1	0	1	0	4	5	13	22
Big River	32	55	7	W.3rd	100	98	11	8	1	9	1	2	0	0	2
Big River	30	56	8	W.3rd	100	99	7	1	0	1	0	0	1	0	1
Big River	26	56	9	W.3rd	100	97	2	2	1	3	0	3	0	0	3
Big River	8	56	10	W.3rd	100	99	0	0	0	0	0	1	0	0	1
Turtle Lake(Glaslyn)	34	53	18	W.3rd	100	97	0	0	0	0	0	2	1	0	3
Bronson P.F.	6	58	22	W.3rd	60	57	4	0	0	0	0	1	0	2	3
Lac la Ronge	11	62	24	W.2nd	100	97	0	0	0	0	0	2	1	0	3
Lac la Ronge	2	65	24	W.2nd	100	94	0	1	0	1	0	2	4	0	6
Lac la Ronge	32	70	18	W.2nd	100	96	1	0	0	0	0	2	2	0	4

(e) Larch Sawfly Rearings.

During January, February and March of 1952 approximately 8600 larch sawfly cocoons were reared in a controlled temperature cabinet. The cocoons were reared on moist cotton in jelly jars, 25 cocoons per jar. The cocoons were placed in the rearing cabinet at an initial temperature of 40° F. The temperature was raised one to two degrees per day until a maximum of 70° F. was reached three weeks after incubation was started.

Results of the rearings are shown in Tables E, F. G. and H.

TABLE E.

Summary of Larch Sawfly Rearings - 1951

Eastern, Southern and Northern Manitoba

Origin of Cocoons	No. of Cocoons reared	Number of Emergents				Number of Living Unemerged						Parasitized by Tritneptis	No. of Cocoons Discarded
		Sawfly adults		Parasites		Sawflies			Parasites				
		Female	Male	Dip.	Hym.	Larvae	Pupae	Adults	Hym. Eggs	Larvae	Dip. Larvae		
Telford	100	41	1	29	1	0	0	0	0	0	0	5	23
Telford	100	16	0	22	0	0	0	0	0	0	0	43	19
Pointe du Bois	84	18	0	31	0	0	0	0	0	0	0	18	17
Pointe du Bois	110	30	0	42	0	0	0	0	0	0	0	8	30
Seddon's Corner	100	33	1	22	0	0	0	0	0	0	0	1	43
Pointe du Bois	110	37	0	42	0	0	0	0	0	0	0	3	28
Stead	100	19	0	32	1	0	0	0	0	0	0	20	28
Sprague	100	22	0	3	3	34	1	5	0	0	2	0	30
Piney	100	30	0	9	1	25	2	2	0	0	1	0	30
Sandilands F.R.	100	32	0	9	0	21	0	3	0	0	0	0	35
Sandilands F.R.	100	31	0	13	0	12	3	1	0	0	0	0	40
Sandilands F.R.	100	34	0	17	0	10	2	0	0	0	0	0	37
Riverton	100	30	0	21	2	29	0	3	0	0	0	0	15
Gypsumville	100	34	1	27	0	25	0	2	0	0	0	0	11
Cranberry Portage	100	15	0	0	0	56	0	29	0	0	0	0	0
Channing	50	3	0	0	0	0	9	30	0	0	8	0	0
Amisk Lake	100	15	0	0	0	45	0	27	0	0	0	10	3

TABLE F.

Summary of Larch Sawfly Rearings - 1951

Western Manitoba

rigin of ocoons	No. of Cocoons reared	Number of Emergents				Number of Living Unemerged						Parasitized by Tripmentis	No. of Cocoons Discarded
		Sawfly adults		Parasites		Sawflies			Parasites				
		Female	Male	Dip	Hym	Larvae	Pupae	Adults	Hym. Eggs	Larvae	Dip. Larvae		
asagaming	100	78	2	8	1	4	0	1	0	1	0	0	5
wan	100	37	1	17	2	17	1	2	0	0		19	4
later	100	86	2	3	0	0	0	2	0	0	0	2	5
rland	100	68	2	8	1	15	0	2	0	0	0	4	0
asagaming	100	52		22	1	0	1	0	0	0	0	0	24
ssburn	100	68	2	3	6	5	2	0	0	0	0	2	12
rland	100	46	1	17	2	1	0	0	0	0	0	0	33
feking	100	60	2	16	1	1	3	0	0	0	1	1	15
rland	100	58	1	11	3	2	1	0	0	2	0	6	16
asagaming	100	71	1	3	0	2	2	0	0	0	0	13	8
andview	100	64	0	11	1	2	2	0	0	0	0	6	14
wan	100	52	1	19	2	2	0	3	0	0	0	2	19
rch River	30	9	0	10	1	0	1	0	0	0	0	0	9
asagaming	100	57	0	5	5	10	4	1	0	0	0	0	18
nitonas	100	47	0	18	0	6	3	0	0	0	0	10	16
rban	100	23	1	17	0	4	0	0	0	0	0	0	55
asagaming	100	64	4	9	4	7	0	0	0	0	0	4	8
feking	100	31	0	20	5	1	1	0	0	0	0	6	36
asagaming	100	20	1	33	2	2	4	0	0	0	0	12	26
asagaming	100	49	1	8	1	7	2	0	0	0	0	2	30
dge Lake	100	65	1	8	1	3	0	1	0	0	0	5	16
eld	100	57	0	5	1	1	0	0	0	0	0	0	36
ggy Creek	100	69	3	9	2	3	1	0	0	0	0	2	11
sburn	100	46	0	14	7	6	0	0	0	0	0	4	23

TABLE 8.

Summary of Larch Sawfly Rearings - 1951

Hudson Bay, Saskatchewan.

Origin of Cocoons	No. of Cocoons reared	Number of Emergents: Sawfly Adults		Number of Emergents: Parasites		Number of Living Unemerged: Sawflies			Number of Living Unemerged: Parasites			Parasitised by Tritneptis	No. of Cocoons Discarded
		Female	Male	Dip.	Hym.	Larvae	Pupae	Adults	Hym. Eggs	Larvae	Dipt. Larvae		
Armit Road	100	36	0	7	0	0	0	0	0	0	0	0	57
Armit Road	100	47	0	10	2	4	0	0	0	0	0	0	37
Armit Road	100	31	0	8	0	6	0	0	0	0	0	0	55
Ruby Lake	100	40	0	6	0	2	0	3	0	0	0	0	49
Ruby Lake	100	28	0	1	0	6	0	0	0	0	0	8	57
Fort a la Corne	100	40	0	0	3	2	0	0	0	0	0	0	55
Veillardville	100	24	0	3	0	6	0	0	0	0	0	5	62
Veillardville	100	9	0	0	0	5	0	0	0	0	0	2	84
Greenbush Trail	100	48	0	2	0	7	0	8	0	0	0	2	33
Whitefox	100	43	0	1	1	7	0	0	0	0	0	0	48
Nipawin P.F.	100	18	0	4	0	4	0	0	0	0	0	0	74
Orley	100	67	1	2	0	2	0	1	0	0	0	0	27
Hudson Bay	100	28	1	18	0	6	0	1	0	0	0	0	46
Hudson Bay M.15	100	22	0	1	0	3	0	0	0	0	0	6	68
Wachee	100	34	0	7	0	0	0	0	0	0	0	0	59
McBride Lake	100	59	0	12	1	2	0	0	0	0	0	0	26
Pelly	100	16	0	0	0	12	0	0	0	0	0	0	72
Madge Lake	100	18	0	4	0	0	0	0	0	0	0	0	78
Chemong	100	55	1	7	0	5	0	1	0	0	0	0	31

TABLE H.

Summary of Larch Sawfly Rearings - 1951

Prince Albert, Meadow Lake and Northern Districts Saskatchewan

Origin of Cocoons	No. of Cocoons reared	Number of Emergents: Sawfly Adults		Number of Emergents: Parasites		Number of Living Unemerged: Sawflies			Number of Living Unemerged: Parasites			Parasitized by Triungentis	No. of Cocoons Discarded
		Female	Male	Dip.	Hym.	Larvae	Pupae	Adults	Hym. Eggs	Larvae	Dipt. Larvae		
McDowell	160	65	0	0	14	1	0	0	0	0	0	0	20
Holbein	125	82	0	0	9	20	0	0	0	0	0	1	13
Crutwell	100	46	1	1	2	0	0	0	0	0	0	24	26
Crutwell	100	45	1	0	14	10	0	0	0	0	0	5	25
Home Block	125	39	0	0	23	0	0	0	0	0	0	32	31
Home Block	125	36	2	0	2	0	0	0	0	0	0	75	10
Red Rock Block	125	48	0	0	3	12	0	0	0	0	0	49	13
Red Rock Block	100	66	2	0	0	0	0	0	0	0	0	13	19
Red Rock Block	100	53	3	0	4	39	0	0	0	1	0	0	0
Steep Creek Block	100	51	0	0	18	0	0	0	0	0	0	0	31
Big River	100	75	0	1	3	3	0	0	0	0	0	10	8
Big River	100	72	2	0	1	0	1	0	0	0	0	0	24
Big River	125	51	2	0	7	12	0	0	0	0	0	44	9
Dumble	100	53	0	0	3	8	0	0	0	1	0	9	26
Camwood	100	34	0	0	9	16	2	0	0	0	0	0	39
Fort a la Corne	125	72	0	0	0	0	0	0	0	0	0	2	51
Fort a la Corne	125	73	3	1	1	28	0	0	0	0	0	0	19
Fort a la Corne	125	53	1	0	10	23	0	0	0	0	0	15	24
Candle Lake	100	90	0	0	2	2	0	0	0	0	0	0	6
Emma Lake P.F.	100	63	2	0	5	16	0	0	0	0	0	0	14
Mayview	100	34	0	0	0	0	0	0	0	0	0	56	10
Lac la Ronge	100	77	0	0	1	0	0	0	0	0	0	0	22
Lac la Ronge	100	66	1	0	2	11	2	0	0	0	0	0	18
Lac la Ronge	100	87	1	0	1	8	0	0	0	0	0	0	3
Glaslyn	100	78	1	0	0	10	1	0	0	0	0	0	10

2. Forest Tent Caterpillar, *Malacosoma disstria* (Hbn.)

by

V. Hildahl

(a) Distribution.

In 1951, new infestations of the forest tent caterpillar appeared in south-eastern Manitoba, but in areas previously infested populations continued to decline. New infestations occurred in the Moose Lake area and around the Big Whiteshell-Crow-Duck Portage in the Whiteshell Forest Reserve. The sudden increase in populations in these areas suggests that south-eastern Manitoba may be subjected to a more widespread outbreak in 1952.

In south-eastern Manitoba, large stands of white poplar between Moose Lake and the Northwest Angle Inlet on the Manitoba-Ontario boundary were partially or completely defoliated by the forest tent caterpillar. The most severe defoliation occurred in tps. 3, 4 and 5, rgs. 17, E.P. mer., and in three separate local areas in tps. 3 and 4, rges. 15 and 16, E.P. mer. between Moose Lake and Whitemouth Lake. White poplar and its understory were completely defoliated in these areas. From Whitemouth Lake south to Vassar and west to Piney stands were only lightly defoliated. The infestation around the Big Whiteshell-Crow-Duck Portage in the Whiteshell Forest Reserve was severe and completely defoliated all deciduous trees. It covered approximately 320 acres in secs. 12 and 13, tp. 13, rge. 8, E.P. mer.

The severe infestation recorded in 1949 on an island in Big Whiteshell Lake continued to decline, but it was still causing light to moderate defoliation at the northern extremity of the island. East of Lake Winnipeg the infestations previously reported at Quesnel and Sasaginnigak Lakes also continued to subside. The area around Family Lake was severely defoliated in 1950, however, lack of air travel prevented a survey of this area in 1951.

Small collections of this insect were obtained also from the following points in south-eastern Manitoba in 1951: Caddy Lake, Rennie, the Sandilands Forest Reserve (sec. 35, tp. 5, rge. 8, E.P. mer.), Lac du Bonnet, and Fort Garry. Two collections were made in the Northern District of Manitoba, one at Reader Lake and the other near Sturgeon Landing on the Manitoba-Saskatchewan boundary.

In central Saskatchewan, the forest tent caterpillar increased in abundance. Relatively small but severe infestations appeared, for the first time, in the vicinity of Beaupre and Sled Lakes and north-east of Prince Albert National Park. It also continued to severely defoliate poplar north of Glaslyn. This sudden appearance of new infestations may mark the beginning of another general outbreak closely resembling the one that severely defoliated most of the poplar belt of Saskatchewan between 1930 and 1944.

A small infestation of this insect was recorded along the No. 2 Highway north-east of Prince Albert National Park. The infestation covered parts of five sections. Poplar stands in the west half of sec. 31 and the north-west quarter of sec. 30, tp. 57, rge. 26, W.2nd mer. were lightly to moderately defoliated. In sec. 25, tp. 57, rge. 27 and sec. 1, tp. 58, rge. 26, W.2nd mer. defoliation was light. Severe defoliation occurred in the east half of sec. 36, tp. 57, rge. 27, W.2nd mer. A few larvae were collected in secs. 4 and 10, tp. 57, rge. 1, W.3rd mer. in Prince Albert National Park, but no defoliation to white poplar was observed.

In the vicinity of Beaupre and Sled Lakes the forest tent caterpillar severely defoliated pockets of white poplar in the area bounded by the north end of Cowan Lake, Green Lake, Sled Lake and Beaupre Lake. Within this area, severe defoliation occurred north of Appleby Bay in secs. 16, 22 and 26, tp. 63, rge. 9, W.3rd mer., south of Sled Lake in secs. 25 to 36, tp. 62, rge. 10, W.3rd mer., west of Sled Lake in secs. 23, 24 and 25, tp. 62, rge. 12 and sec. 30, tp. 62, rge. 11, W.3rd mer. and east of Green Lake in secs. 4, 12, 13, 23, 24 and 25, tp. 61, rge. 12, and secs. 7, 17, 18, 19, 20 and 30, tp. 61, rge. 11, W.3rd mer. Moderate defoliation was noted in secs. 22, 23, 24, 25, 26, 27, 33, 34, 35 and 36, tp. 62, rge. 10, W.3rd mer. In the remainder of the area between Cowan Lake, Green Lake, Sled Lake and Beaupre Lake, defoliation was light with only occasional trees showing partial defoliation.

The infestation north of Glaslyn, first recorded in 1950, continued to defoliate deciduous trees severely, but showed no evidence of having spread. The large aspen tortrix, Archips conflictana (Wlk.) was abundant also in this area and appeared to be causing as much defoliation as the forest tent caterpillar. Severe defoliation occurred in the east half of sec. 13, tp. 54, rge. 17, W.3rd mer. and in the west half of sec. 7, tp. 54, rge. 16, W.3rd mer. A light to moderate infestation prevailed in secs. 12, 13 and 24, tp. 54, rge. 17 and secs. 6, 7 and 18, tp. 54, rge. 16, W.3rd mer.

(b) Egg Surveys.

In order to predict as accurately as possible the probable extent of infestations and the severity of defoliation in 1952, an egg survey was made in the fall of 1951. White poplar was examined for egg bands where forest tent caterpillar infestations were present during the summer and in adjacent areas. Examinations were made at approximately five mile intervals in as many directions as possible from the centre of the infestations until negative results were obtained. Three trees were felled at each examination point and all twigs and branches carefully examined for egg bands. The number of egg bands and other data were recorded for each tree. From 5 to 20 egg bands per tree were found in many areas and occasionally the count exceeded 50 bands per tree.

The egg bands obtained during the survey were reared to determine the percentage of parasitism and the percentage survival of the overwintering larvae. Parasites were present in only 8 of the 74 areas in Manitoba and 3 of the 72 areas in Saskatchewan where egg bands were collected. The number of eggs destroyed by parasites was small and there was no evidence of mortality from other causes. As shown in the accompanying Tables, the field surveys and laboratory rearings point to a wide distribution and a high rate of survival among overwintering larvae.

(c) Conclusions

Results of the egg survey and laboratory rearings indicate that populations of the forest tent caterpillar will increase and cause light to severe defoliation over a much larger area in south-eastern Manitoba in 1952. The severely infested area will probably be bounded on the south by the United States, on the east by Ontario, on the west by Steinbach and Beausejour and on the north by the Winnipeg River. Severe defoliation may again be expected in the area between Moose Lake and the Northwest Angle Inlet, and in the area around the Big Whiteshell-Crow-Duck Portage in the Whiteshell Forest Reserve.

In Northern Saskatchewan, severe defoliation may again be expected in the areas that were severely attacked in 1951. In addition, the egg pattern indicates that these small infestations may merge into a general outbreak in 1952. Severe defoliation is also expected to occur over a small area south of Lac la Ronge in sec. 31, tp. 69, rge. 22, W.2nd mer. In this area, an average of 24 egg bands were found per tree.

A map showing present infestations in Manitoba and Saskatchewan, and Tables showing egg distributions as determined by field surveys and the probable degree of defoliation in 1952 at each examination point are appended to this report. The dots on the map indicate collection points only.

TABLE I - EASTERN MANITOBA

Place	Location Sec.	Tp.	Rge.	Mer.	Aver.Ht. of Trees Examined	Aver.DBH of Trees Examined	Aver.No. of Egg Bands per Tree	% of Eggs Containing Living Larvae	% Parasitized	Prediction # for 1952
Red Rock Lake	8	12	15	E.P.	20.3	3.3	2.	98	0	L-M
Brereton Lake	29	11	15	E.P.	30.	3.3	3.	98	0	L-M
Betula Lake	1	13	14	E.P.	27.7	3.7	.7	87	0	L
Heart Lake	29	13	14	E.P.	23.7	4.	.3	93	0	L
Rennie	29	10	14	E.P.	17.	2.3	3.3	92	0	L-M
Big Whiteshell	13	13	16	E.P.	22.3	2.7	8.7	97	0	M-H
Big Whiteshell	13	13	16	E.P.	23.3	3.	13.3	93	0	M-H
Big Whiteshell	13	13	16	E.P.	25.	3.	44.	98	0	H
Big Whiteshell	13	13	16	E.P.	28.3	2.3	8.3	93	0	M-H
Big Whiteshell	13	13	16	E.P.	19.3	2.3	50.	98	0	H
Big Whiteshell	13	13	16	E.P.	15.	2.	16.	92	0	H
Crow Duck Portage	13	13	16	E.P.	28.3	2.3	9.3	96	0	M-H
Big Whiteshell Ptge.	13	13	16	E.P.	23.3	2.	2.7	95	0	L-M
Big Whiteshell "	13	13	16	E.P.	26.	2.	36.	91	0	H
Big Whiteshell "	13	13	16	E.P.	26.	2.	9.3	90	0	M-H
Big Whiteshell "	13	13	16	E.P.	28.7	2.7	4.5	98	0	M-H
Green Lake	20	13	16	E.P.	30.	3.	1.	98	0	L
Aneda	23.	13	9	E.P.	25.7	4.	.3	98	0	L
Pointe du Bois	20	13	12	E.P.	23.3	3.	1.	91	2.3	L
Pointe du Bois	36	15	12	E.P.	21.7	3.	.3	96	0	L
Pointe du Bois	7	16	14	E.P.	25.3	3.3	.7	93	0	L
Pointe du Bois	35	15	14	E.P.	16.	2.3	.3	98	0	L
Lac du Bonnet	16	14	10	E.P.	20.	3.	.3	90	0	L
Falcon Lake	28	8	16	E.P.	23.7	4.	4.7	87	6.2	L-M
Falcon Lake	10	8	15	E.P.	24.	3.	.3	78	3.3	L
Falcon Lake	8.	9	17	E.P.	21.7	2.7	3.3	85	0	L-M
Star Lake	20	9	17	E.P.	25.	2.7	2.	97	0	L-M

(continued)

TABLE I - EASTERN MANITOBA (concluded)

Place	Location Sec.	Tp.	Rge.	Mer.	Aver. Ht. of Trees Examined	Aver. DBH of Trees Examined	Aver. No. of Egg Bands per Tree	% of Eggs Containing Living Larvae	% Parasitized	Prediction # for 1952
Caddy Lake	5	10	17	E.P.	26.3	3.	.3	98	0	L
Telford	7	10	16	E.P.	26.	3.	5.3	93	0	L-M
Milner Ridge	7	14	10	E.P.	14.	2.3	Nil	Nil	0	-
Stead	9	17	18	E.P.	26.	3.3	Nil	Nil	0	-
Gull Lake	26	16	7	E.P.	16.7	2.	Nil	Nil	0	-
Grand Marais	16	18	7	E.P.	24.3	2.3	Nil	Nil	0	-
Belair	9	19	7	E.P.	18.	2.3	Nil	Nil	0	-
Hillside	28	19	7	E.P.	25.	3.	Nil	Nil	0	-

- L - Light, M - moderate, H - heavy

TABLE 2 - SOUTHERN DISTRICT

Place	Location Sec.	tp.	Rge.	Mer.	Aver. Ht. of Trees Examined	Aver. DBH of Trees Examined	Aver. No. of Egg Bands per Tree	% of Eggs Containing Living Larvae	% Parasitized	Prediction for 1952
Moose Lake	2	3	16	E.P.	15.	5.	13.3	87.4	0	M-H
Moose Lake	3	3	16	E.P.	18.3	3.3	28.3	91.2	0	H
Moose Lake	18	3	17	E.P.	23.6	3.	36.3	90.5	0	H
Moose Lake Rd.	3	2	14	E.P.	22.7	3.	2.7	89.4	0	L-M
Moose Lake Rd.	20	2	15	E.P.	17.	2.7	3.7	94.6	0	L-M
Middlebro	5	1	16	E.P.	16.	3.	6.7	95.	0	M-H
Sprague	8	1	15	E.P.	20.	2.7	1.7	93.2	0	L
Sprague	16	1	14	E.P.	20.	3.	1.	90.6	0	L
Whitemouth Lake	34	2	13	E.P.	28.3	4.7	1.7	78.	3.1	L
Whitemouth Lake	20	3	13	E.P.	29.3	4.	1.	95.8	0	L
Whitemouth Lake	8	4	13	E.P.	24.	4.	3.	82.9	0	L-M
Whitemouth Lake	15	3	13	E.P.	21.	3.	2.3	91.2	0	L-M
South Junction	15	1	13	E.P.	22.7	3.7	2.3	88.5	2.1	L-M
Vassar	29	2	13	E.P.	26.7	4.3	4.	93.	0	L-M
Vassar	8	2	13	E.P.	18.3	3.	4.3	95.	0	L-M
Piney	25.	1	12	E.P.	28.	4.3	1.3	81.8	.60	L
Menisino	5	2	10	E.P.	13.3	2.	1.3	84.6	0	L
Sundown	7	2	9	E.P.	18.6	2.7	.3	86.1	0	L
Caliento	19	2	8	E.P.	14.7	2.	.3	84.2	0	L
Badger	24.	2	11	E.P.	22.3	2.7	.3	89.8	0	L
Garrick	21	3	11	E.P.	29.	4.	1.3	82.	0	L
Sandilands F.R.	3	5	10	E.P.	23.3	3.7	1.	96.8	0	L
Sandilands F.R.	1	6	9	E.P.	22.7	3.	.3	96.	0	L
St. Labre Road	20	4	11	E.P.	23.3	3.7	.6	87.	0	L
St. Labre Road	13	4	12	E.P.	18.	3.	1.	86.3	.76	L

(continued)

TABLE 2 - SOUTHERN DISTRICT (concluded)

Place	Location Sec.	Tp.	Rge.	Mer.	Aver. Ht. of Trees Examined	Aver. DBH of Trees Examined	Aver. No. of Egg Bands per Tree	% of Eggs Containing Living Larvae	% Parasitized	Prediction for 1952 ‡
La Broquerie	30	6	8	E.P.	16.	2.3	.3	89.6	0	L
Sandilands F.R.	2	8	11	E.P.	26.	2.3	.6	90.2	0	L
Hadashville	9	9	12	E.P.	16.3	2.3	2.3	96.7	0	L-M
Richer	12	8	9	E.P.	20.	2.	.6	93.	0	L
Glen	9	8	15	E.P.	23.3	2.	.6	94.4	0	L
McKinley	16	8	3	E.P.	25.3	2.3	4.	85.8	1.8	L-M
East Braintree	28	7	14	E.P.	26.7	2.7	1.3	84.6	0	L
Dawson Trail	10	7	13	E.P.	26.	2.7	1.	90.2	0	L
Dawson Trail	26	6	15	E.P.	23.	2.6	1.6	82.8	0	L
Harrison Creek	11	5	17	E.P.	28.	3.6	8.	92.8	0	M-H
Whitemouth Lake	10	3	13	E.P.	20.	3.	1.3	83.5	0	L
Dawson Trail	30	5	17	E.P.	28.	4.	4.	85.	0	L-M
St. Labre Road	30	4	12	E.P.	16.	3.	2.	89.	0	L-M
Woodridge	1	4	10	E.P.	24.	4.	.3	95.	0	L

‡ - L - light, M - moderate, H - heavy

TABLE 3 - SASKATCHEWAN

Place	Location Sec.	Tp.	Rge.	Mer.	Aver. Ht. of Trees Examined	Aver. DBH. of Trees Examined	Aver. No. of Egg Bands per Tree	% of Eggs Containing Living Larvae	% Parasitism	Prediction for 1952
Big River	8	59	9	W3rd	52.3	4.5	1.	96.4	0	L
Meadow Lake	1	61	14	W3rd	30.3	3.	.3	99.3	0	L
Green Lake	35	60	11	W3rd	56.3	5.	1.3	98.3	0	L
Green Lake	5	61	11	W3rd	57.3	5.4	9.3	89.5	0	M-H
Meadow Lake	4	60	16	W3rd	33.7	3.3	.7	76.1	0	L
Meadow Lake	23	60	15	W3rd	34.	3.6	2.	97.	0	L-M
Meadow Lake	24	54	17	W3rd	44.	4.3	2.	89.	0	L-M
Meadow Lake	26	56	17	W3rd	47.	5.4	2.	82.	0	L-M
Green Lake	24	61	13	W3rd	34.	3.6	1.	39.5	0	L
Green Lake	34	59	10	W3rd	44.	4.6	2.	99.4	0	L-M
Green Lake	3	60	11	W3rd	58.3	5.1	3.	45.	0	L-M
Meadow Lake	12	54	17	W3rd	46.7	5.1	8.3	74.4	0	M-H
Meadow Lake	6	54	16	W3rd	43.7	3.5	7.	92.4	0	M-H
Meadow Lake	7	59	16	W3rd	28.	3.	.3	99.3	0	L
Meadow Lake	13	57	17	W3rd	46.	4.2	.3	99.4	0	L
Meadow Lake	5	60	17	W3rd	32.3	2.6	.3	95.5	0	L
Meadow Lake	25	60	18	W3rd	24.3	2.8	.7	91.4	0	L
Meadow Lake	12	58	17	W3rd	45.	4.3	1.3	98.4	0	L
Meadow Lake	33	55	17	W3rd	39.	4.1	.7	88.	0	L
Meadow Lake	10	55	17	W3rd	41.7	4.1	2.3	98.	0	L-M
Meadow Lake	1	54	17	W3rd	34.7	3.6	34.3	56.	0	H
Meadow Lake	1	54	17	W3rd	49.3	4.8	23.	45.4	0	H
Meadow Lake	7	54	16	W3rd	38.7	3.7	15.	50.	0	H
Meadow Lake	18	54	16	W3rd	35.7	3.3	4.	84.6	0	L-M
Glaslyn, Sask.	1	53	17	W3rd	43.7	4.5	2.3	83.2	0	L-M
Glaslyn, Sask.	12	53	17	W3rd	28.	3.1	1.3	77.1	0	L
Meadow Lake	13	54	17	W3rd	43.3	5.	2.3	98.2	0	L-M
Meadow Lake	7	54	16	W3rd	45.3	4.3	15.	86.1	0	H

TABLE 3 - SASKATCHEWAN (continued)

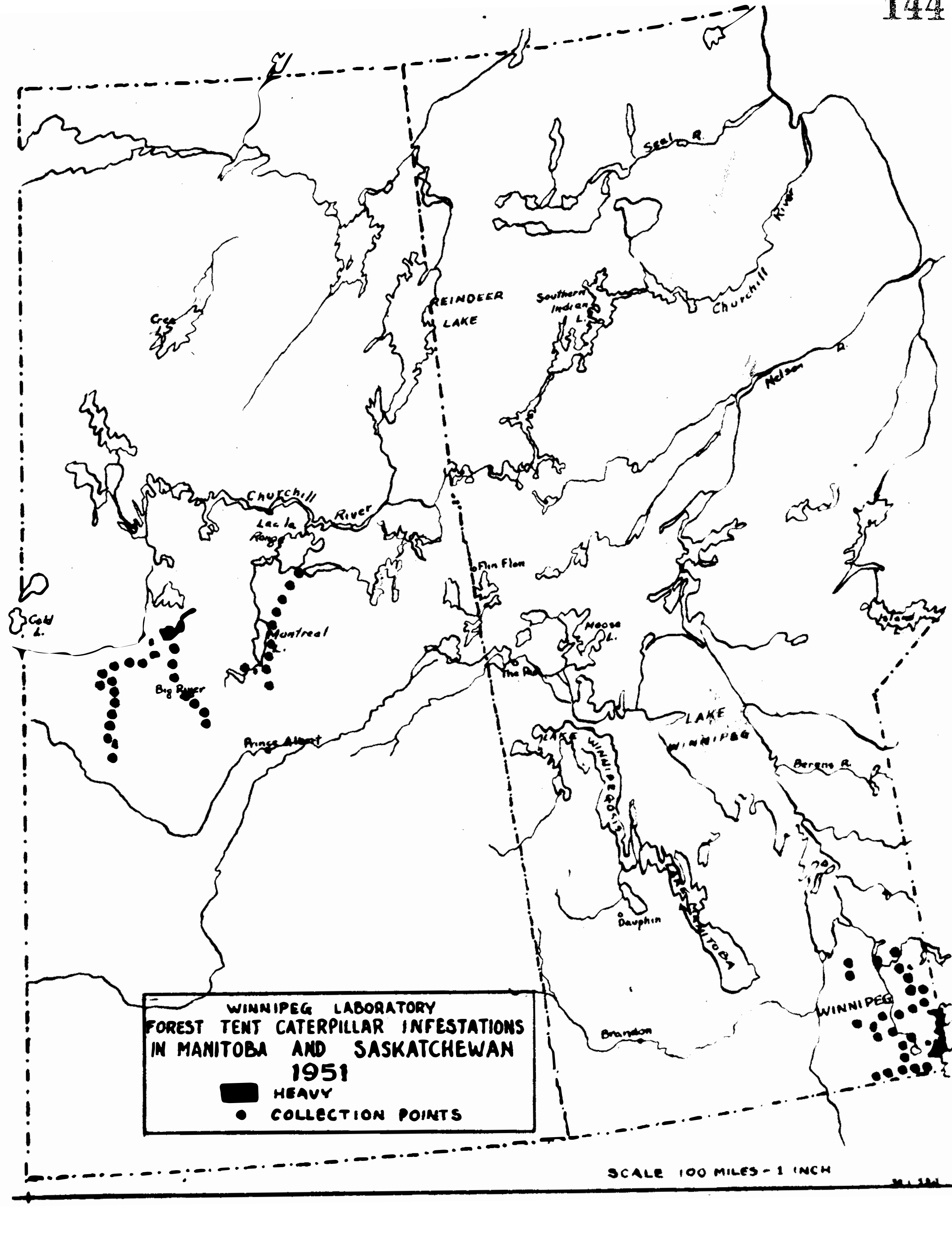
Place	Location Sec.	Tp.	Rge.	Mer.	Aver. Ht. of Trees Examined	Aver. DBH of Trees Examined	Aver. No. of Egg Bands per Tree	% of Eggs Containing Living Larvae	% Parasitism	Prediction for 1952	#
Glaslyn, Sask.	24	52	17	W3rd	39.7	4.6	1.	84.2	3.3	L	
Big River	10	56	7	W3rd	32.3	3.3	.7	99.4	0	L	
Big River	31	58	8	W3rd	31.	3.5	1.	99.	0	L	
Big River	31	58	6	W3rd	31.	3.1	.7	99.3	0	L	
Big River	8	63	9	W3rd	49.	4.8	14.3	85.	0	H	
Big River	23	62	10	W3rd	66.7	5.6	17.3	89.	0	H	
Big River	25	62	10	W3rd	67.7	5.9	23.	98.	0	H	
Big River	31	69	9	W3rd	45.3	5.1	8.	92.1	0	L-M	
Big River	25	62	10	W3rd	56.3	5.1	37.7	96.4	0	H	
Big River	26	63	9	W3rd	62.	5.6	3.	76.4	0	L-M	
Big River	10	64	9	W3rd	58.7	5.	1.7	98.5	0	L	
Big River	34	60	10	W3rd	57.7	4.8	1.3	96.	0	L	
Big River	11	62	10	W3rd	38.	4.7	6.	76.2	2.1	M-H	
Big River	14	60	10	W3rd	51.	4.7	2.	99.1	0	L-M	
Big River	34	60	10	W3rd	56.7	4.5	2.7	95.5	0	L-M	
Big River	32	62	9	W3rd	58.7	4.8	14.3	99.	0	H	
Meadow Lake	13	60	16	W3rd	33.	3.6	.7	99.	0	L	
Green Lake	24	60	11	W3rd	56.	5.2	1.7	82.5	0	L	
Green Lake	23	60	11	W3rd	34.	3.6	2.	99.2	0	L	
Green Lake	18	60	11	W3rd	25.7	5.6	25.7	99.4	0	H	
Waskesiu	25	57	27	W2nd	50.3	4.3	12.	70.	0	H	
Waskesiu	1	57	27	W2nd	41.3	3.9	7.	96.3	0	M-H	
Waskesiu	26	58	26	W2nd	43.	3.7	.3	99.4	0	L	
Waskesiu	31	57	26	W2nd	45.	4.4	3.7	98.5	0	L-M	
Waskesiu	36	57	27	W2nd	36.7	3.3	12.3	89.	0	H	

(continued)

TABLE 3 - SASKATCHEWAN (concluded)

Place	Location Sec.	Tp.	Rge.	Mer.	Aver. Ht. of Trees Examined	Aver. DBH of Trees Examined	Aver. No. of Egg Bands per Tree	% of Eggs Containing Living Larvae	% Parasitism	Prediction for 1952 *
Waskesiu	17	59	25	W2nd	52.	4.8	4.7	97.4	0	L-M
Waskesiu	16	58	26	W2nd	27.	2.7	.3	82.	0	L
Waskesiu	4	59	25	W2nd	25.3	2.8	1.3	49.	0	L
Molenosa	11	62	24	W2nd	38.7	3.2	1.	98.	0	L
Lac la Ronge	19	70	22	W2nd	30.3	3.	.3	98.	0	L
Lac la Ronge	2	68	23	W2nd	56.	5.8	1.	96.4	0	L
Lac la Ronge	35	68	23	W2nd	48.3	4.	.3	98.	0	L
Lac la Ronge	13	67	23	W2nd	49.	4.	1.3	97.	0	L
Lac la Ronge	35	65	24	W2nd	42.	4.	1.7	99.1	0	L
Lac la Ronge	31	69	22	W2nd	61.	9.	24.3	98.	0	H
Molenosa	22	61	24	W2nd	23.	3.	.3	97.3	0	L
Molenosa	10	64	24	W2nd	45.	5.	4.3	98.	0	L-M
Waskesiu	32	56	1	W3rd	34.	3.	1.7	98.	0	L
Waskesiu	10	56	1	W3rd	39.	3.	.3	99.1	0	L
Waskesiu	13	57	1	W3rd	36.	4.	.3	99.1	0	L
Waskesiu	31	57	26	W2nd	45.	4.4	3.7	38.	0	L-M
Waskesiu	36	57	27	W2nd	41.	3.8	7.7	64.	0	M-H
Waskesiu	25	61	25	W2nd	48.7	5.5	3.	83.3	6.5	L-M
Waskesiu	36	57	27	W2nd	46.7	4.8	8.3	72.4	0	M-H

* L - light, M - moderate, H - heavy


WINNIPEG LABORATORY
FOREST TENT CATERPILLAR INFESTATIONS
IN MANITOBA AND SASKATCHEWAN
1951
HEAVY
COLLECTION POINTS
SCALE 100 MILES - 1 INCH
Seal R.
Churchill River
REINDEER LAKE
Southern Indian L.
Nelson R.
Cree L.
Churchill River
Lac la Ronge
Flin Flon
Cold L.
Montreal L.
Big River
Prince Albert
Moose L.
The Pas
LAKE WINNIPEG
LAKE WINNIPEGOSIS
LAKE MANITOBA
Dauphin
Brandon
WINNIPEG
Berens R.
Island L.

3. PERMANENT SAMPLE PLOTS AND STATIONS

by

V. Hildahl

In 1947, a long term project of establishing permanent sample plots and stations was started in Manitoba and Saskatchewan. The object of the project was to achieve greater continuity of survey sampling and to obtain continuous records on insect fluctuations and the damage insect infestations cause to forest stands.

Since that time, 103 permanent sample plots and 167 permanent sample stations have been established by the Rangers. Of these, 50 permanent sample plots and 116 permanent sample stations are located in Manitoba, and 53 permanent sample plots and 51 permanent sample stations in Saskatchewan. The sites for the plots and stations were selected on the basis of freedom from interference and accessibility, therefore, the majority were established either in forest reserves or on Crown lands.

A summary of the permanent sample plots and stations showing their distribution by tree species according to forest districts and their locations is contained in the following tables.

Summary of Permanent Sample Plots by Forest Districts.

Forest District	Number of Plots by Tree Species						
	Jack Pine	White Spruce	Tamarack	White Poplar	Black Spruce	Black Poplar	Total
Southern	7	3	12	5	-	-	27
Eastern	-	-	10	2	-	-	12
Western	-	-	11	-	-	-	11
Northern	-	-	-	-	-	-	0
Hudson Bay	-	-	7	-	-	-	7
Prince Albert	9	-	22	5	1	1	38
Meadow Lake	-	-	3	5	-	-	8
Total	16	3	65	17	1	1	103

Summary of Permanent Sampling Stations by Forest Districts

Forest District	Number of Stations by Tree Species									
	Jack pine	White Spruce	Tamarack	White Poplar	Black Spruce	Black Poplar	Birch	Balsam Fir	Scots pine	Total
Southern	21	1	1	1	-	-	1	-	-	25
Eastern	10	-	3	5	4	-	2	1	-	25
Western	6	13	15	10	1	1	-	-	1	47
Northern	6	1	5	2	3	-	2	-	-	19
Hudson Bay	6	8	2	14	-	1	-	-	-	31
Prince Albert	11	-	2	-	2	-	-	-	-	15
Meadow Lake	2	-	-	1	1	-	1	-	-	5
Total	62	23	28	33	11	2	6	1	1	167

TABLE A

Permanent Sample Plots

Southern and Interlake Districts, Manitoba.

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
1-S	35	5	9	E.P.	J. Pine	At Junction of Piney Highway and road to H.Q.
2-S	1	6	9	E.P.	J. Pine	On Cote Road 30' south.
3-S	7	6	10	E.P.	J. Pine	2 1/3 northeast of H.Q. on Dawson Road.
4-S	25	5	9	E.P.	J. Pine	1 1/5 miles S.E. of H.Q. on Piney Road.
5-S	20	6	10	E.P.	J. Pine	4 3/10 miles northeast of H.Q. along Dawson Rd.
6-S	25	5	9	E.P.	J. Pine	2 miles south of H.Q. on Piney Road.
7-S	18	5	10	E.P.	J. Pine	3 miles S.E. of H.Q.
8-S	34	5	9	E.P.	Tamarack	1 1/5 miles west of H.Q. on road to Marchand.
14-S	19	8	9	W.P.	W. Spruce	6 miles along road east of Cypress River.
15-S	5	10	15	W.P.	W. Spruce	Vicinity of Campsite, S.W.F.R.
16-S	5	10	15	W.P.	W. Spruce	½ mile N.E. of Campsite, S.W.F.R.
17-S	18	6	9	E.P.	Tamarack	2 2/10 miles north of Marchand H.Q.
18-S	5	8	10	E.P.	Tamarack	4 1/10 miles west of Dawson cabin along Dawson Trail.
19-S	36	7	10	E.P.	Tamarack	1 mile east of Dawson Cabin.
20-S	31	7	11	E.P.	Tamarack	1½ miles east of Dawson Cabin.
21-S	32	7	11	E.P.	Tamarack	2 7/10 miles east of Dawson Cabin.
22-S	3	8	11	E.P.	Tamarack	4.9 miles east of Dawson Cabin.
23-S	2	8	11	E.P.	Tamarack	5 6/10 miles east of Dawson Cabin.
24-S	34	5	9	E.P.	Tamarack	1 mile west of H.Q. along Marchand Road.
32-I	32	23	4	E.P.	Tamarack	2½ miles north of Riverton.
33-I	25	32	9	W.P.	Tamarack	½ mile northeast of Gypsumville.
37-S	9	8	16	E.P.	Tamarack	7.7 miles from Junction of #1 highway and Falcon Lake Road.
1-S	10	8	15	E.P.	Poplar	6 miles northeast of E. Braintree along Falcon Lake Road.

TABLE A - Concluded

Permanent Sample Plots

Southern and Interlake Districts, Manitoba.

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
2-S	1	6	9	E.P.	Poplar	1 mile north of H.Q. along Dawson Road.
3-S	3	1	13	E.P.	Poplar	½ mile southwest of S. Junction on left hand side of road.
4-S	8	3	13	E.P.	Poplar	3 miles north of Vassar along Whitemouth Road.
5-S	10	3	13	E.P.	Poplar	½ mile north of Whitemouth Lake Fire Tower.

TABLE B

Permanent Sample Stations

Southern and Interlake Districts, Manitoba.

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
1-S	27	1	12	E.P.	J. Pine	4 miles east of Piney on right hand side of road.
2-S	31	2	12	E.P.	J. Pine	2 miles south of Badger Sandilands Forest Reserve.
3-S	1	6	9	E.P.	Birch	2 miles northeast of Reserve H.Q. S.F.R.
4-S	1	6	7	E.P.	Poplar	2 miles northeast of Reserve H.Q. S.F.R.
5-S	18	7	7	E.P.	W. Spruce	3 miles south of Dawson Cabin.
6-S	32	7	11	E.P.	Tamarack	2 miles northeast of Dawson Cabin.

TABLE C

Permanent Sample Stations

Sandiland Forest Reserve, Manitoba.

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
4-S	35	5	9	E.P.	J. Pine	2/10 of a mile south on Woodridge Road.
5-S	30	5	10	E.P.	J. Pine	1/10 of a mile south of Sundown Lumber Mill.
6-S	30	5	10	E.P.	J. Pine	1/5 of a mile south of Sundown Lumber Mill.
8-S	29	5	10	E.P.	J. Pine	Along road at ½ mile mound.
9-S	29	5	10	E.P.	J. Pine	North of ½ mile mound along road.
10-S	3	5	10	E.P.	J. Pine	North ½ sec. of 3.
11-S	6	6	10	E.P.	J. Pine	¼ mile east of Dawson Cabin along trail.
12-S	3	6	10	E.P.	J. Pine	1/10 of mile north of Dawson Road Junction.
13-S	10	5	10	E.P.	J. Pine	At Junction of main road and trail.
14-S	10	5	10	E.P.	J. Pine	At Junction of main road and trail.
15-S	29	5	10	E.P.	J. Pine	Along Dawson road.
16-S	36	5	9	E.P.	J. Pine	Along road at Headquarters.
17-S	36	5	9	E.P.	J. Pine	Along road at Headquarters.
18-S	35	5	9	E.P.	J. Pine	Along road at Headquarters.
19-S	29	5	10	E.P.	J. Pine	Along Sundown Camp Road.
20-S	31	5	10	E.P.	J. Pine	Along Sundown Camp Road.
21-S	30	5	9	E.P.	J. Pine	1/10 mile west of fire guard.
22-S	30	5	10	E.P.	J. Pine	South of Sundown Lumber Camp, along road.
23-S	30	5	10	E.P.	J. Pine	South of Sundown Lumber Camp, along road.

TABLE D

Permanent Sample Plots

Eastern District, Manitoba

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
E1	8	9	17	E.P.	W. Poplar	1 7/10 mi. along Falcon Lake Road, south of #1 Highway.
E2	17	10	16	E.P.	W. Poplar	1 mi. east of Telford at Old gravel pit.
25	10	11	13	E.P.	Tamarack	10.2 mi. west of Rennie on #1 Highway.
26	22	10	15	E.P.	Tamarack	4.5 mi. east of Jct. of #1 and L. Brereton Road, 300 yds. off highway north of tracks.
27	NE17	10	16	E.P.	Tamarack	9 mi. east of Rennie on #1 at Telford Siding.
28	16	10	16	E.P.	Tamarack	2 mi. east of Bear Lake Camp on #1 at curve.
29	30	9	17	E.P.	Tamarack	1 mi. west of West Hawk Lake, 50 ft. from Mi. Post 108.
30	8	9	17	E.P.	Tamarack	1 2/10 mi. from Jct. #1 and Falcon Lake Road.
31	31	10	14	E.P.	Tamarack	8.4 mi. west of Rennie on #1 Highway.
34	24	15	11	E.P.	Tamarack	2 7/10 mi. from Jct. of Pointe du Bois and Pine Falls Road.
35	30	15	12	E.P.	Tamarack	5 mi. east of Pine Falls and Pointe du Bois Road Jct.
36	3	13	9	E.P.	Tamarack	4/10 mi. north of Seddon's Corner.

TABLE E

Permanent Sample Stations

Eastern District, Manitoba

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
19E	23	14	10	E.P.	Birch	5 mi. south of Lac du Bonnet-east side at forks.
20E	18	14	10	E.P.	B. Spruce	8 mi. south of Lac du Bonnet-west side-60 yds. off highway.
21E	7	14	10	E.P.	W. Poplar	10 mi. south of Lac du Bonnet on south side.
22E	15	14	10	E.P.	J. Pine	8 mi. south Lac du Bonnet on east side.
23E	25	15	11	E.P.	B. Spruce	23 yds. east of permanent tamarack plot #34.
24E	30	15	12	E.P.	W. Poplar	6.4 mi. north of Lac du Bonnet-Pointe du Bois Road Junction.
25E	6	16	13	E.P.	J. Pine	13 mi. north of Lac du Bonnet-Forestry H.Q.
26E	2	13	9	E.P.	J. Pine	1½ mi. east of Seddon's Corner-300 yds on trail.
27E	34	18	8	E.P.	W. Poplar	7.5 mi. north Stead on North Star Trail.
28E	36	17	8	E.P.	J. Pine	6.5 mi. north Stead on North Star Trail.
29E	26	17	8	E.P.	J. Pine	5.5 mi. north Stead on North Star Trail.
30E	25	17	8	E.P.	J. Pine	9/10 mi. north of Stead Tower on North Star Trail.
31E	16	14	10	E.P.	J. Pine	9 mi. southeast Lac du Bonnet on NW side.
32E	7	14	10	E.P.	W. Poplar	2/10 mi. south of transmission line and highway crossing.
33E	26	13	9	E.P.	Birch	4 mi. south of Milner Ridge east side of road.
34E	4	13	10	E.P.	J. Pine	½ mi. west of power line on #1 highway.
35E	3	13	9	E.P.	Tamarack	½ mi. north of Seddon's Corner at spring.
36E	NW 3	13	9	E.P.	B. Spruce	150 yds. north of Station 35E.
37E	35	15	14	E.P.	J. Pine	4/10 mi. west of New tower at Pointe du Bois.
38E	35	15	14	E.P.	B. Spruce	1 1/10 mi. west of tower at Pointe du Bois on highway.
39E	3	16	14	E.P.	Tamarack	2 mi. west of New tower along Pointe du Bois Road.
40E	12	16	13	E.P.	J. Pine	9 1/10 mi. west of new tower on Pointe du Bois Road 2/10 mi. from Mi. Post 16.
41E	29	16	13	E.P.	Balsam Fir	6 7/10 mi. north of Pointe du Bois and Bird River Road Junction.
42E	8	16	13	E.P.	W. Poplar	4/10 mi. north Bird River-Pointe du Bois Rd. Jct.
43E	1	14	10	E.P.	Tamarack	3.4 mi. south on Brookfield Rd. from Lac du Bonnet Hwy.

TABLE F

Permanent Sample Plots

Western District, Manitoba

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
1	5	20	17	W.P.	Larch	1.2 mi. north of Norgate Rd. on Whirlpool Rd.
2	16	20	19	W.P.	Larch	Milepost 11 L. Audy Road.
3	25	20	19	W.P.	Larch	200 yds. north of Dom. Forest Camp.
4	23	21	19	W.P.	Larch	#10 highway 4 mi. north of Dom. Forest Road.
5	14	21	21	W.P.	Larch	P.O.W. Road 1.9 mi. west of Lake Audy Road.
6	36	19	17	W.P.	Larch	Opposite Milepost 14 Norgate Road.
7	4	22	19	W.P.	Larch	500 yds. south of Moon Lake.
8	11	35	23	W.P.	Larch	Mi. 245 #10 highway near Cowan.
9	15	36	25	W.P.	Larch	Mi. 253.2 #10 highway.
10	16	46	25	W.P.	Larch	20.1 mi. north of Mafeking.
11	19	44	25	W.P.	Larch	Moon Lake 8.4 mi. north of Mafeking.

TABLE G

Permanent Sample Stations

Western District, Manitoba.

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
W 1	9	21	19	W.P.	W. Spruce	$1\frac{1}{4}$ mi. south of Moon L. on #10 highway.
2	35	21	19	W.P.	W. Spruce	Mi. 146 #10 highway.
3	23	21	19	W.P.	Larch	Mi. $144\frac{1}{2}$ #10 highway.
4	14	20	19	W.P.	W. Spruce	#10, 7/10 mi. north of L. Audy Jct.
5	10	20	19	W.P.	W. Poplar	#10, 2/10 mi. north of L. Audy Jct.
6	3	21	20	W.P.	W. Spruce	L. Audy Road 2.1 mi. west of #10.
7	4	21	20	W.P.	W. Poplar	L. Audy Road 2 miles from Baptist Rd.
8	35	19	17	W.P.	J. Pine	Mi. 13 Norgate Rd.
9	35	19	17	W.P.	W. Spruce	Mi. $8\frac{1}{2}$ Norgate Rd.
10	25	19	18	W.P.	W. Poplar	300 yds. east of Whirlpool Bridge, Norgate.
11	19	26	26	W.P.	W. Poplar	$\frac{3}{4}$ mi. east of Bield Ranger Station on boundary.
12	22	26	26	W.P.	W. Spruce	2 mi. west of Valley River Bridge on boundary road, Bield.
13	22	26	26	W.P.	Larch	2 mi. west of Valley River Bridge on boundary road, Bield.
14	1	27	24	W.P.	J. Pine	Ranger Station plantation, Grandview.
15	1	27	24	W.P.	Scotch Pine	Ranger Station plantation, Grandview.
16	1	27	24	W.P.	W. Spruce	Ranger Station plantation, Grandview.
17	28	30	25	W.P.	W. Spruce	6/10 mi. west of Blue Lakes, Garland.
18	28	30	25	W.P.	B. Poplar	1 mi. west of Blue Lakes, Garland.
19	14	30	25	W.P.	W. Poplar	2 mi. east of Blue Lakes.
20	13	30	25	W.P.	J. Pine	Blue Lake Road.
21	13	30	25	W.P.	W. Poplar	200 yds. east of Brige, Blue Lake Road.
22	19	30	24	W.P.	W. Spruce	Across road from Cabin, Singoosh.
23	32	29	23	W.P.	W. Spruce	1 mi. into D.M.F.R. on old Singoosh Trail.
24	17	20	19	W.P.	W. Spruce	L. Audy Road, $3\frac{1}{2}$ mi. NW Jct. #10.
25	2	34	23	W.P.	Larch & B. Spruce	East side of R.R. track, 1 mile north of Cowan Tower.

TABLE G - Concluded

Permanent Sample Stations

Western District, Manitoba.

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
26	31	32	22	W.P.	J. Pine	2 3/10 mi. west of Pine River.
27	12	27	24	W.P.	B. Spruce	1 9/10 mi. north of Grandview Ranger Station.
28	19	21	20	W.P.	Larch & B. Spruce	1 7/10 mi. north of Jct., L. Audy and #10.
29	7	21	20	W.P.	W. Spruce	16 1/10 mi. NW of Jct., #10 and L. Audy Road.
30	30	19	17	W.P.	J. Pine	3.3 mi. east of #10 on Norgate Road.
31	19	21	20	W.P.	Larch	3 mi. north of Jct., L. Audy and P.O.W. Road.
32	1	20	19	W.P.	W. Spruce	3.7 mi. from #10 on North Shore Road.
26A	30	19	18	W.P.	W. Poplar	1/10 mi. east of Nursery, R.M.N.P.
27A	30	19	18	W.P.	W. Poplar	6/10 mi. east of Nursery, R.M.N.P.
28A	27	19	18	W.P.	J. Pine	1 3/10 mi. east of #10 on Norgate Road.
33	8	30	26	W.P.	W. Poplar	Boundary Road, north of Bowsman.
34	21	30	26	W.P.	W. Poplar	10 mi. north of Bowsman.
35	28	30	26	W.P.	W. Birch	2 mi. southwest of Birch River.
36	24	22	25	W.P.	Larch	North of Hyska's, R.M.N.P.
42	1	22	25	W.P.	Larch	Near Hyska's, R.M.N.P.
43	20	33	25	W.P.	Larch	17 mi. south of Minitonas, D.M.N.R.
44	28	34	22	W.P.	Larch	From Sclater go - 1 mi.E., 1 mi. N., R½ E.
45	11	30	29	W.P.	Larch	#31, 6 mi. south of Madge Lake Jct.
46	28	30	28	W.P.	Larch	4 mi. north and ¾ mi. E. of Boggy Creek.
49	35	30	24	W.P.	Larch & B. Spruce	Near old Dom. Camp, Singoosh Lake.
50	10	31	23	W.P.	Larch	½ mi. east of Garland River on Singoosh Rd.
53	16	30	25	W.P.	Larch	Nestrum's Mill Site.

TABLE N

Permanent Sample Stations

Northern District, Manitoba.

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
N-16	22	57	26	W.P.	Tamarack	7/10 miles SE on Radio Range Rd. Plot on west side of road. Method of access-motor vehicle.
N-17	6	54	24	W.P.	J. Pine & W. Poplar	Mile 22 7/10 on Clearwater highway, north side of highway.
N-18	34	57	25	W.P.	J. Pine	½ mile SE of Clearwater Airport at old road, north side of road.
N-19		57	26	W.P.	B. Spruce	Mile 15, Clearwater Highway, south side of road 8½ chns. N. and 2½ chns. E. of markers.
N-20	34	57	26	W.P.	J. Pine	½ mi. E. of Prospector on Hwy., north of Hwy.
N-21		53	27	W.P.	Tamarack	7/10 miles S. on Rlwy. crossing at Westray W. of highway.
N-22	28	54	25	W.P.	B. Spruce	Mile 91 on The Pas Highway.
N-23	6	57	26	W.P.	Tamarack	1 2/10 miles west of Grace Lake, west of marker.
N-24	32	57	27	W.P.	Tamarack	2 miles N. of The Pas, south side of hwy.
N-25	26	61	27	W.P.	J. Pine	20 miles S. of Cranberry Ptge., east of hwy.
N-27	27	65	28	W.P.	B. Spruce	21 miles S. of Flin Flon on south side of hwy.
N-28	7	66	28	W.P.	J. Pine	14 miles SE of Flin Flon, north side of hwy.
N-29	29	66	28	W.P.	Tamarack	10½ miles SE of Flin Flon, east of hwy.
N-30	29	66	9	W.P.	Birch & J. Pine	2 miles E. of Channing, east side of hwy.
N-1	20	68	8	W.P.	W. Poplar	Wabowden, south of track.
N-2	15	73	2	W.P.	W. Spruce	Thicket Portage, south of track opposite Forestry Station.
N-3	15	73	2	W.P.	W. Poplar	Thicket Portage, 100 yds south of R.R. Depot, east side of Portage Trail.
N-4				W.P.	J. Pine	Lat. 56°20", Long. 94°42", ½ mi. south of the town of Gillam on road known as River Road.
N-5				W.P.	Birch	At Junction of H.B. railway line and Nelson River. south of R.R. and west of river.

TABLE I

Permanent Sample Plots

Hudson Bay District, Saskatchewan

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
1	SW18	31	32	W.P.	Tamarack	4 miles north of Pelly on east side of road.
2	SE12	44	2	W.2	Tamarack	11½ miles east of #9 hwy. on Armit ridge marker on north side of the road.
3		49	1	W.2	Tamarack	16.2 miles north of Wachea.
4					Tamarack	12 miles west of Hudson Bay, on R.R.
5	21	45	5	W.2		6.2 miles west of Viellardville on Green Bush Rd.
6		44	32	W.2		21.7 miles SE of Hudson Bay, along Armit Road.
7		44	31	W.P.		27.5 miles SE of Hudson Bay, along Armit Trail.

TABLE J

Permanent Sample Stations

Hudson Bay District, Saskatchewan

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
HB1	16	45	4	W.2	J. Pine	1½ miles north of Viellardville.
HB2		45	4	W.2	Tamarack	2 miles north of Viellardville.
HB3		45	4	W.2	J. Pine	3 miles north of Viellardville.
HB4	23	45	4	W.2	W. Poplar	3.7 miles north of Viellardville.
HB5	9	46	4	W.2	W. Spruce	5 3/10 miles north of Viellardville.
HB6	10	41	11	W.2	W. Poplar	Green Water Lake, 1 mile east of Lake on trail.
HB7	10	41	11	W.2	W. Poplar	300 yds. north of ranger station, on trail.
HB8	15	36	32	W.P.	W. Poplar	½ mile south of Maloneck Ranger Station.
HB9	15	36	32	W.P.	W. Spruce	Maloneck Ranger Stn., 200 yds. south of White Poplar Stn.
HB10	15	36	32	W.P.	W. Poplar	Maloneck Ranger Stn., 300 yards south of W. Spruce Stn.
HB11	13	33	30	W.P.	W. Poplar	Madge Lake. 3/10 mile north of Jct. on Man. Boundary and Benito Beach Rd. W. side of Rd.
HB12	1	39	5	W.2	W. Spruce	4 miles north of Ushta, left side of hwy.#10.
HB13	10	41	5	W.2	W. Spruce	6 miles north of Reserve.
HB14	13	50	9	W.2	Larch	East boundary of Forest Reserve. Block 29F, 1.8 miles north of Cross roads.
HB15	3	52	13	W.2	J. Pine	14.6 miles north of Whitefox on Flin Flon Hwy.
HB16	17	53	12	W.2	J. Pine	17.8 miles north of Whitefox on Flin Flon Hwy.
HB17	7	54	11	W.2	W. Spruce	Flin Flon Hwy. 24.9 miles north of Whitefox
HB18	14	38	11	W.2	W. Poplar	7/10 miles south of Parkhill Tower.
HB19	11	38	11	W.2	W. Poplar	1.2 miles south of Parkhill Tower.
HB20		55	10	W.2	W. Spruce	35 miles NE of Whitefox on Flin Flon Hwy.
HB21	34	53	12	W.2	J. Pine	½ mile NE of Whitefox Hwy.
HB22		45	4	W.2	J. Pine	Approx. 3½ miles north of Viellardville on spruce products trail, east side.
HB23	19	46	4	W.2	B. Poplar	Spruce products trail, north of Viellardville.
HB24	15	46	3	W.2	W. Spruce	North of H. Bay along Otosquin trail.
HB25	25	41	6	W.2	W. Poplar	¾ mile north of Dillabough, Sask.

TABLE J – Concluded

Permanent Sample Stations

Hudson Bay District, Saskatchewan

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
HB26	25	41	6	W.2	Poplar	South of Dillabough.
HB27	32	42	3	W.2	W. Spruce	½ mile west of #10 hwy. on Clemenceau Road.
HB28	1	47	3	W.2	W. Poplar	North of Waches on Otosquin trail.
HB29	15	36	5	W.2	W. Poplar	2½ miles north of Usherville, Sask., via road.
HB30	22	38	5	W.2	W. Poplar	North of Usherville, via road.
HB31	2	39	3	W.2	W. Poplar	3½ miles south of Tallpines via road.

TABLE K

Permanent Sample Plots
Prince Albert and Meadow Lake Districts, Saskatchewan.

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
1	NE¼22	49	1	W.3	B. Spruce B. Poplar	4/10 mile west of Crutwell Rd. marker, 47' south of #3 highway.
2	NE¼22	49	1	W.3	Tamarack	Marker 190' SE of #1 plot marker.
3	SW¼ 1	49	28	W.2	J. Pine	1 9/10 miles south of #3 highway, 50' from roadside E.
4	NW¼ 6	49	27	W.2	J. Pine	1 3/10 miles south of #3 highway, 60' from roadside E.
5	22	49	25	W.2	J. Pine	4/10 mile east of Red Rock Cabin, 70' north of road.
6	27	49	25	W.2	Tamarack	7/10 mile east of Red Rock Cabin, 235 yards north of road.
7	NW¼23	49	1	W.3	J. Pine	3/10 mile south of #3 highway, 40' west of road.
8	SE¼27	49	1	W.3	Tamarack	3/10 mile north of #3 highway, 100 yds. west of road.
9	NE¼ 6	49	27	W.3	J. Pine	6 miles west of P.A., 100' south of road.
10	16	49	26	W.2	J. Pine	100 yds. SE of Nesbit H.Q.
11	SW¼21	49	26	W.2	J. Pine	1 3/10 miles north of Nesbit H.Q., 75' east of road.
12	SE¼ 6	49	25	W.2	Tamarack	1 3/10 miles east of Reserve Boundary, 100' south of road.
13	SE¼ 6	49	25	W.2	B. Spruce	1/3 mile east of Reserve Boundary, 60 yds. S. of road.
14	SW¼18	49	27	W.2	J. Pine	8 4/10 miles west of P.A. along #3 highway, 100 yds north of road.
15	SW¼26	49	1	W.3	J. Pine	4/10 yds. east of Crutwell Rd., 15' from trail.
16	33	50	19	W.2	Tamarack	4 miles north of English Cabin.
17	NE¼13	49	26	W.2	Tamarack	2 7/10 miles NW of #2 highway at San. Road.
18	NE¼ 8	49	26	W.2	Tamarack	½ mile west of #3 highway.
19	SW¼30	56	8	W.3	Tamarack	8 miles west of headquarters.
20	26	56	9	W.3	Tamarack	11 miles west of H.Q. on Camp 15 Road.
21	32	55	7	W.3	Tamarack	3 miles south of headquarters.
22	28	50	19	W.2	Tamarack	3 miles north of English Cabin.

TABLE X - Continued

Permanent Sample Plots

Prince Albert and Meadow Lake Districts,

Saskatchewan.

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
23	4	50	20	W.2	Tamarack	6 miles west of English Cabin.
24	SW¼12	55	17	W.3	Tamarack	13.4 miles south of Divide Fire Tower-Hwy.#4.
25	13	55	17	W.3	Tamarack & B. Spruce	3.7 miles south of Game Reserve Boundary, Hwy. #4.
26	34	53	18	W.3	Tamarack & B. Spruce	½ mile north of Turtle Lake Cabin along Lake Shore.
27	15	49	1	W.3	Tamarack	½ mile north Crutwell R.R. Station.
28	NE¼28	48	23	W.2	Tamarack	2½ miles west of Fanford School on Fir Ridge Rd.
29	13	56	24	W.2	Tamarack	10.5 miles NW of Store at Candle Lake.
30	SE¼24	53	2	W.3	Tamarack	4.5 miles west of Park Gate & 2/10 miles south on Bayview Road.
31	21	44	1	W.3	Tamarack	4.2 miles south from MacDowall H.Q.
32	SW¼13	49	2	W.2	Tamarack	8/10 mile SE of Holbien Fire Tower.
33	NW¼ 9	49	25	W.2	Tamarack	3/10 mile east of West Boundary and .15 mile along Fire Guard.
34	SW¼10	49	27	W.2	W. Poplar	4.2 miles west P.A. & 2/10 mile west of East Boundary of Nesbit P.F. Hwy. #3.
35	NW¼16	59	22	W.3	Tamarack	6.5 miles NW of Loon L. & .9 miles NE of Hwy. #26.
36	SE¼14	62	26	W.3	Tamarack	1.3 miles north of Pierceland & 3/10 mi. NW of road.
37	5	61	12	W.3	Tamarack	3.5 miles south of H.Q.
38	13	54	17	W.3	W. Poplar & B. Poplar	4.2 miles north of South Boundary, M.L. Prov. For. on Hwy. #4.
39	12	54	17	W.3	W. Poplar	3.7 miles north of South Boundary, M.L. Prov. For. along #4 Hwy.
40	24	54	17	W.3	W. Poplar	5.3 miles north of South Boundary of M.L. Prov. For. along #4 Hwy.
41	13	61	12	W.3	W. Poplar	6 miles east of Green Lake.
42	12	61	12	W.3	W. Poplar	5.5 miles east of Green Lake.
43	35	57	27	W.3	W. Poplar	5.2 miles north of 3rd Mer. along #2 Highway.

TABLE K - Concluded

Permanent Sample Plots

Prince Albert and Meadow Lake Districts, Saskatchewan

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
44	8	63	8	W.3	W. Poplar	9/10 mile west of Dore Lake Road along Sled Lake Road.
45	25	62	10	W.3	W. Poplar	4.1 miles south of Junction of Sled and Dore Lakes Road.
46	23	62	10	W.3	W. Poplar	5 miles south of Junction of Sled and Dore Lakes Road.

TABLE I.

Permanent Sample Stations

Prince Albert and Meadow Lake Districts,

Saskatchewan.

Plot No.	Sec.	Tp.	Rge.	Mer.	Tree Species	Detailed Location
PA2	9	58	26	W.2	J. Pine	½ mi. north of Bittern Creek Ranger Station.
PA3	13	48	23	W.2	J. Pine	At old Forestry H.Q.'s in Steep Creek Blk.
PA4	SW¼ 8	49	26	W.2	B. Spruce	1 mi. north of Bridge in Swamp at Disease release Area.
PA5	6	49	23	W.2	Tamarack	¾ mi. from Reserve Boundary in Steep Creek Blk.
PA6	NW¼31	49	24	W.2	J. Pine	4 miles east of Reserve Boundary in Red Rock Blk.
PA7	9	50	22	W.2	Tamarack	2/10 mi. east of Reserve Boundary in Ft.a la Corne P.F.
PA8	NW¼25	50	18	W.2	J. Pine	6/10 mi. west Poplar Creek Cabin in Ft.a la Corne P.F.
PA9		56	18	W.2	J. Pine	At mi. post 21, 13 mi. north of the Torch River.
PA10	NW¼26	53	1	W.3	J. Pine	2/10 mi. north of Warden, Pocock's cabin along #2 Hwy.
PA11	NW¼27	57	1	W.3	B. Spruce	2.3 mi. north of Waskesiu along Hanging Hearts Rd.
PA12	5	49	23	W.2	J. Pine	2 mi. east of West Boundary in Steep Creek Blk.
PA13	NW¼12	47	2	W.3	J. Pine	5 6/10 mi. SW of Reserve H.Q., along Winyard Rd.
PA14	SW¼ 1	50	20	W.2	J. Pine	3.3 mi. west of English Cabin in Ft.a la Corne P.F.
PA15	NE¼ 4	50	19	W.2	J. Pine	7/10 mi. north of Junction of Cav. Rd. & Torch R. trail.
PA16	NE¼22	49	27	W.2	J. Pine	4.6 mi. NW of #2 highway along Round Lake Rd.
ML1	26	56	16	W.3	J. Pine	2 mi. south of Fire tower along #4 highway.
ML2	15	55	17	W.3	B. Spruce	13½ mi. north of Turtle Lake Rd. along #4 highway.
ML3	4	56	17	W.3	J. Pine	At south Boundary of Game preserve in M.L.P.F.
ML4	1	58	17	W.3	W. Poplar	1 7/10 mi. south of North Boundary along #4 hwy.
ML5	31	56	16	W.3	Birch	1 mi. east of #4 highway along Mostoos trail.

IV LARCH SAWFLY

EXPERIMENTAL STARVATION OF FIFTH-INSTAR LARCH SAWFLY LARVAE

PRELIMINARY REPORT

Report by R.J. Heron

EXPERIMENTAL STARVATION OF FIFTH-INSTAR LARCH SAWFLY LARVAE

I. Introduction

Complete defoliation of the host tree by larch sawfly larvae occurs frequently during heavy infestations of this insect. This can be attributed largely to the feeding of the fifth (ultimate) instar larvae. Approximately eighty percent (80%) of the larval feeding takes place during the fifth stadium. Exhaustion of the food supply brought about in this way results in the larvae being subject to the effects of complete inanition. The frequency of occurrence of this situation under natural conditions is not known, but it is suspected that it is of common occurrence. Inanition would affect, especially, the late developing larvae. As an outbreak continues it is likely that the starvation factor would become of increasing importance, due to progressive reduction of needle growth in trees suffering repeated annual defoliation.

During the summers of 1950-51 an experimental investigation of the effects of starvation on fifth instar larvae was carried out. This study was conducted at the Red Rock Lake Field Laboratory, Whiteshell Forest Reserve, Manitoba. The immediate object of the study was to determine the relative resistance to starvation of larvae exposed to periods of starvation of various duration. The effects of various treatments on the length of larval life, larval mortality, and weights of surviving cocooned larvae have been determined.

II Experimental Procedure

The larvae used in this study were collected in the field as fourth (penultimate) instar larvae. These were taken to the insectary and fed until ecdysis. Following this they were segregated into six groups of approximately 50 larvae each. These groups of larvae were then treated as follows:

Group I - Controls - larvae were fed throughout development.

Group II - Larvae were fed for 3 days and then starved.

Group III - Larvae were fed for 5 days and then starved.

Group IV - Larvae were starved for 3 days and then fed.

Group V - Larvae were starved for 5 days and then fed.

Group VI - Larvae were starved throughout the fifth instar.

During the period of starvation the groups of larvae were placed in covered jelly jars containing moist cotton wool. Humidity was thus maintained at a high level to prevent mortality due to desiccation.

Cocoon weights recorded below are live (wet) weights. These were made using a Roller-Smith Torsion balance with an accuracy of 00.2 milligrams.

III Results

(a) Mortality due to complete inanition:-

Mortality data for each of the experimental groups are summarized in the accompanying table. Only the control groups of Group IV which were starved for three days and then fed exhibited no mortality. When the period of starvation exceeded half the total duration of the fifth stadium (i.e. starved 5 days) mortality approached one-hundred percent. The groups which were fed for an initial period of five days and then starved had a mortality of 63.4%. The onset of mortality in those insects which had an initial feeding period was delayed much longer than in insects which did not feed. See Table 1 "Avg. No. of days until death" and compare Series 2 and 3 vs Series 5 and 6

(b) Effect of starvation on the duration of the fifth larval stadium to cocoon formation or completion of feeding.

The mean duration of the fifth stadium larval feeding period of the control group was 9.4 days. The effect of starvation during the terminal portion of the normal feeding period was to decrease the duration of the period prior to cocoon formation when the time of starvation was less than one-half the normal development period. On the other hand, the stadium was prolonged when the period of starvation was in excess of one-half the normal feeding period, irrespective of whether the starvation was initial or terminal. Results are tabulated in the table.

(c) Effects of starvation on weights of surviving cocooned larvae.

Larvae which were starved for a period exceeding one-half the normal duration of the feeding period and survived to cocoon (Series II) were significantly lighter at cocooning time than control larvae. In addition these larvae exhibited a greater variability in cocoon weights. Cocooned larvae of Series IV which were starved for only three days (less than one-half the normal feeding period) and then allowed to feed for the remainder of the stadium were not significantly lighter than control larvae and weights showed no greater variability within the groups than the control larvae.

Larvae of Group II which were fed for an initial period of 5 days and then starved, thus feeding for more than one-half the normal feeding portion of the stadium, were not significantly lighter (following the cocooning) than control larvae, but showed greater intra group variability than the controls.

The Data are summarized in the table.

(d) Behaviour of starved larvae:-

During the early stages of starvation (3 to 4 days) the larvae exhibited a marked tendency to wander. Orientation factors during this period were not studied but results from a study on light-reactions based on a "two-light" type of experiment showed that the photo-positive behaviour of larvae was apparently independent of their nutritional state.

When inanition was extended to four or five days the larvae became completely immobilized. Larvae transferred to foliage in this condition (Series V) were unable to establish themselves and eventually died.

IV Conclusion

It can be concluded from the results of insectary rearings presented here that the ultimate larval instar of the larch sawfly is very susceptible to the effects of complete inanition. Under field conditions the onset of mortality would likely be further accentuated by desiccation effects from which the larvae in these insectary rearings were protected. An extension of the study reported here is planned.

Table I

Series	Initial No. of Larvae	Treatment	Per Cent Mortality	No. days in 5th instar prior to cocooning	Av. No. days until death	Mean Cocoon Wts. (MGS)
I	50	Fed Throughout (controls)	0.0	9.4 ± 1.7	-	74.7 ± 8.9
2	47	Fed 3 days then starved	95.6	13.3 ± 1.7	14.6 ± 1.1	40.0 ± 20.5
3	41	Fed 5 days then starved	63.4	8.0 ± 0.0	>9.0	51.9 ± 16.8
4	50	Starved 3 days then fed	0.0	11.8 ± 0.5	-	70.0 ± 8.4
5	50	Starved 5 days then fed	100.0	-	7.6 ± 0.7	-
6	50	Starved throughout	100.0	-	7.1 ± 0.5	-

TECHNICAL REPORT 1951
PROJECT NO. E.-30-09-4

V LARCH SAWFLY

GROWTH AND MANAGEMENT OF TAMARACK

Report by H. A. McKinnon
Field Work by H. A. McKinnon
and D. Groves

GROWTH AND MANAGEMENT OF TAMARACK

A. Introduction

1. Description of Area

(a) Crutwell Corner Swamp.
(b) Railroad Swamp.

2. History of Present Larch Sawfly Outbreak in Prince Albert Area

B. Object of Study

C. Methods

1. Selection and Treatment of Plots.

2. Study of Previous Growth

3. Study of Current Year's Growth

4. Samples Collected

D. Results

1. Results of Growth on Thinned Plots

(a) Previous Growth.
(b) Current Growth.

2. Growth in a Mixed Stand

(a) Current Year Growth

3. Comparison of Different Species

(a) Previous Growth.
(b) Current Growth.

4. Work Completed in 1951

GROWTH AND MANAGEMENT OF TAMARACK

A. Introduction

This project was designed to study the growth habits of tamarack *Larix laricina* (Du Roi) K. Koch (Syn. *Larix americana* Michx.) to obtain further information useful to investigators of the larch sawfly, *Pristiphora erichsonii* (Htg.). From this study recommendations may be made for better management of tamarack.

1. Description of Area

Field work for this study was carried out in the Nisbet Provincial Forest Reserve near Prince Albert, Sask. Numerous tamarack swamps in this area were examined but due to lack of variation in sites, only two sites were used. These are described below.

(a) Crutwell Swamp

Situated 13 miles west of Prince Albert on Highway #3 (fig. 1). This stand is nearly pure tamarack with sparsely scattered black spruce (*Picea mariana* (Mill.) B.S.P.). It is bordered by black spruce with balsam poplar (*Populus balsamifera* L.), trembling aspen (*P. tremuloides* Michx.), white birch (*Betula papyrifera* Marsh.), and white spruce (*P. glauca* (Moench) Voss) on the higher ground. Jack pine (*Pinus Banksiana* Lamb.) forests surround the whole of the swamp. Several open areas within the swamp are inhabited by swamp birch (*B. glandulosa* Michx.). Other ground cover is sparse, consisting of a few herbs and grasses. The ground surface is typical of a wet swamp with small hummocks of duff and is generally very irregular. However the swamp is dry, root collars are noticeably higher than ground level, and the roots are exceedingly shallow. This indicates that at one time the swamp was wet and that drainage in recent years has lowered the water table to cause the present dry condition. The swamp drains south into Benett's Lake, which usually dries up in the late summer months. There was no standing water in the swamp at any time during the spring and summer. Seven plots were established in this swamp, located as follows:

(i) Plot I: Directly south of Highway #3 about 0.4 miles west of Crutwell Corner; easily visible from the road.

(ii) Plot II: Proceed about 0.8 miles west of Crutwell Corner to winter trail leading south from Highway #3. A blazed tall white spruce marks the entrance. Proceed south on the trail a distance of 23 chains, then go due west 4 chains.

(iii) Plot III: Proceed west from Crutwell Corner 0.8 miles, then south on winter trail 33 chains 3 rods to junction of a secondary trail approaching from the north west, then north west on secondary trail from junction 5 chains, then due west ½ chain.

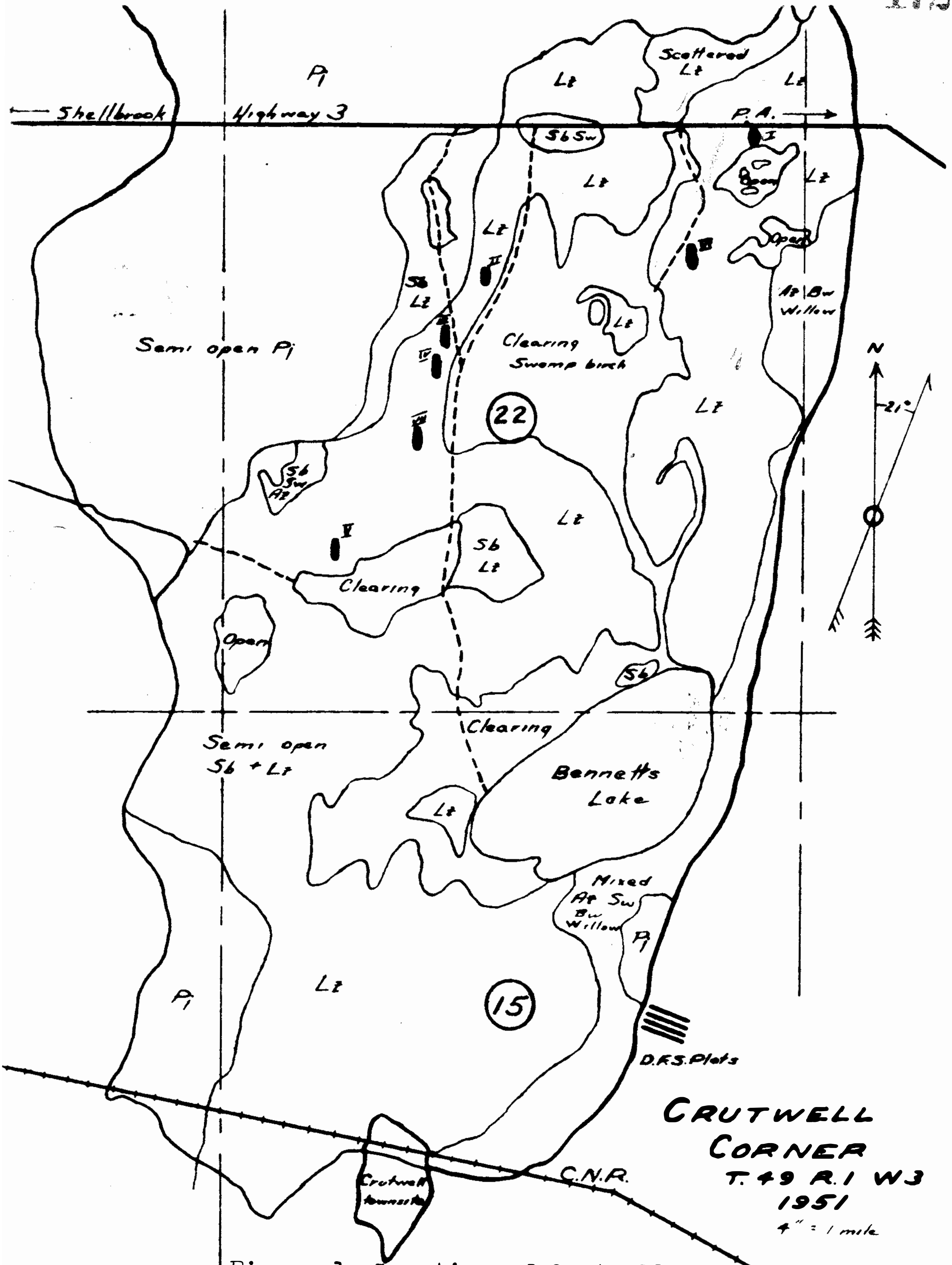


Figure 1. Location of Crutwell Swamp.

(iv) Plot IV: Proceed south on trail 35 chains 3 rods to blazed tamarack. This is also the junction of a secondary trail approaching from the north west. Proceed north west on secondary trail one chain and due west one chain.
(v) Plot V: Proceed 1.3 miles west of Grutwell Corner to summer bush road, then south through jack pine about 0.7 miles to first cross road, then east until end of road. Follow blazes to clearing, then north east to open grown blazed tamarack, then north along foot path about one chain. West boundary of plot is practically on foot path.
(vi) Plot VI: Proceed due south of Plot I to clearing, and follow the clearing west until it comes out on a winter road. Follow the winter road to a well blazed tree on the south side, then continue on blazed trail about 2 chains to plot.
(vii) Plot VII: Proceed 0.8 miles west of Grutwell Corner to winter trail, then south 42 chains to a blazed tamarack on west side. Follow west along blazed trail to plot. Altitude of the plots are shown in fig. 2.

(b) Railroad Swamp

Immediately north of Prince Albert townsite. Composed of mixed black spruce and tamarack, reasonably wet in the spring with floating bog and standing water in some parts. Many types of vegetation are present, including herbs, sedges, and grasses. Labrador tea (Ledum groenlandicum Oeder) is abundant in this area. See map (Fig. 3) for location of plots B and D.

Field work began about mid-April. Saskatchewan Department of Natural Resources were consulted and assisted in the study by offering advice in procedure and help in the field.

2. History of Present Larch Sawfly Outbreak in Prince Albert Area *

1946: - First evidence of larch sawfly in this area was noted in the Prince Albert National Park in 1946. At this time sawfly was present north of Pelly, Sask., where defoliation was heavy, and north east of Carrot River where defoliation was recorded as light. These are the only two instances of it being in Saskatchewan. Within the P.A.N.P. gate only a few larvae were found and no defoliation was evident. - McDowall, L.

1947: - Collections of larch sawfly were made as far west as the Big River Provincial Forest but no defoliation was noted. Two collections were made in the park, one where it was found in 1946 and the other near Waskesiu. There was no significant defoliation

* Annual Technical Report, Forest Insect Lab., Winnipeg, Man.

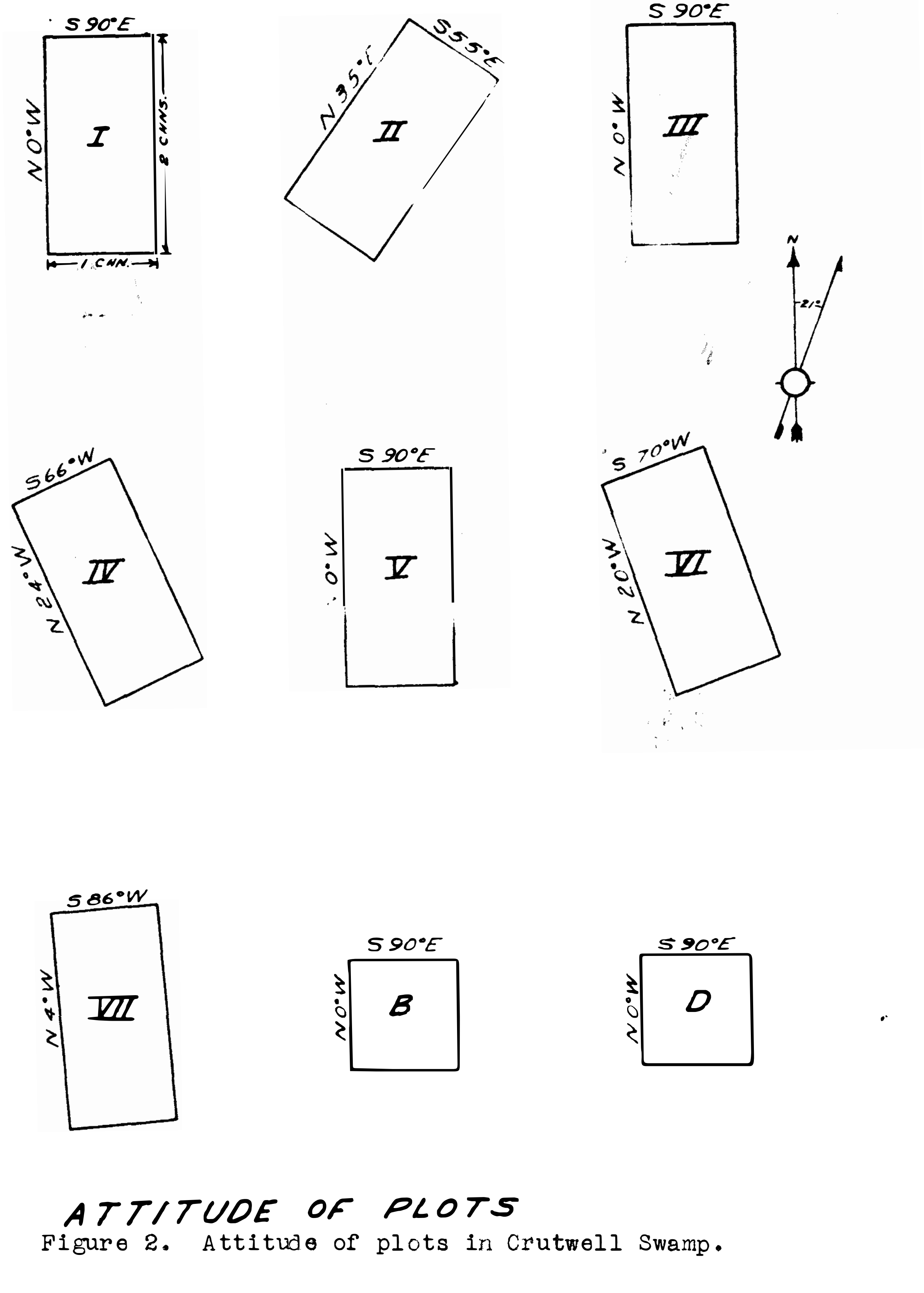


Figure 2. Attitude of plots in Crutwell Swamp.

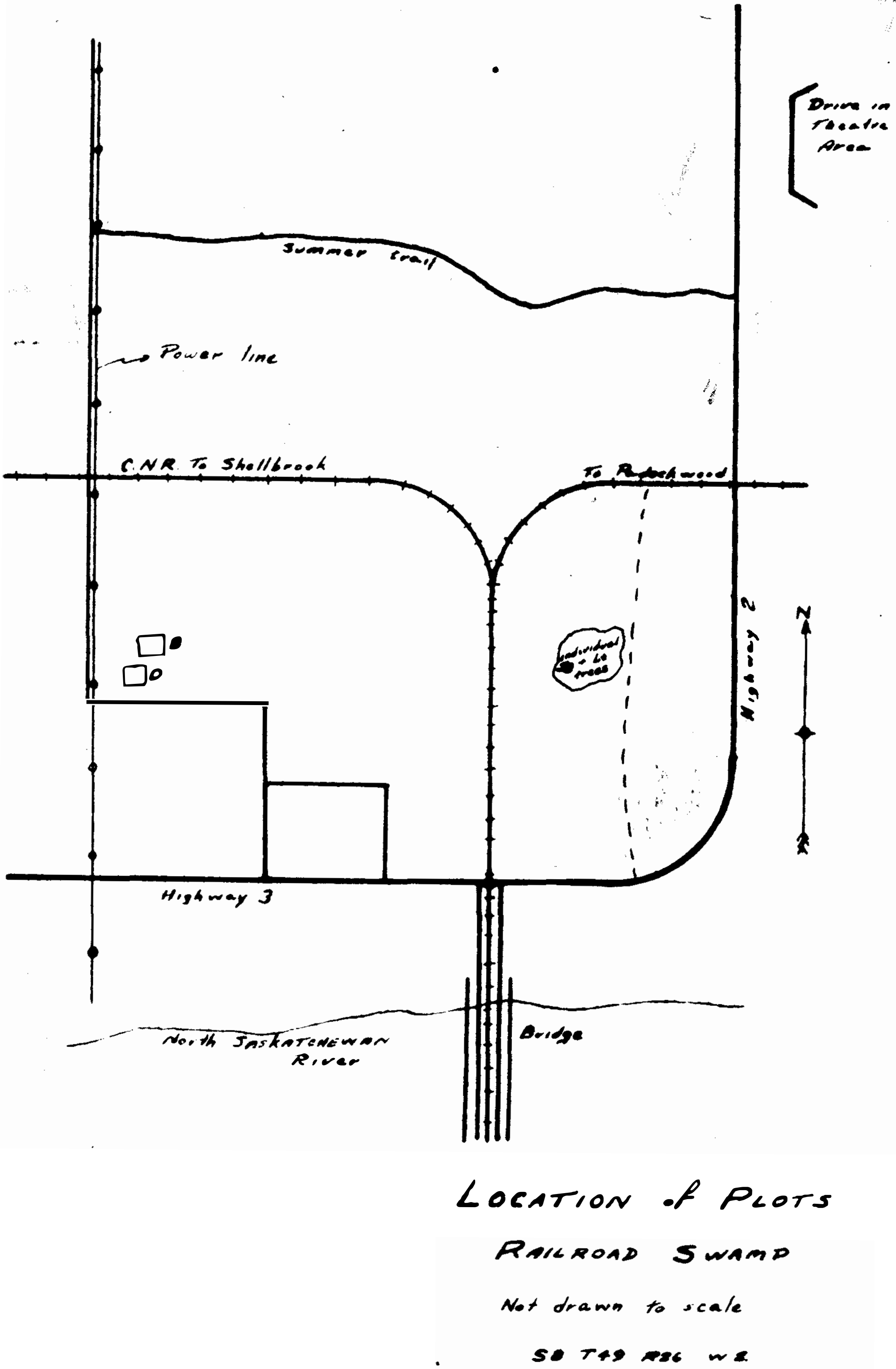


Figure 3. Location of plots in Railroad Swamp.

in either place. Most of the swamps near Prince Albert bore some signs of defoliation, the Railroad Swamp being most severe with 15 to 40%. Light defoliation was noted at Grutwell Corner, and 4 miles south of MacDowall on Highway #12. Light feeding was again noted at Carrot River, Nipawin, and at Madge Lake, and it was found to be quite active at Pelly. - McDowall, L.

1948: - The Railroad Swamp was completely stripped by July 30th and the new foliage starting. Beauvaria was released July 22. Defoliation was light 4 miles north of Prince Albert. Swamps in the Steep Creek block of the Nesbit Provincial Forest were completely defoliated and beginning to put out new needles. Feeding was light in the Red Rock block. 40% defoliation at MacDowall. Light at Fort a la Corne and Candle Lake, with a trace at Emma Lake. Larvae were active and plentiful at Grutwell Corner but decreased early from unknown causes. Very few cocoons were found. - Edmunds, H.A.J.

1949: - Defoliation at Grutwell Corner was heavy (15 to 70%), cocoons were abundant, no sign of infestation abating. The Railroad Swamp was 75% defoliated by July 25th and put out new foliage during August. This swamp was exceedingly wet during July and August. Attack was very severe at Fort a la Corne, defoliation 100%, feeding was complete by July 25th, second foliage came out in August. Feeding was heavy in the Canwood Block. Larch sawfly was present in all swamps at Big River but defoliation was light. - McDowall, L. & Lawrence, J.J.

1950: - The larch sawfly outbreak increased in intensity and became more widespread throughout central, western, and northern Saskatchewan in 1950. Defoliation in the Home, Steep Creek, and Red Rock blocks of the Nisbet Provincial Forest was classified as 80%. Grutwell Corner averaged 60 to 90%, Fort a la Corne 80 to 98%. Infestations were light through the Candle Lake Provincial Forest and the Emma Lake Provincial Forest. A slight increase was evident in Prince Albert National Park. Attack was heavy at Canwood but from there west and north it continued to be light. - Lawrence, J.J. & McLeod, B.B.

1951: - The larch sawfly again caused severe defoliation of tamarack in the southern portion of the Prince Albert District. Throughout the Nisbet Provincial Forest and the Fort a la Corne Provincial Forest defoliation of tamarack was severe. In the Candle Lake Provincial Forest defoliation increased in 1951. Two areas of severe defoliation were recorded in the Emma Lake Provincial Forest. North of these locations to the boundary of the Prince Albert National Park damage was light. Throughout the park defoliation was light. North west of Prince Albert defoliation was moderate to light. Larch sawfly populations were somewhat higher in 1951 than in 1950 in the Meadow Lake Provincial Forest but defoliation was still light. - Lawrence, J.J. & McLeod, B.B.

B. Object of Study

(1) To study the effect of selection thinning in a tamarack stand in relation to the larch sawfly, including differences in radial growth, length of growing period, season of maximum radial increase, and susceptibility to attack by larch sawfly.

(2) To study radial growth of tamarack in a pure and mixed stand.

(3) To study growth on undisturbed plots of different densities to learn if natural thinning occurs.

(4) To compare season of radial growth in tamarack, jack pine and black spruce.

C. Methods

1. Selection and Treatment of Plots

The area was thoroughly reconnoitered before plots were chosen. When a suitable area was located temporary 1/5 acre plots were established in the Crutwell Corner Swamp. A hand compass was used to sight the lines, distances were chained, corner posts were driven and store string was used as a boundary. A tally was taken of all living trees on the plot, using tree calipers, and recorded in 1" diameter classes. All diameters were read at breast height.

Density, vigor, and distribution were factors considered in choosing a plot. Seven temporary plots were laid out but only 4 were used in the thinning experiment. These were as identical in all respects as was practical but they still varied in density and basal area. (Table I). When the plots were selected, the boundaries were straightened by using a staff compass, rechained, and permanent corner posts were set. Boundaries were cleared so that the corner posts were easily visible. The plots were then retallied. Final tally varied slightly from the original. Plots were thinned to the following densities: 1200, 600, 300 trees per acre, and one was left undisturbed as a check plot. Trees to remain in the plots were marked by tying a short cord around the trunk - this method enables corrections to be made more easily than by blazing with an axe or paint. Equal consideration was given to distribution, health and vigor, and size of the trees to remain standing. Dominants and co-dominants made up most of the remaining trees. A number of extra trees were left to replace ones damaged or overexposed by thinning. Excess trees were removed by the D.N.R. fire crew on May 15. A strip ½ chain in width surrounding each plot was thinned to approximately the same density as the plot, thus the whole of the plot is affected by the treatment. The felled trees were skidded out of the plot on May 28. Densities after thinning are shown in Table II.

Two 1/10 acre undisturbed plots were established in the Railroad Swamp, and marked B and D. (See Fig. 3). These plots are on similar sites and are of the same density. Plot B is nearly pure tamarack and plot D contains tamarack and black spruce in equal numbers; the densities are shown in Table III.

Twenty tamarack trees were set up to record current growth in plot B and ten each of tamarack and black spruce in plot D.

TABLE I. Density of plots before thinning.

Plot	Spec.	1"	2"	3"	4"	5"	6"	Tot.	Bas.Ar.	Av.Dia.
I	Tam.	34	102	139	50	11	4	340	15.886	2.7"
	B.Sp.									
II	Tam.	36	149	134	41	7		357	14.865	2.5
	B.Sp.	2	1	3	1	1	2	10		
III	Tam.	52	168	137	33	2		392	14.242	2.5
	B.Sp.		2	1			1	4		
IV	Tam.	55	197	118	28	2		400	13.261	2.3
	B.Sp.	1		3				4		

TABLE II. Density of plots after thinning.

Plot	Spec.	1"	2"	3"	4"	5"	6"	Tot.	Bas.Ar.	Av.Dia.
I	Tam.		5	45	34	11	6	101	6.787	3.7
	B.Sp.									
II	Tam.	2	16	86	43	13		160	10.404	3.3
	B.Sp.			2			1	3		
IV	Tam.	3	86	110	33	4		236	10.816	2.8
	B.Sp.			2				2		

TABLE III. Density of Plots in Railroad Swamp.

	1	2	3	4	5	6	Total	Av. Dia.		B.A.
				PLOT B						
Tam.	2	22	24	38	28	4	118	3.7)	3.1	9.591
B.Sp.	9	15	8	6	4		42	2.5)		1.839
							160			11.430
				PLOT D						
Tam.	3	22	30	21	6	2	84	3.1)	3.0	5.013
B.Sp.	13	14	25	24	5		81	2.9)		4.381
							165			9.394

Three plots were chosen in the Grutwell Swamp to record growth in various natural densities. Plots are each 1/5 acre in size and are undisturbed. Densities are 2300/a, 1125/a and 950/a. Table IV. All trees in plot were tallied and recorded. In each plot 5 trees in each diameter class were tagged, the diameter and height recorded, and borings taken on 2 trees. These records are shown in Table V. Plots are to be remeasured in five years.

As early in the season as possible, ten individual trees of tamarack, black spruce, and jack pine were set up to study the current year's radial growth. The jack pine are located directly south east of the Prince Albert cabin. The tamarack and black spruce are in the Railroad Swamp, see Fig. 3.

2. Previous Growth

Numerous borings were collected from all swamps in the Prince Albert region. These were mounted in corrugated cardboard and returned to the laboratory. (Fig. 4).

Ten borings at breast height were taken from each of the treated plots to study previous growth and learn the age of the standing trees. The growth rings on the cores were measured in five year intervals by .02". Celluloid riders were made to fit an engineer's scale which rested on two wooden blocks. The cores were placed in the groove of the triangular scale and measurements were made by moving the riders a distance equal to five years' growth and reading the 1/50 scale. This method was necessary for reasonable accuracy as some growth rings were so narrow that a hand lens or low power binoculars were used to count them. (See Fig. 5). False rings may be frequent although no definite method of recognizing them has been learned. Some rings were only two rows of cells in thickness but are believed to be a complete annual increment. Temporary slides

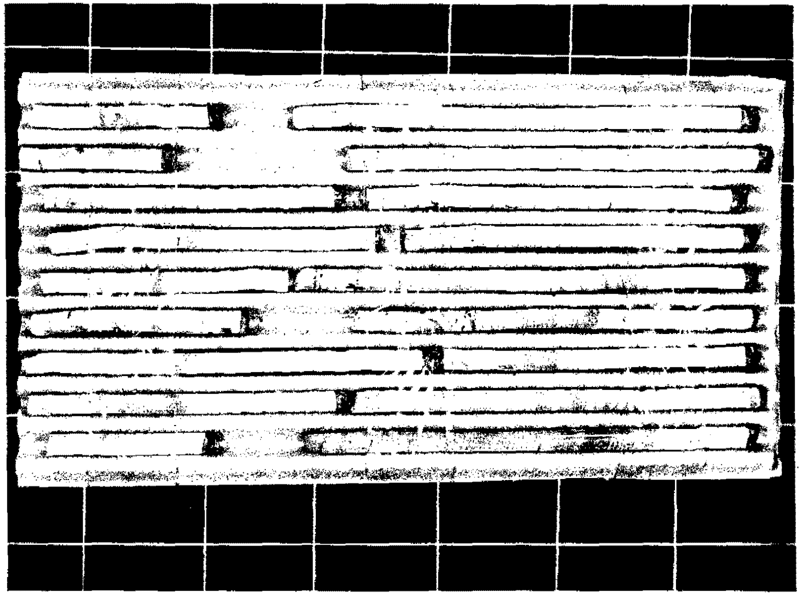


Fig. 6. [illegible] borings mounted on a [illegible] with [illegible].

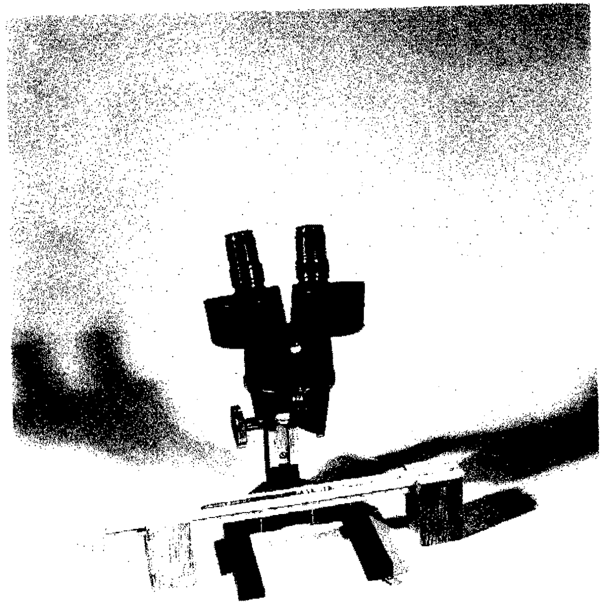


Fig. 7. [illegible] used to count and measure [illegible].

TABLE IV. Density of Undisturbed Plots at Crutwell Corner.

Plot	Spec.	1"	2"	3"	4"	5"	6"	7"	Tot.	Bas. Ar.	Av. Dia.
V	Tan.	9	75	96	46	2			226	10.643	2.8
VI	Tan.	5	42	37	50	38	15	2	189	10.416	3.9
VII	Tan.	49	146	136	65	8	2	2	404	17.512	2.6

TABLE V. D.B.H. and Heights of trees on Undisturbed Plots 1951.

Plot V

2" Class Tree #	Dia.	Ht.	3" Class Tree #	Dia.	Ht.	4" Class Tree #	Dia.	Ht.
501	2.3	16	506°	3.1	22	511°	4.2	26
502	2.2	16	507°	3.0	24	512°	3.9	27
503°	1.9	15	508	3.0	24	513	3.8	25
504°	2.2	18	509	3.0	26	514	4.1	30
505	1.9	13	510	3.1	24	515	4.1	22

Plot VI

2" Tree #	Dia.	Ht.	3" Tree #	Dia.	Ht.	4" Tree #	Dia.	Ht.	5" Tree #	Dia.	Ht.	6" Tree #	Dia.	Ht.
516°	2.4	20	521°	3.0	24	526°	4.1	32	531°	5.3	36	536	5.8	44
517°	2.0	20	522°	3.1	24	527°	4.1	31	532°	5.0	38	537	6.0	40
518	2.2	14	523°	3.3	26	528	4.2	32	533	5.0	40	538°	5.8	41
519	2.0	16	524	3.2	23	529	4.0	35	534	5.1	37	539°	6.1	43
520	2.0	16	525	3.2	27	530	4.2	36	535	4.9	35	540	6.4	48

Plot VII

2" Tree #	Dia.	Ht.	3" Tree #	Dia.	Ht.	4" Tree #	Dia.	Ht.	5" Tree #	Dia.	Ht.
541	1.8	14	546°	3.0	24	551°	4.0	37	556°	5.1	42
542°	2.3	19	547	3.3	35	552	4.0	35	557	4.9	45
543	2.1	22	548°	3.1	26	553°	3.9	34	558°	5.4	40
544	2.2	22	549	3.2	32	554	3.8	31	559	5.5	47
545°	2.2	21	550	3.1	32	555	3.9	32	560	5.3	42

° Borings were taken on these trees.

were made of a number of rings suspected to be "false" and examined under a microscope. This did not reveal any further evidence to prove they were false and since they are perfectly normal except that they are narrow, they will be considered a full year's growth.

2. Present Growth

When the plots were chosen and the trees to remain in the plots selected, thirty of the remaining trees were set up to measure with a dial guage dendrometer. Readings were taken twice weekly from May until September. This interval included all of the growing season. An Ames dial guage (B.C. Ames Co., Waltham, Mass. Model 282 available from H.C. Burton Co., Hamilton, Ont.) was used in a frame built by Halross Instruments, Winnipeg. (Fig. 8). The dial guage dendrometer has been used successfully by many researchers including Warrack & Joergensen (1950). The instrument used in the study employs the same basic principles although the design was modified. The frame was made so that three pegs on it would fit the slots of three screws driven into the bole of a tree in a triangular pattern. Once the setting was made it was fixed, as there was only one position that the frame would seat on the screws, thus assuring an identical attitude at each reading and eliminating error. The plunger of the dial contacts a point on the bark equidistant from the screws. A Glaziers point was cemented with Ambroid cement to each tree at the point of contact of the plunger. This made a uniform permanent contact point. On Plot D the points on half the trees were omitted to determine if they were necessary as a contact point for accurate readings. The bark was trimmed smooth and the readings taken with the plunger resting directly on the bark. This was satisfactory except in one case where sap exuded. There was no difference in the readings between trees with and without contact points; however the number sampled in this way was too small to be significant. Trimming the bark smoothly and applying Ambroid Cement (or any waterproof glue) will probably be as efficient as the glazier point, thus eliminating error when a point becomes loose or when the cement fails and the point drops off. Only two points became loose during the first summer but they should all be checked and re-glued where necessary before the next growing season begins.

A template was used in spacing the screws in the tree trunk. One eighth inch holes were drilled with a Yankee automatic drill and the screws driven with a spiral screwdriver. This equipment speeded the operation. Number 8, 1½" brass, flat-headed screws were used, leaving ½" to ¾" protruding from the tree. The points

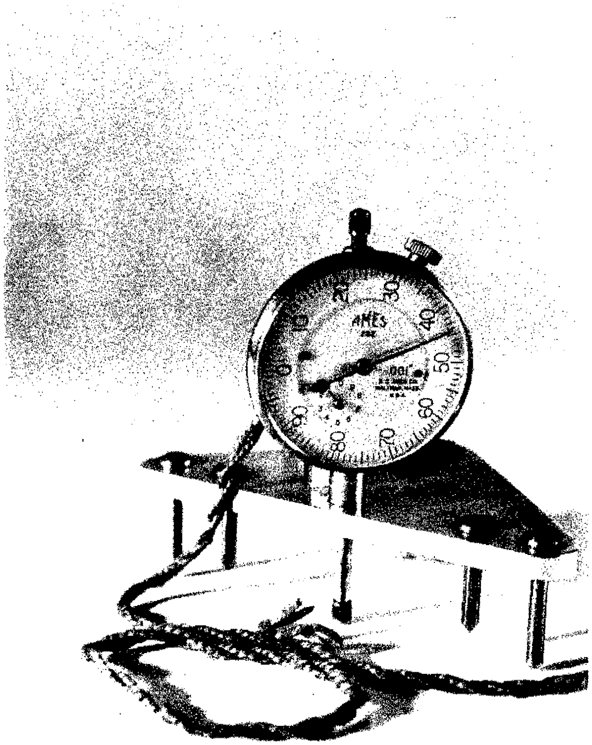


Fig. 6. Ames dial gage dendrometer [illegible]

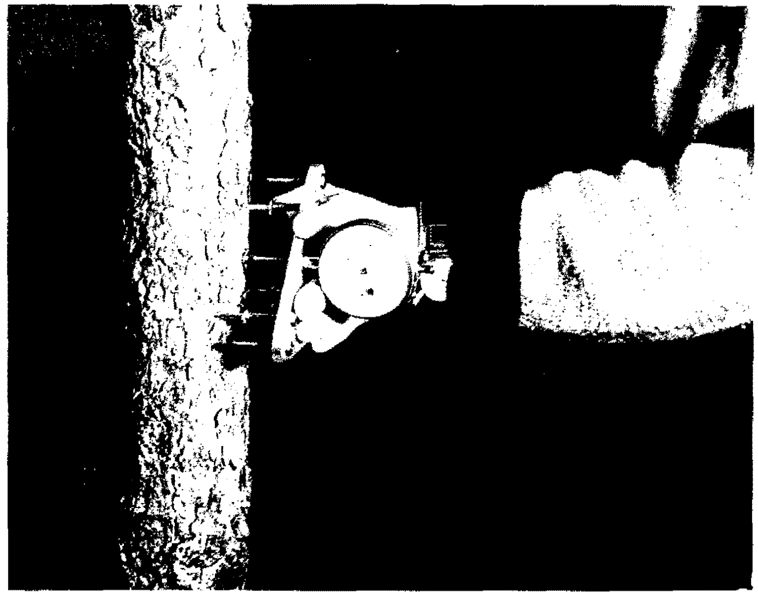


Fig. 7. Dendrometer [illegible]

of the dendrometer seat in the slots of the screws. (See Fig. 7). The heads of the screws define a permanently fixed plane parallel to the bole. When the dendrometer is placed in position on the tree, the spindle measures the distance between the bark and the fixed plane. This is read from the dial in .001 inches. The difference in consecutive readings yields a precise record of radial increment.

Jackson (1951) used a dial dendrometer and suggests the following instrument check which could easily be used to advantage in this study:

> "Install an extra set of three screws in each experimental area and then sink a flat-headed brass screw to a depth of ½ inch in the wood at the spot on the bark that is struck by the spindle. Readings made on the check stations enable the operator to ascertain the amount of the instrument error for each remeasurement."

4. Samples

Beginning June 15 weekly samples of outer wood (including 2 years xylem, cambium, and phloem), current terminal growth, and last year's terminal were collected and preserved for study during the winter. It is hoped this will help to establish the length of growing season.

Samples were preserved in Formalin-Aceto-Alcohol (FAA).

70% Ethyl Alcohol	- 90 cc
Glacial Acetic Acid	- 5 cc
Formalin	- 5 cc

Discs of several trees were collected for examination to learn whether effect of larch sawfly attack is equally distributed in all portions of the tree at the same time. Two base discs from old trees were collected to learn the history of previous attacks. These discs date back over two hundred years.

D. Results

1. Results of growth on thinned plots.

(a) Previous growth.

Tamarack borings taken in the field at D.B.H. were closely examined in the laboratory and measured by five year intervals. This record of past growth was drawn on a graph in fig. 8. Two definite age classes occur in the Crutwell swamp; the younger trees are between 20 and 30 years at breast height and the older ones between 50 and 70 years. Practically no trees were found between 30 and 50 years old. The average diameter of the older and younger trees is the same regardless of the difference in age. This is due to a severe loss of growth between 1900 and 1930 in the older trees. Annual rings show that optimum growing conditions have existed in this swamp for the past 25 years. The same "release" occurred in tamarack swamps in Fort a la Corne and in the Red Rock block. Fig. 9 shows typical examples of restricted growth and release which occurred in tamarack. Two factors or a combination of both may have improved the site of these swamps. (1) Intense cutting of tamarack in this area prior to 1930 may have released the remaining merchantable trees and the seedlings by improving light and moisture conditions. (2) A slight increase (about 3°F.) in summer temperature (April to September inclusive) and decrease in precipitation (2.5 inches) occurring about 1925 in this area may have had a drying effect sufficient to provide more favourable growing conditions. The climatic changes are shown graphically in fig. 10.

In any case a decided improvement in environment has induced near maximum diameter growth in the past 25 years.

During the past five years defoliation by larch sawfly in this area has been quite severe, but very few borings have shown any restriction of ring growth since the attack. Harper A.G. (1913) states that "looking back into the history of the trees as recorded in the annual growth rings of the woody cylinder, the first indication of defoliation by the sawfly larvae is the striking absence of the strongly thickened tracheids that usually occur as the zone of 'autumn wood' at the close of the year's growth. At first, perhaps, there is no significant decrease in the ring breadth itself but subsequent years show much narrower rings, with, however, in some cases a fair proportion of normally thickened autumn wood."

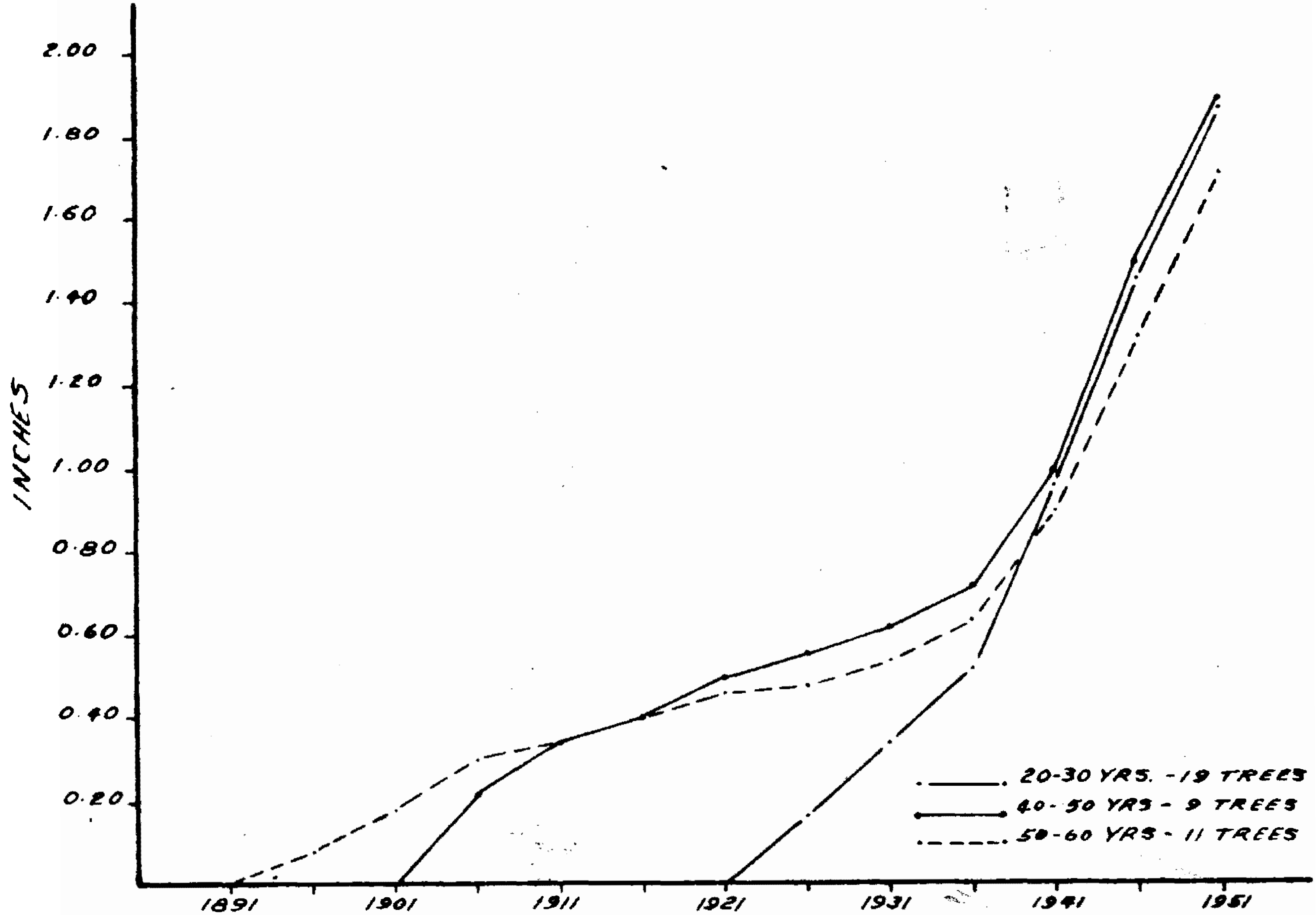
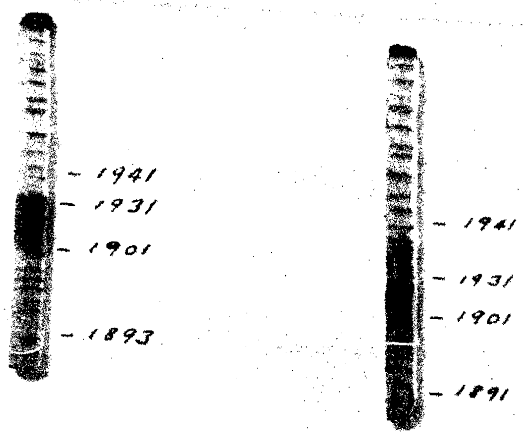


Figure 8. Record of radial growth of tamarack in Crutwell Swamp.



Typical examples of tamarack release.

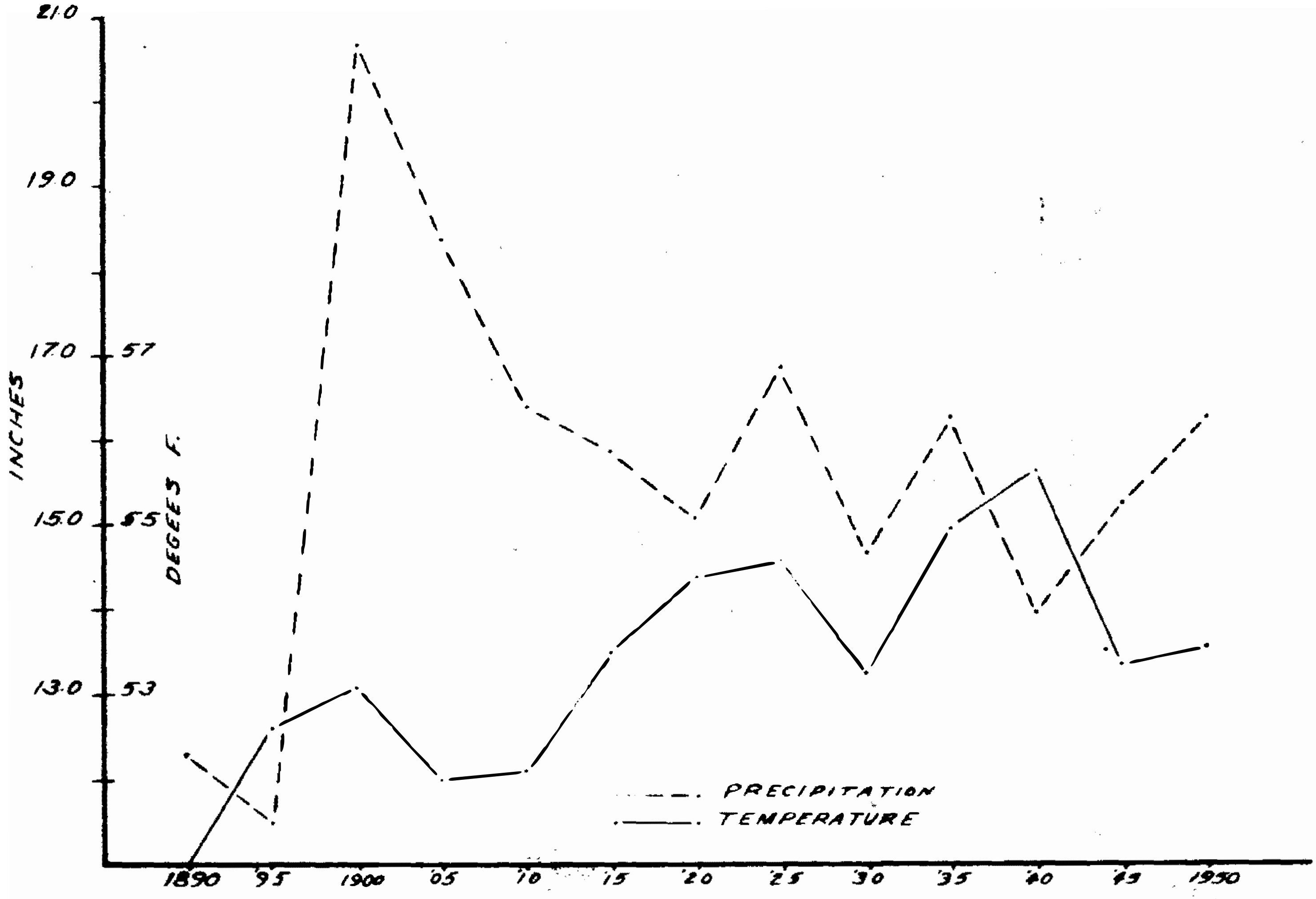


Figure 10. Precipitation and temperature fluctuation in the Crutwell area.

This method of dating larch sawfly epidemics would be very simple to use but on examination of a considerable number of tamarack borings this tendency rarely occurred. A few variations existed such as lack of late wood thickening the first year of attack and no restriction in ring width in subsequent rings; normal late-wood thickening and gradual decrease in ring width until in the fourth and fifth years of attack the annual ring became quite narrow; other borings showed normal growth during four years of attack with very restricted annual ring in the fifth year. Variations of growth since attack are shown in fig. 11. Climate, site, and variations in season probably counteract the starvation effects of defoliation to the extent that Harper's method of dating is not entirely accurate, but the lack of late wood-thickening has occurred in several cases within two or three years of the first serious defoliation and it may be used as an estimation in dating attacks. The period of slow growth after 1900 was not preceded by the symptoms described by Harper although it is suspected that sawfly was in the area about 1912.

(b) Current growth.

Twice weekly dendrometer readings began on the thinned tamarack plots on May 14. Fluctuations in readings occurred immediately and continued until readings ceased September 23. A slight increase was noted between May 14 and June 12. Then rapid radial increase was recorded until July 30.

Working in New York, Knudson (1913) states that very little growth took place in tamarack previous to May 25, and the growth which occurred was confined entirely to the cambium and phloem. From May 25 to June 3 a very marked increase occurred. By July 6 the ring of xylem was almost complete. He also states that the season of diameter growth in larch is relatively short with practically all the growth occurring during the month of June. The small increase produced from the time of bud opening April 19 to May 25 consisted entirely of cambium and phloem.

Readings recorded in this study at Prince Albert during 1951 distinctly show the same growth trends although at later dates due to a difference in geographical location.

Most rapid growth began June 12 and progressed until it reached a peak on July 30. After that date readings began fluctuating and gradually diminishing, finally becoming stable at a point equal to the growth about July 25. This is shown in fig. 12.

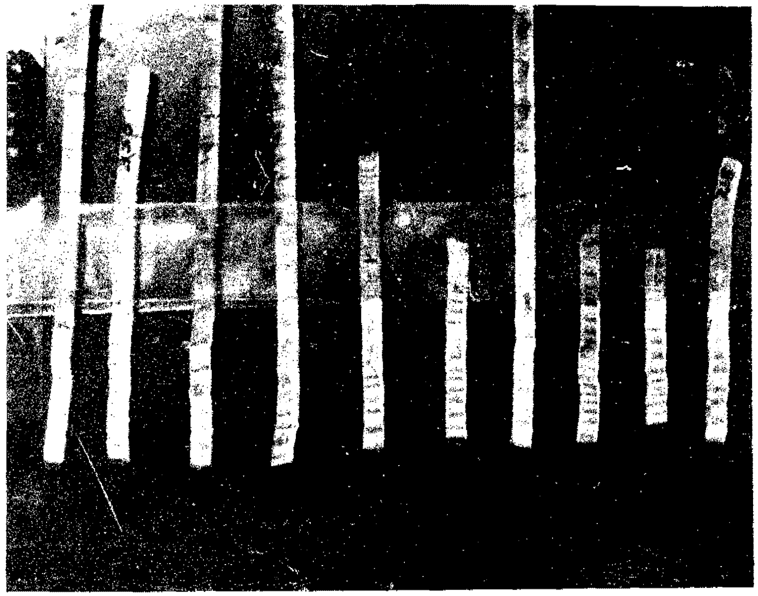


Fig. 1[illegible]. Variations in radial growth
of tamarack at [illegible]
showing current [illegible].

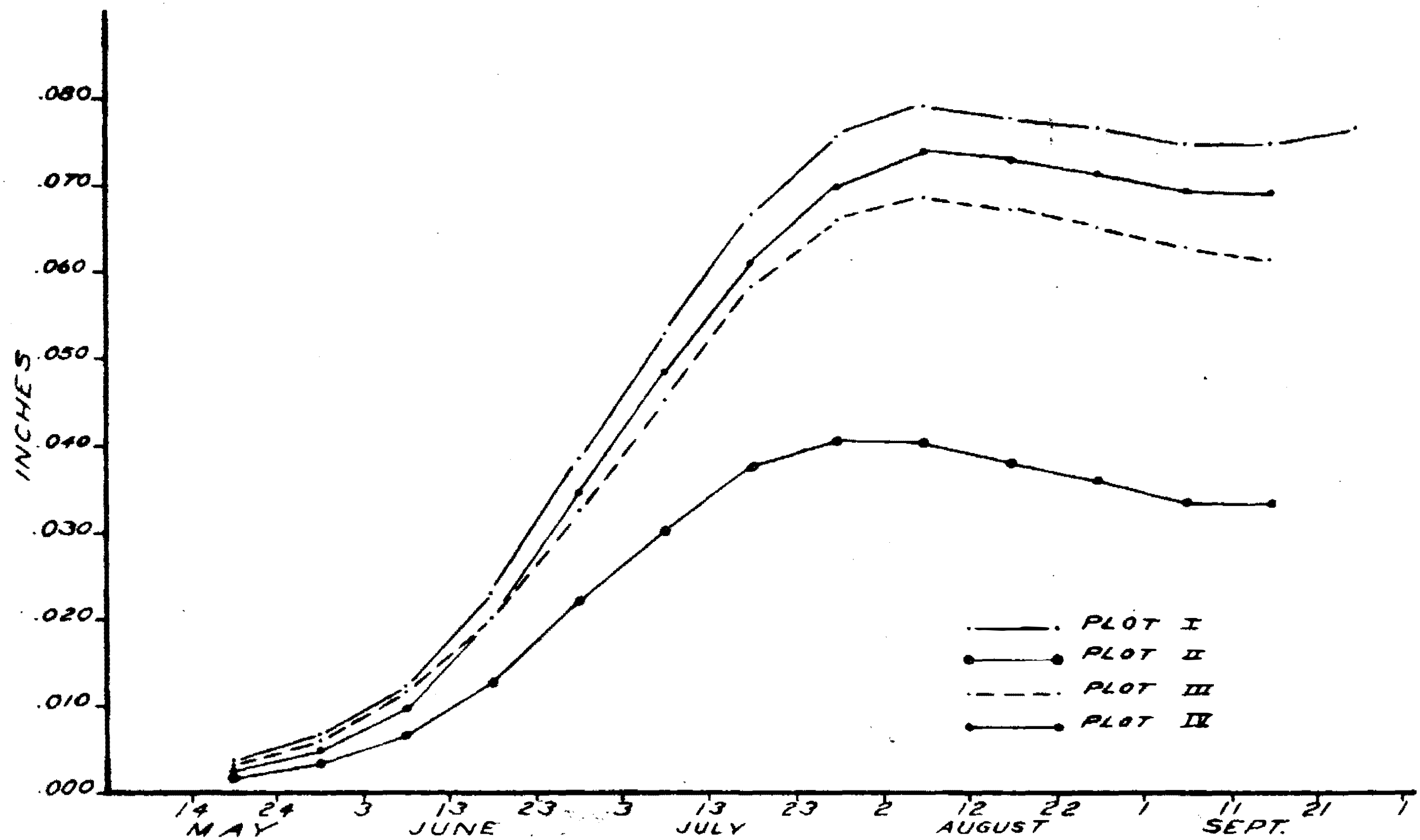


Figure 12. Seasonal radial growth of tamarack during 1951 in the Crutwell Swamp.

Readings ceased on Sept. 25 but should have continued until fluctuations ceased entirely as during the last week a slight increase was noted.

The first 5th instar larvae of the larch sawfly was found in the field on July 8. Defoliation by this insect was noticeable by mid-July. More than half of the 1951 radial growth had developed by the time the sawfly had reached the 5th instar (when it does the most feeding) and was nearing completion as defoliation became severe. Thus it is reasonable to assume that seasonal variations are important factors if not determining factors in the amount of wood lost due to defoliation by this insect. Subsequent dendrometer records and a reasonable estimation of defoliation will determine the actual loss of radial growth caused by sawfly defoliation.

All trees were very consistent in fluctuations which are probably caused by variations in sap flow. Rainfall and temperature had no obvious affect on fluctuations although more detailed information may yield data on some factor which must be very important to produce such consistent results.

Minimum, maximum and mean radial increase for the four plots are shown in Table.

Plot	Minimum	Maximum	Mean of 30 trees	St. Dev.
I	0.031"	0.156"	0.083"	0.025
II	0.011	0.070	0.039	0.016
III	0.014	0.094	0.065	0.017
IV	0.026	0.134	0.072	0.024

From this table it was concluded that in 1951 there was no significant difference in radial growth between the four plots; subsequent records may show the effects of thinning and defoliation.

Grouping the trees of all four plots into diameter classes shows that diameter size had no effect on radial increase in 1951. This is illustrated in the following table.

Dia. Class	No. Sampled	Rad. increase	St. deviation
3"	7	0.061"	0.017
4"	81	0.063"	0.026
5"	66	0.066"	0.034
6"	5	0.083	0.011

2. Growth in a mixed stand.

(a) Current Growth

Dendrometer readings on plots B and D did not begin until July 7, so most of the growing season was over before records could be kept. Accumulated readings for the short period recorded are presented in Fig. 13. This graph shows the consistency in radial fluctuations which occurred in both tamarack and black spruce.

3. Comparison of different species.

(a) Previous Growth

Black spruce and tamarack increment borings were taken in two age classes. Both species of the same age show about equal final diameter although the pattern of growth varies. Annual increments of black spruce have been very regular in both young and older trees. Annual rings of tamarack indicate poor growing conditions for this species between 1900 and 1930, with a rapid increase of ring growth until 1951.

Recovery of growth in tamarack in recent years has compensated for the sub-normal growth during the poor growing years so that at present both species have attained the same diameter. An insufficient number of borings on black spruce were collected to make a significant comparison, but the borings which were collected were from trees adjacent to tamarack. This comparison is shown in Fig. 14.

(b) Current Growth

Dendrometer readings on ten trees each of black spruce, jack pine, and tamarack were recorded from April 16 until Sept. 25 in 1951. Fluctuations occurred as soon as readings began.

Radial increase of tamarack was slow and limited until June 12 when it began to increase rapidly and continued until July 30. Fluctuations occurred after July 30 and radius decreased slightly, but showed an upward tendency again before readings ceased on Sept. 25.

Black spruce growth increased very steadily from May 10 until July 30 then fluctuated without decreasing in radius until readings ceased.

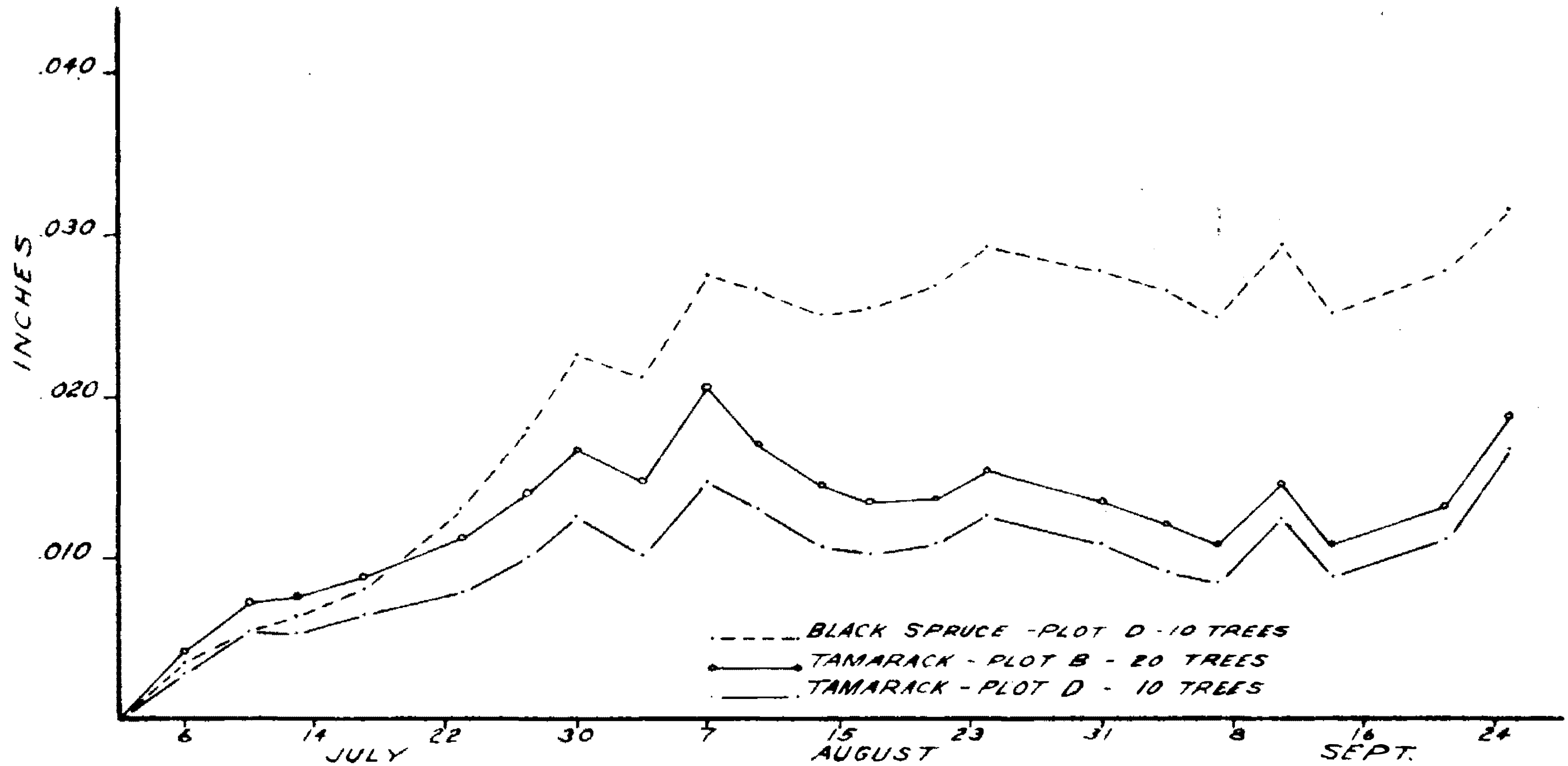


Figure 13. Radial growth of black spruce and tamarack during part of the 1951 season.

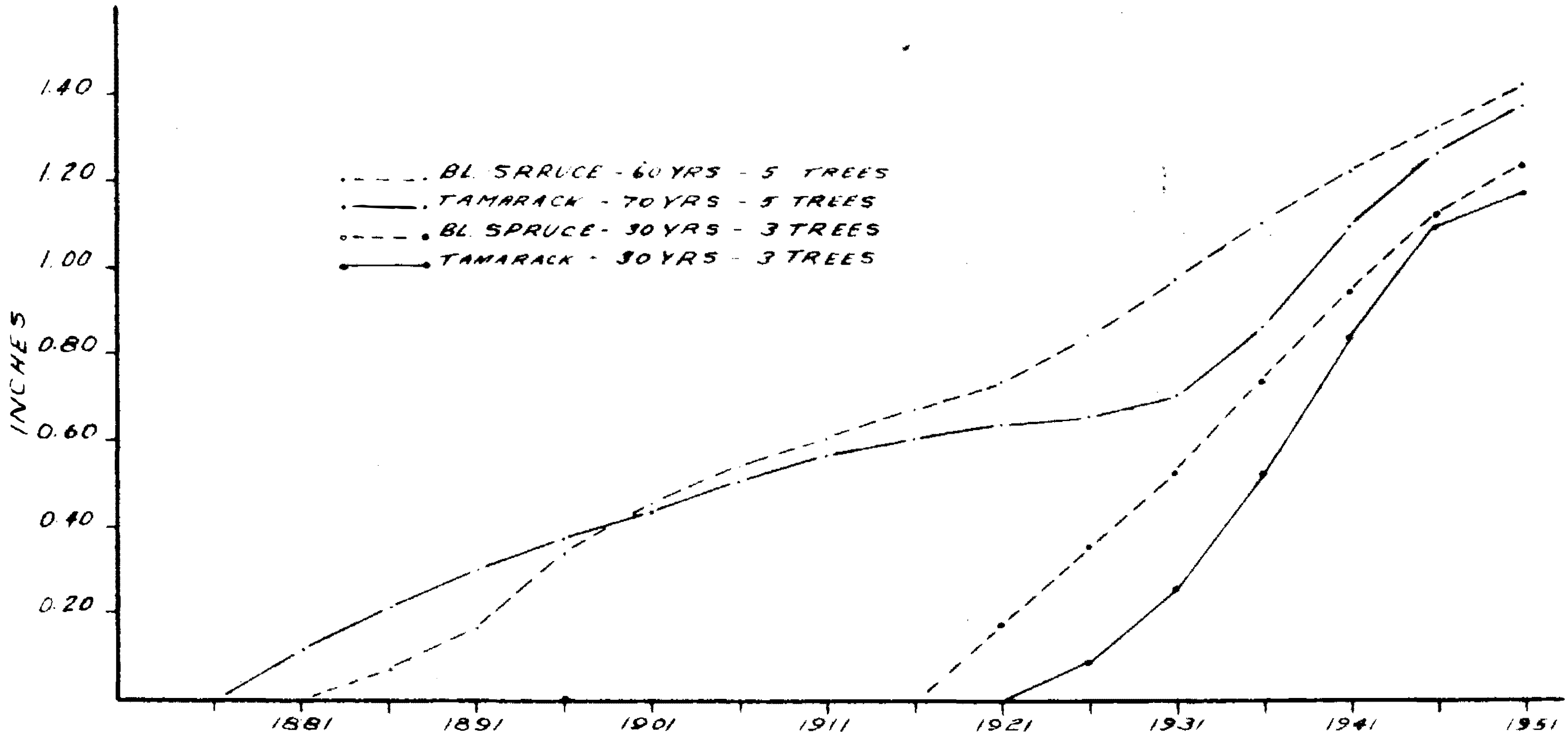


Figure 14. Comparison of black spruce and tamarack growth near Prince Albert, Sask.

Radial growth of jack pine was nearly coincident with tamarack until July 30 and then continued to increase for a week when fluctuations occurred but still increased slightly until readings ceased.

Fig. 15 shows the trend in radial growth of the three species. The black spruce and tamarack trees were on the same semi-open site in the Railroad swamp, the jack pine were in a stand near the field camp.

Although this year's records appear to indicate quite a difference in radial growth, patterns of the three species cannot be considered as conclusive results. Seasonal variations will probably alter the growth patterns so that further records will be necessary to establish a significant result.

4. Work Completed in 1951.

Nine permanent plots and three groups of ten individual trees have been established for a continuous study of the growth of tamarack. Dendrometer readings were recorded twice weekly on 190 trees. These were distributed as follows:

Thirty trees in each of the three thinned plots and in the check plot.
Twenty in each of the plots of pure tamarack and mixed tamarack-black spruce.
Ten individual trees each of black spruce, tamarack, and jack pine.

Three plots were established in tamarack of natural various densities.

Complete tallies were recorded of each plot including before and after tallies of the thinned plots.

Data recorded during the summer of 1951 have been analysed and presented to show the trend of radial growth in tamarack and black spruce for that period.

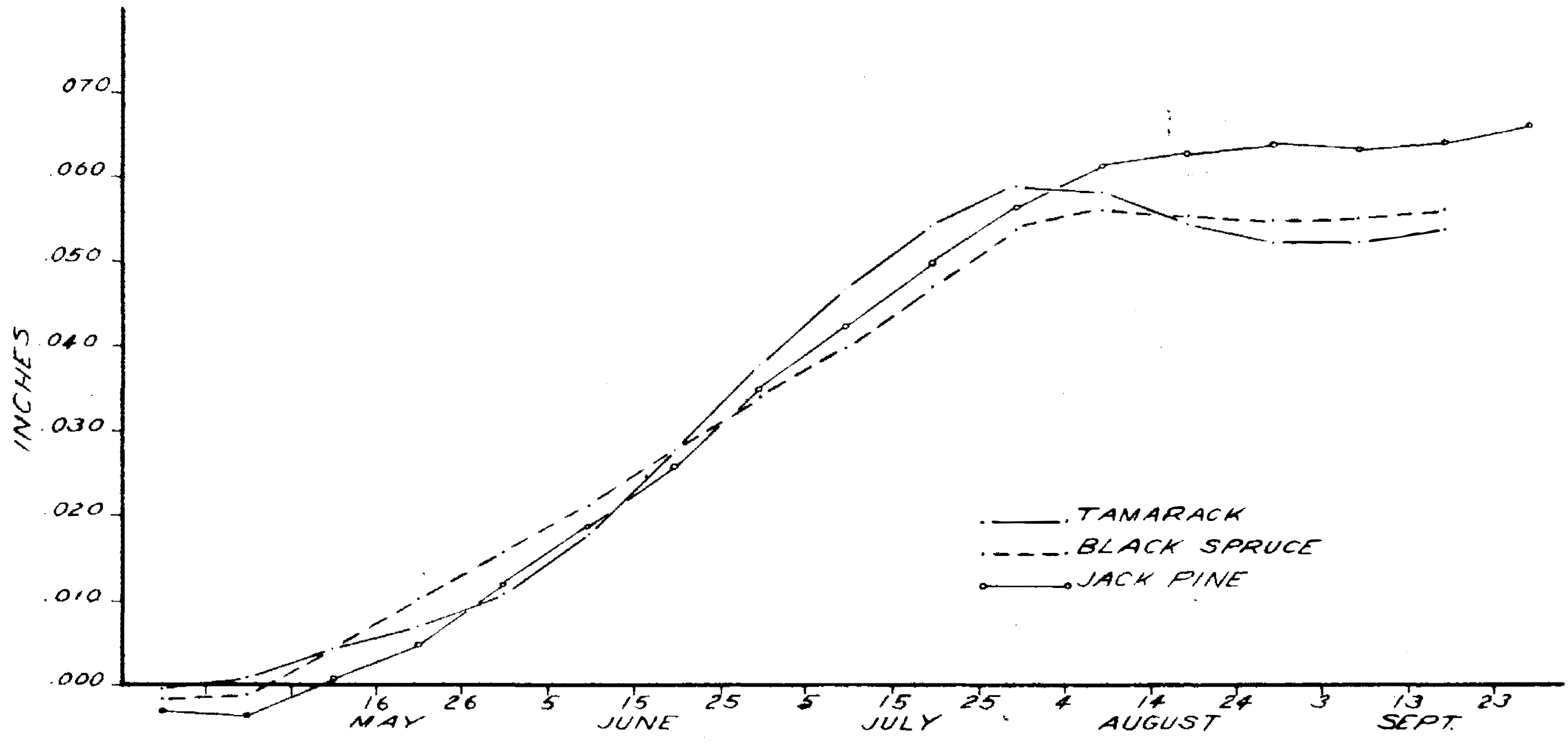


Figure 15. Trends in radial growth of tamarack, black spruce, and jack pine near Prince Albert, Sask., during 1951.

REFERENCES

Jackson, L. W. R. Use of the dendrometer for the precise measurement of tree growth. The Forest Farmer 10 (9): 0 June, 1951.

Warrack, G. & Joergensen Chr. Precision measurement of Radial Growth and daily radial flustuations in Douglas Fir. Forestry Chronicle 26 (1): 52-66. March, 1950.

Harper, A.G. Defoliation: Its affect upon the growth and structure of the wood of Larix. Annals of Botany Vol. 27, No. 118. Oct. 1913.

Knudson, L. Observations on the inception, season, and duration of cambium development in the American Larch. Bulletin of the Torrey Botanical Club 40 (5): 271. June, 1913.

ANNUAL TECHNICAL REPORT 1951

PROJECT NO. E.30-09-4

VI LARCH SAWFLY

ECOLOGICAL STUDIES

Report by W. J. Turnock

Field Work by W. J. Turnock
and D. Groves.

LARCH SAWFLY ECOLOGICAL STUDIES

A. Introduction and Description of Working Areas

B. Meteorological and Phenological Records

C. Ecological Observations

1. Cocoon Stage

(a) Time of Pupation.
(b) Sampling Studies.
(c) Natural Control.

2. Adult Stage

(a) Natural Emergence.
(b) Effect of Cocoon Depth and Soil Temperature on Adult Emergence.
(c) Adult Fecundity and Longevity.

3. Egg Stage

(a) Oviposition.
(b) Natural Control.

4. Larval Stage

(a) Hatching of the Eggs.
(b) Larval Development.
(c) Natural Control.

5. Diapause

A. Introduction and Description of Working Areas

This is a preliminary report on a project designed to study the ecology and climatology of the larch sawfly. As 1951 was the first summer of this project an attempt was made to become familiar with P. erichsonii in the field and to investigate certain aspects of its life history, seasonal development, mortality and sampling problems, as well as some of the physical and vegetational features of the habitat.

The investigations were conducted in three bogs in the vicinity of the Prince Albert Field Station. These bogs will be referred to as the Railroad Bog, Crutwell Bog, and the Airport Bog. A description of the physical and vegetational characteristics of each bog will be given below.

For purposes of comparing the three bogs and different areas within the bogs a crude classification of the tamarack sites was prepared. This classification (Table 1.) is based on the composition and density of the tamarack stands and the moisture levels that were observed. The classes are admittedly crude but appear to be ecologically sound. Further study of vegetation and water levels in these and other bogs would be necessary to prepare a more detailed classification.

Table 1. Description of Tamarack Site Classes in the Prince Albert Area.

Site Class	Moisture Condition	Stand Characteristics
A	Moist	Mixed tL, bS; usually medium density
B	Moist	Pure tL; usually medium density
C	Wet	Pure tL; low to medium density
D	Very wet	Pure tL; scattered on sedge mat

Railroad Bog: This bog is located on the north bank of the North Saskatchewan River within the Prince Albert city limits. The water level in the bog is maintained by a number of springs, whose locations are marked by small pools filled with suspended organic matter, surrounded by an area of open sedge mat. Drainage is mainly by seepage into the river.

Tamarack sites vary from class D, near the spring-fed pools, to a limited area of mature bog forest, trembling aspen, jack pine, white spruce, balsam poplar, black spruce and tamarack, on shallow peat over sand near the northern edge of the bog. All four site classes are represented here, class A being most numerous.

Crutwell Bog: This bog is located in the Home Block of the Nisbet Provincial Forest 12 miles west of Prince Albert along Highway No.55, lying west of Crutwell Corner and north of the village of Crutwell. It surrounds the dry bed of Bennett's Lake.

The appearance of the stand and the peat formation indicate that the bog was quite wet, with tamarack stands of classes B and C predominating. A change in drainage about 25 years ago made the whole bog dry. It now supports stands of tamarack of varying density with some black spruce and black poplar. Ground vegetation is conspicuously absent; even mosses are rare.

Emergence cages were situated in a stand just south of the highway with a density 1800 to 2000 stems per acre.

Airport Bog: This bog is located in the Red Rock Block of the Nisbet Provincial Forest about three miles north-east of the Prince Albert Airport. The bog was not examined thoroughly in 1951. The only site class observed was class B, along the northern edge of the bog, where cocoon collections were made in the fall.

For additional descriptions of the Crutwell and Railroad Bogs see Section VI of this Report.

B. Meteorological and Phenological Records

1. Meteorological Conditions, April 15 to September 30, 1951.

The records of the Meteorological Division, Dept. of Transport, for the Prince Albert District, as reported in the Weekly Weather Summary for the Prairie Provinces were used to compile the following summary. Records of a standard thermograph and rain guage that were kept at the Prince Albert Field Station were also available.

The first warm spell of the season began April 26 with the daily maximum temperature reaching 60°F. Above normal temperatures prevailed until the end of May. The mean temperature for May was 4.75°F. above normal. The first week of May was marked by excessively heavy rains but these were offset by subnormal precipitation during the second and fourth weeks. The May precipitation was 14 per cent below normal.

The first week of June was very cool and damp. Unsettled weather persisted throughout the month with the exception of a few days ending June 18. The mean monthly temper ture was 4°F. below normal. Precipitation in the first and last weeks of June was above normal but the total for the month was 13 per cent below normal.

The mean temperature for July was only 0.75°F. below normal. Above normal temperatures occurred in the weeks ending July 9 and 30. Precipitation in the first half of July was below normal but abundant rainfall during the last two weeks brought the total to 27 per cent above normal.

Conditions were fairly stable for most of August but during the last week the weather became unsettled and fluctuated widely. The mean temperature for the month was normal. Precipitation until August 25 was far below normal; rains then occurred but were not sufficient to raise the monthly total above a 4 per cent deficiency.

The early part of September was generally sunny and warm with low precipitation. About September 20, two storm centres passed in rapid succession, bringing snow and low temperatures. The first killing frost occurred September 21. Heavy snows and low temperatures persisted until the end of the month. The mean temperature was 1°F. below normal and the total precipitation was 15 per cent above normal.

The mean temperature for the whole season was normal, total precipitation was 11 per cent below normal. May was the only month with above normal temperatures. July and September had above normal precipitation. Cool weather in June and July caused slow growth of the grain crops and delayed harvesting. Much of the crop was still in the fields when snow and cold weather struck on September 20 and prevented further harvesting.

copy 4

ological Record. Prin. lbert, Sask. 1951.

Date	Tamarack	Larch Sawfly	Miscellaneous
Apr.14			Ice broke in Sask. R.
14			Willow catkins out
25			Poplar catkins out
26			First mourning cloak butterfly seen.
27			First robin seen.
28			First redwing blackbird.
28			First adult and larvae mosquitoes.
May 1	Buds opening, needles exposed.		
8	Pollen falling		
14	Dendrometer readings fluctuating.		
18			White spruce buds opening pollen falling.
20			First chokecherry blossoms.
24		First adults seen in field.	
31	Needles fully grown, terminal shoots extending beyond needles.		Jack pine pollen falling buds elongating.
Jun.10	Dendrom. readings beginning to increase.		
12	Terminals $1\frac{1}{2}$" to 3" long.	Oviposition beginning.	
25	Terminals rapidly elongating.	1st & 2nd instar larvae found at Crutwell.	
18			First wild rose blossom.
Jul. 8		First 5th instar larvae found, defoliation barely noticeable.	
15	Terminal growth about complete.	Defoliation noticeable in all swamps.	
25		C.C. 20% def. Christopher Lake swamp stripped.	

Jul. 30	Dendrometer readings reached a peak.	
Aug. 7	readings fluctuating.	C.O. 75% def. Many larvae dead on trees.
Sept. 25	readings still fluctuating. Frost in trees.	

C. Ecological Observations on P. Erichsonii

1. Cocoon Stage

(a) Time of Pupation.

Post-diapause development of larch sawfly larvae at the Railroad Bog began fairly early in 1951. The first pupa was found in cocoons examined on May 28. Some information on the number of pupae present at different dates in the spring was obtained by the examination of cocoons collected in the cocoon sampling experiments. These samples were taken from May 15 to June 16. The per cent of pupae in each sample is given in Table 2.

Table 2. Per cent pupation in cocoons collected at the Railroad Bog.

Date	Number Cocoons	Per cent Pupae
Before May 28	14	0
" 28	26	42.3
June 5	20	15
" 7-8	16	43.8
" 11-12	15	66.7
" 15-16	16	75

(b) Cocoon Sampling.

The use of cocoon samples as a method of following changes in larch sawfly populations from year to year has some advantages. The cocoons are fairly accessible for a period of two to three weeks in the fall, during which time the population remains fairly constant. From the time the cocoon is formed, however, many factors are active in reducing the population and these may not have equal effects from year to year. This introduces some error into the population estimate but not nearly as much as the error caused by the extreme variability in the number of cocoons found in samples taken from the same area. Filuk (Ann. Tech. Rpt. Wpg. Lab. 1947) found that the amount of variability changed from year to year as well as from place to place. The high variability increases the number of samples that are necessary to define the mean population within the limits of a standard error. The number of samples that Filuk calculated to be necessary to define the mean population of an area would involve time and labour outside the bounds of practicability.

The following data were collected in an attempt to discover if distribution of cocoons was as variable beneath the crown of a single tamarack as it has been shown to be for a larger area. The collection and analysis of the data was designed to show the relation between the number of cocoons per sample and the location of the sample with regard to the cardinal directional quarter and the distance from the trunk of the tree if such relationships existed.

With this intent, three tamarack trees were selected in the Railroad Bog. The trees were about 40 feet high, co-dominants, and with well-developed crowns. Beneath the crown of Tree I, sample areas were marked on the ground as shown in Figure 1. Each sample area was 8.5 x 17 inches with a surface area of one square foot. Each sample consisted of all the cocoons found in the moss within a single sample area. Table 3. gives the number of cocoons collected in samples from Tree I.

The method used to sample under Tree I was found to be too laborious and the pressure of other work forced a change in the size of the sample area to reduce the labour. The sample areas under Trees II and III were 4x4 inches with a surface area of 16 square inches. The sample areas were marked out as shown in Figure 1 except for the difference in sample size and that there were 12 samples taken along the line of each ca dinal direction. The number of cocoons per sample is given in Table 4.

From the above data the mean number of cocoons per sample, the standard deviation, and the co-efficient of variability were calculated for each tree. The statistics were:

	Sample Area	Mean	Standard Deviation	Co-efficient of Variability
Tree I	1 sq. ft.	41.9	27.84	66.4%
Tree II	16 " in.	14.04	13.95	99.4%
Tree III	16 " "	11.58	8.61	74.4%

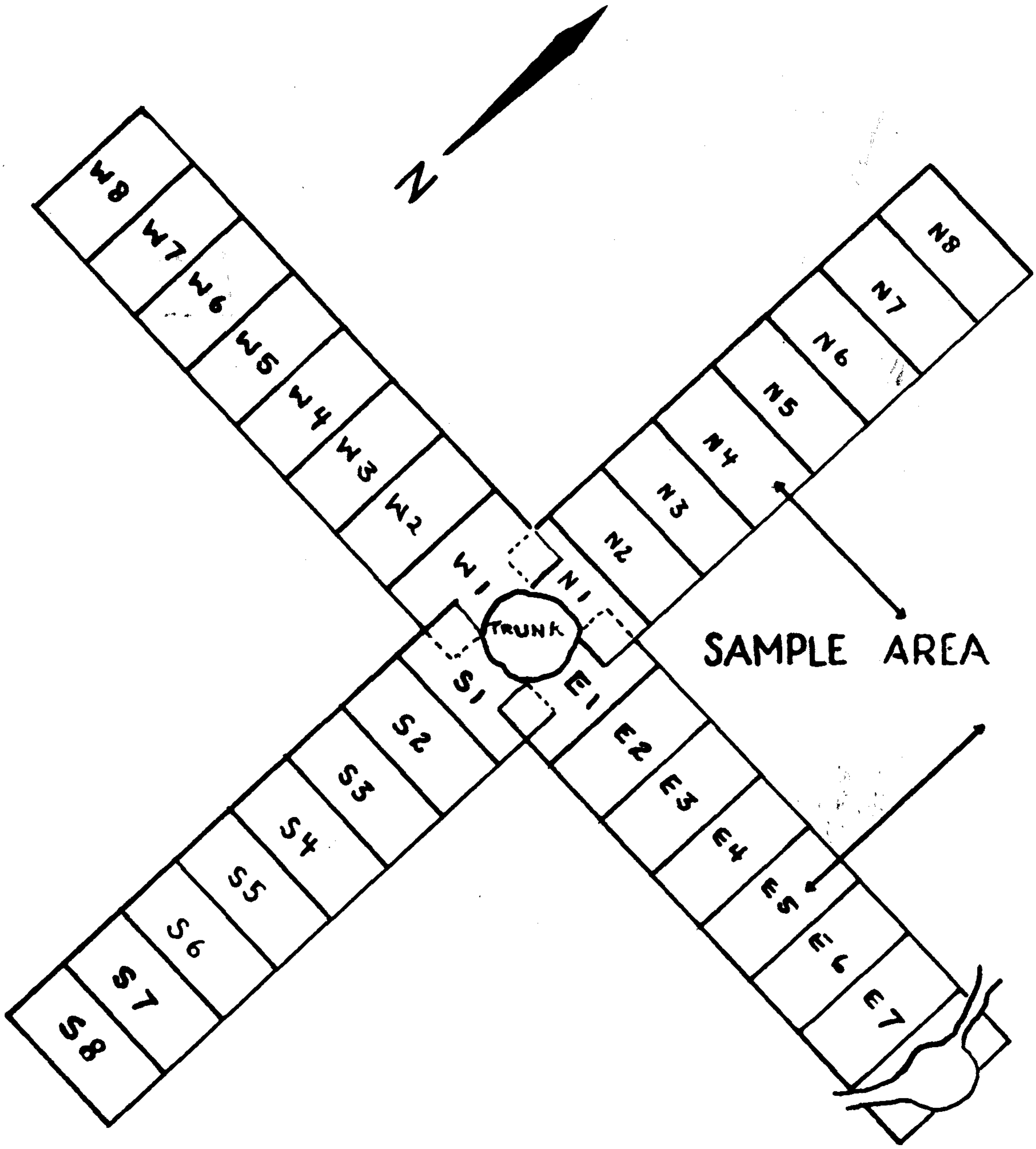


Figure 1. Method of sampling to determine the distribution of cocoons beneath the crown of the tree.

Table 3. Number of cocoons per square foot sample under the crown of Tree I.

Cardinal Direction	0-8.5	8.5-17	17-25.5	25.5-34	34-42.5	42.5-51	51-59.5	59.5-68	Sum
	Distance from trunk in inches								
N	109	62	94	68	10	11	20	14	388
E	61	62	57	19	23	18	22	*	262
S	62	36	70	73	36	56	29	34≠	396
W	71	49	67	33	11	3	14	5	253
Sum	303	209	288	193	80	88	85	53	

*No sample taken. ≠ Mouse cache.

Table 4. Number of cocoons per 16 square inch sample under the crown of Tree II and Tree III.

Card. Dir.	0-4	4-8	8-12	12-16	16-20	20-24	24-28	28-32	32-36	36-40	40-44	44-48	Sum
	Distance from trunk in inches												
Tree II													
N	42	15	21	32	6	31	6	33	18	8	4	0	216
E	12	27	52	21	30	40	12	5	2	0	0	0	201
S	22	13	4	9	7	7	7	4	8	4	2	4	91
W	42	15	14	5	10	7	5	2	0	3	15	48	166
Sum	118	70	91	67	53	85	30	44	28	15	21	52	674
Tree III													
N	22	10	14	5	16	9	9	29	13	8	11	8	154
E	24	13	16	1	5	4	14	3	9	8	4	4	105
S	8	23	17	8	38	11	0	12	5	5	10	6	143
W	37	12	30	14	11	5	14	6	5	3	11	6	154
Sum	91	58	77	28	70	29	37	50	32	24	36	24	556

The extreme variability in sample size is apparently partially due to the small sample area. Filuk (loc. cit.) found that the variability could be reduced by taking larger samples. To test this for the present data the samples from Tree I were paired to form sample areas of two square foot surface area. For Trees II and III all the samples in each cardinal direction were pooled to give four samples each representing a sampling area of 1.33 square feet for each tree. The following statistics were then calculated.

	Sample Area	Number Samples	Mean	Standard Deviation	Co-efficient of Variability
Tree I	2 sq.ft.	16	82.3	50.4	61.2%
Tree II	1.33 " "	4	168.5	48.3	28.7%
Tree III	1.33 " "	4	139.0	17.5	12.8%

These figures confirm Filuk's statement.

The significance of the difference between the number of cocoons in samples taken from the four cardinal directions was tested by analysis of variance. The data were standardized by converting the total number of cocoons taken from each direction of each tree to the number of cocoons per square foot (Table 5-A). The calculation of variance from these figures is summarized in Table 5-B. The statistics show that the differences in the number of cocoons per square foot for the cardinal directions are not significantly different.

The figures given in Tables 3 and 4 appear to indicate that the number of cocoons per sample tends to decrease in samples taken from the trunk of the tree toward the periphery of the crown projection. The difference in the number of cocoons in samples taken at different distances from the trunk for Trees II and III (Table 4) was tested by analysis of variance. The calculations (Table 6) show that the differences are not significant.

The possibility that the significance of the difference between the number of cocoons at different distance had been obscured by the small size and high variability of the samples was examined by grouping the

Table 5. Analysis of variance for difference in number of cocons in four directional samples.

A. Average number cocoons per square foot.

Direction	Tree No. I	II	III	Sum	Average
N	48.5	162.	115.5	326	108.7
S	49.5	68.2	107.3	225	75.0
E	37.4	150.8	78.8	267	89.0
W	31.6	124.5	115.5	271.6	90.5
Sum	167.0	505.5	417.1	1089.6	$\bar{x}$ = 90.8 N = 12.

B. Analysis of variance of average number of cocoons per square

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F.	Standard Error
Trees	2	15,412.24	7,706.12	9.89	
Directions	3	1,716.51	572.17	0.-	
Error	6	4,674.75	779.13		27.91
Total	11	21,803.5			

Σx^2 = 120,739.18

$\Sigma x \bar{x}$ = 98,935.68

Σ square Trees - 114,347.92 - 98,935.68 = 15,412.24

Σ " Directions - 100,652.19 - 98,935.68 = 1,716.51

Σ " Total = 120,739.18 - 98,935.68 = 21,803.5

Table 6. Analysis of variance for the difference in number of cocoons between samples varying in their distance from the trunk of the tree.

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F.	Standard Error
Samples	7	105.73	15.1	0.-	
Distance from Trunk	11	335.44	30.49	0.-	
Error	77	12,335.46	160.2		12.66%
Total	95	12,776.63			

samples from each direction into those between the trunk and two feet from the trunk and from two feet to the periphery of the crown projection. The samples from Tree I were also used. Table 7-A gives the number of cocoons in each group used in the analysis. The calculation of variance is summarized in Table 7-B. The number of cocoons found between the trunk and two feet from the trunk was found to be significantly (to the one per cent level) greater than the number of cocoons found outside the two foot distance.

Table 7. Analysis of variance for the difference in number of cocoons between samples taken from the trunk to two feet and samples from two feet to the periphery.

A. Number of cocoons per sample.

Distance from Trunk	Tree No. I N	E	S	W	Tree No. II N	E	S	W	Tree No. III N	E	S	W	Sum	Avge.
0-2	265	180	168	187	147	62	182	93	76	105	63	109	1637	136.4
2 -	123	82	228	66	69	29	19	73	78	38	42	45	892	74.3
Sum	388	262	396	253	216	91	201	166	154	143	105	154	2529	

$\bar{x} = 105.4$

B. Analysis of variance.

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F.	Standard Error
Replicates	11	54,349.9	4,940.9	2.41	
Distance from Trunk	1	23,062.8	23,062.8	*11.26	
Error	11	22,527.7	2,048.0		45.25
Total	23	99,940.4			

*Significant to 1% level (F.1% = 9.65)

Another factor that may affect the distribution of larch sawfly cocoons within a bog is the site class. A number of two-square-foot sample areas were located under tamarack in each of the site classes described in Table 1. Table 8 shows the average number of sound cocoons per sample that were found in each site class.

Table 8. Sound cocoons per two-square-foot sample in different site classes.

Bog	Site Type	No. of Samples	No. Cocoons per Sample	Standard Deviation	Co-eff. Variability
Railroad	A	10	17.6	17.02	96.7%
	B	6	37.3	15.58	41.8%
	C	4	16.0	11.58	72.4%
	D	3	6.7	4.02	60.0%
Airport	B	3	59.0	17.72	30.0%
Crutwell	B (dry)	3	132.7	53.40	40.2%

The small number of samples and their high variability does not permit much confidence in a comparison of the mean number of cocoons per sample on different sites. The differences in amount of variability are interesting and might bear future study.

(c) Natural Control.

The subterranean situation of larch sawfly cocoons makes it difficult to assess the efficiency of the natural control factors affecting them. These natural control factors seem to cause high mortality to cocoons of every generation, at least when larch sawfly is at or near the outbreak level. Butcher (Proc. Man. Ent. Soc. 1951) states that 98.3 percent mortality can occur among cocoons without reducing the effective larval population the following generation.

Table 9 lists the natural control factors that were observed in the Prince Albert area. The relative value of the control achieved by each factor is expressed as a percentage of the total number of empty cocoons examined. The data were obtained by examining the empty cocoons that accumulate in the moss under tamarack trees and separating the cocoons into groups according to the cause of their death. Cocoons that had been recently killed by high water levels (waterlogged) could easily be recognised but older cocoons killed by this factor had to be placed in the miscellaneous category. Collections of cocoons were made in the Railroad Bog in the spring and fall of 1951 and at the Airport Bog in the fall.

A collection of 1800 sound cocoons made in May, 1951, and reared under experimental conditions in the Railroad Bog (see section C.2.b.) gave some information on cocoon mortality during the summer of 1951. The figures for per-cent of cocoons killed by natural factors is given in Table 9. These cocoons were protected from predation by small mammals.

Table 10 compares the mortality among cocoons collected in the fall from different site classes in the Railroad Bog.

The natural control factors listed in Table 9 and the conditions that affect their efficiency will be discussed individually. The data that has been presented suggest that the value of the individual factors in the natural control complex as well as their total effect on cocoon survival varies both in different bogs and on different sites within a bog.

Table 9. Per cent of cumulative cocoon mortality (based on empty cocoons) caused by different natural control factors. The mortality during the summer in the Railroad Bog is expressed as percentages of the number of sound cocoons placed out on May 15.

Control Factor	Cumulative Mortality				Summer Mortality
	Railroad Bog			Red Rock Bog	Railroad Bog
	Spring Sample	Spring Sample	Fall Sample	Fall Sample	
Small mammals	57.6	*82.2	37.5	32.5	**
Parasites	6.8	5.4	4.0	1.9	6.4
Elaterid larvae	4.5	3.3	13.2	3.3	4.2
Waterlogged	0	0	5.0	0	8.6
Fungoid	0.7	0.5	0	0	7.7
Miscellaneous	10.8	8.5	12.2	12.9	9.8
Total Mortality	80.4	---	71.9	50.6	---
Adult Emergence	19.7	*	28.0	49.3	32.8
No. Cocoons	1496	866	1585	209	1800

* Cocoons destroyed by small mammals plus adult emergence
** Protected from small mammal predation

Table 10. Per cent of cocoon mortality (based on empty cocoons) caused by different natural control factors, in different site types of the Railroad Bog, fall sampling.

Control Factor	Site Type A	B	C	D
Small mammals	37.7	31.9	51.8	31.3
Parasites	6.2	3.9	4.2	0.7
Elaterid larvae	9.3	15.4	10.6	18.0
Miscellaneous	11.9	11.2	17.9	37.1*
Total Mortality	65.1	62.4	84.5	87.1
Adult Emergence	34.8	37.6	15.5	12.9
No. cocoons	419	564	330	272

*Mostly waterlogged

Small mammal predation appears to be the most important factor in reducing larch sawfly cocoon populations. Three species of rodents were taken from the Railroad Bog. Two of the three, *Peromyscus maniculatus bairdii* and *Clethrionomys gapperi*, were trapped in site class A where many larch sawfly cocoons had been destroyed. The other, the pocket gopher, *Thomomys talpoides*, was found in a grassy meadow and is unlikely to feed upon larch sawfly cocoons.

The efficiency of small mammals in destroying cocoons varies from bog to bog, from site to site in the same bog, and from year to year, probably in correlation with the rodent cycle. Rodents destroyed more cocoons over a period of years in the Railroad Bog than the other bogs; slightly fewer were destroyed in the Airport Bog, and very little evidence of small mammal activity was seen in the Crutwell Bog. It has been suggested that small mammals are more abundant in dry bogs than in wet bogs but examination of these data shows that dry Crutwell Bog has fewer small mammals than the wet Railroad Bog, and within the Railroad Bog a higher percentage of cocoons were destroyed among cocoons on site class C than on classes A or B, which are somewhat drier. There was evidence of small mammal activity among cocoons collected from site class D, where the moss was saturated with water. Further study will be necessary before the factors controlling small mammal predation can be determined.

Parasites cannot be considered a major natural control factor of larch sawfly in this area. Between four and six per cent parasitism is normal for cocoons collected in the Prince Albert area. The number of cocoons that had contained parasites, 1.9 per cent, that was found among cocoons collected in the Airport Bog indicates an extremely low level of parasite population, agreeing with the estimates made by the Forest Insect Survey.

Mesoleius tenthredinis Morl. was responsible for nearly all the mortality caused by parasites. *Bessa harveyi* (T.T.) was present in very small numbers in the Railroad Bog but was not observed in the Crutwell Bog. *Tritneptis klugii* (Ratz.) caused high mortality to 1950 cocoons in a limited area of the Crutwell Bog but does not appear to be generally distributed.

Table 11 shows the number of parasites that were trapped as they emerged and reached the ground surface. The trapping cages covered a two square foot area of ground. Parasite emergence form 1800 cocoons from the Railroad Bog (see section C.2.b.) gave figures of 4.8 per cent parasitism by *M. tenthredinis* and 0.2 per cent by *B. harveyi*.

Table 11. Number of naturally emerging parasites trapped in two square foot cages.

	No. Cages	Larch sawfly adults	Parasites *M. tenthredinis*	*B. harveyi*
Railroad Bog	6	53	4	1
Crutwell Bog	3	76	3	0

The amount of parasitism in cocoons collected from different sites shows a slight concentration in Class A and practically no parasitism in class D. The low level of parasitism among cocoons collected from class D might be associated with the water-saturated condition of the soil.

Elaterid larval predation was a fairly important component of the control complex of larch sawfly cocoons. The species responsible for this predation are not known. During the summer of 1951, elaterid larvae were collected whenever possible and sent to Mr. R. Y. Zacharuck of the Entomological Laboratory at Saskatoon. He tentatively identified the following species from the collections made from tamarack bogs:

	No. specimens
Ludius triundulatus	5
L. nitidulus	2
L. propola propola	2
L. kendalli	1
L. resplendens aerarius	1
Hanus decoratus	2
Ampedus sp.	1

These species were all collected in situations where larch sawfly cocoons were present. It is probable that the majority of these species do not attack cocoons but the larvae of at least one have been observed feeding on larch sawfly larvae in cocoons. The larvae are being reared for positive identification and to obtain information on their feeding habits.

Drowning of the larvae in the cocoons was responsible for an appreciable amount of mortality only on site class D. Some mortality from this cause was found on other site classes, but, at least during the winter of 1950-51, did not destroy many cocoons. Cumulative figures on the mortality caused by this factor are unreliable because a cocoon destroyed by high water levels dries out after the water subsides and is indistinguishable from cocoons dying of other factors.

Fungi in the soil were not found to be a major control factor among larch sawfly cocoons. Even in wet situations few cocoons were found killed by this agency.

2. Adult Stage

(a) Natural Emergence Pattern in 1951.

The summer of 1951 was unusual in its effect on larch sawfly emergence. Normally, adults are present as late as the first week of September. Observations at Prince Albert indicated a striking absence of adults after the beginning of August. This was not merely a local phenomenon; Insect Rangers J. Lawrence and B. McLeod observed the same condition throughout the Western District of Saskatchewan.

Detailed information on the seasonal distribution of adult emergence in the Railroad and Crutwell Bogs was obtained by recording at regular intervals the number of adults in cages placed to trap the newly emerged adults. Each of these open-bottomed cages trapped the adults coming to the surface of a two square foot area of moss (Figure 2). Six cages were placed under tamarack in the Railroad Bog; three on site class A, one on site class B, and two on site class D. Three cages were placed in the Crutwell Bog in a stand of tamarack of site class B with a density of 1800 to 2000 stems per acre adjacent to Thinning Plot 1 (see section VI of this Report).

The emergence records for each bog are summarized in Table 12. Figure 2 shows the daily emergence of adults as a percentage of the total emergence for each bog. A comparison of the total emergence per cage on different site classes is given in Table 13.

Discussion: The emergence data show a difference of three weeks between the date of first emergence of adults in the Crutwell and Railroad Bogs. The explanation for this difference probably lies in the difference in the soil moisture content of the two bogs. The dry soil of the Crutwell Bog would respond more rapidly to increased radiation and air temperature in the spring than the wetter Railroad Bog. After emergence has begun the number of adults emerging daily is probably related to the air temperature and amount of radiation.

The comparison between emergence in cages on different sites was too poorly replicated to give anything more than a general trend. This trend appears similar to that observed in the figures for number of cocoons per sample area taken from different sites.

Further study on the effects of site, stand and temperature on larch sawfly emergence is being planned for the summer of 1952.

Table 12. Natural emergence in screen cages during the summer of 1951.

Date	Railroad Bog Total 6 Cages	Railroad Bog % Total Emergence	Railroad Bog Parasites	Crutwell Bog Total 3 Cages	Crutwell Bog % Total Emergence	Crutwell Bog Parasites
June 8	0	0		15	20.00	
12	0	0		16	21.33	
15	0	0		5	6.67	
19	0	0		4	5.33	
23	0	0		2	2.67	
26	0	0		0	0	
29	3	5.66		0	0	
July 2	18	33.96		-	-	
3	-	-		12	16.00	
4	6	11.32		-	-	
6	5	9.43		3	4.00	
9	2	3.77	1 Mesoleius	-	-	
10	-	-		4	5.33	
11	3	5.66		-	-	
13	5	9.43	2 Mesoleius	3	4.0	2 Mesoleius
16	1	1.89	1 Mesoleius	-	-	
18	2	3.77		2	2.67	
21	0	0		-	-	
23	2	3.77		4	5.33	
25	5	9.43		-	-	
27	1	1.89		5	6.67	1 Mesoleius
29	0	0		0	0	
TOTAL:	53	99.98	4 Mesoleius	75	100%	3 Mesoleius

Table 13. Comparison of total adult emergence per two square foot cage on different site types (see Table 7).

Location	Site Type	No. Cages	Adults per Cage
Crutwell Bog	B (dry)	3	25
Railroad Bog	A	3	13.3
	B	1	12
	D	2	0.5
	All sites	6	8.8

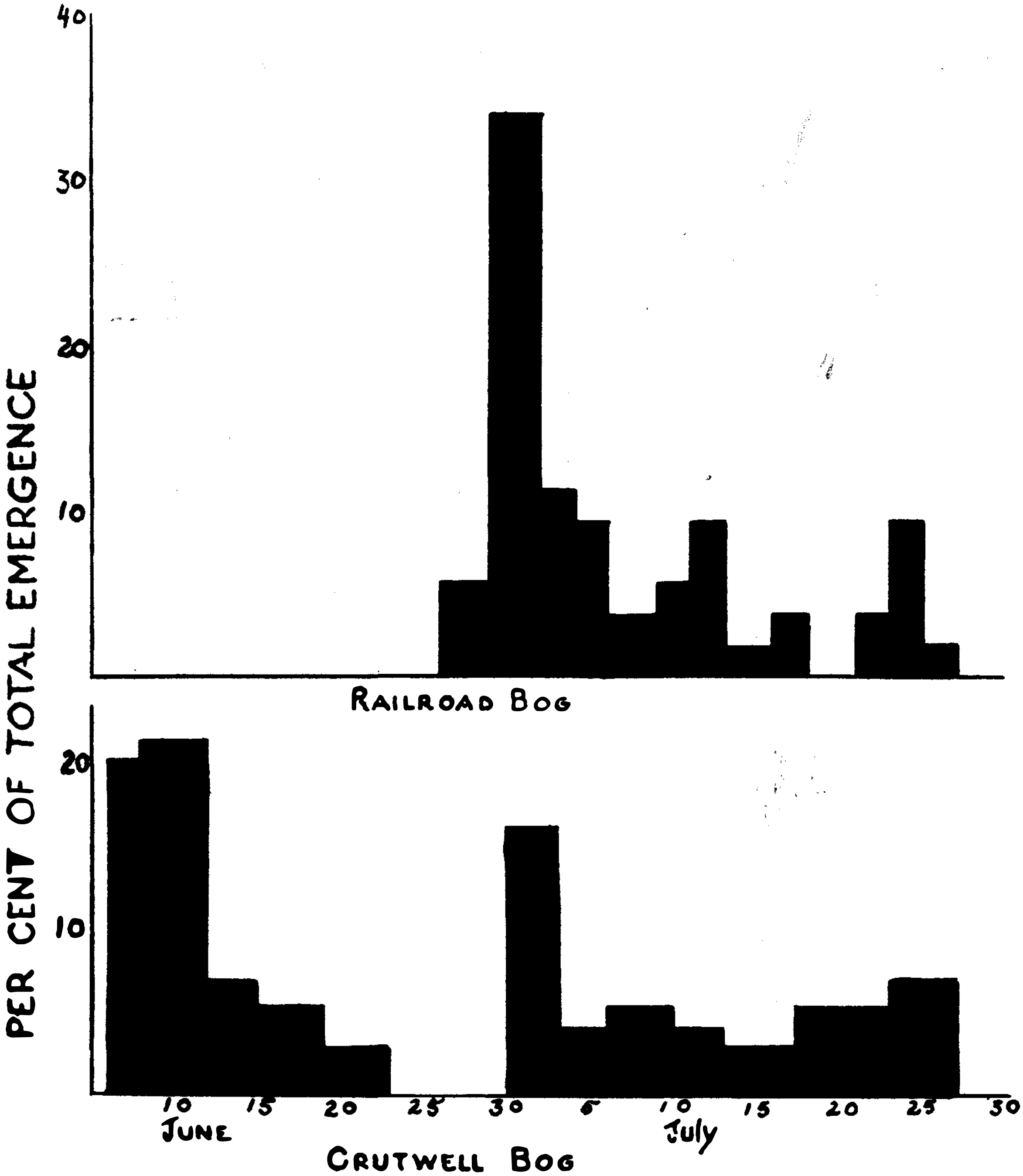


Figure 3. Emergence of larch sawfly adults during the summer of 1951 at two bogs near Prince Albert.

Figure 2. Cage used to trap larch sawfly adults emerging from undisturbed areas. Surface area covered by cage is two square feet.

(b) Effect of Cocoon Depth and Soil Temperature on Adult Emergence.

This experiment was designed to compare the time and amount of adult emergence from cocoons planted at three depths below the ground surface; one inch, three inches, and five inches, under conditions as close to natural as possible. These three depths were chosen to enable the data to be compared with emergence from undisturbed areas. This could be done because in the bog in which this work was conducted the bulk of the cocoons were located, in undisturbed moss, between three-quarters of an inch and three inches below the surface. Three replicates of 200 cocoons each were used for each depth. The cocoons used in the experiment were collected in the Railroad Bog about May 15, 1951, and immediately placed in the moss of one of the experimental cages. At the time the cocoons were collected post-diapause development had not begun; the larvae were in the pronymph stage. The experiment was set up in the Railroad Bog, on site class A. The ground cover was mosses and labrador tea.

The experiment was set up in the following manner.

Nine locations were picked with regard to these qualifications: (1) typical of the general area in ground cover, (2) the water level more than six inches below the ground surface in the spring, and (3) larch sawfly cocoons absent from the moss. At each chosen location a 17 inch square was marked on the surface. The moss within this square was removed in one piece to a depth of six inches. The hole was lined with a screen wire basket with the sides projecting two inches above the surface. The block of moss that had been removed was then dissected horizontally at a desired distance below the surface level. The lower section of moss was then replaced in the hole, 200 cocoons were scattered over the surface, and the upper section of moss gently laid over the cocoons. A screen cage was placed over the area and attached to the projecting edges of the screen basket. Figure 4 shows the cage in position.

Figure 4. Cages used to trap larch sawfly adults emerging from cocoons planted att different depths beneath the surface.

The cage trapped all the adults after they reached the ground surface. The cages were examined thrice weekly throughout the summer and the adults and parasites removed. The records of adult emergence are given in Table 14. These data were analyzed to see if the differences in time of emergence, length of emergence period, and total number of adults emerging at the three depths were significant. The only significant differences found were for the time of emergence. The comparisons were made by analysis of variance for three aspects of the time of emergence, the date of first emergence, the date of 50 per cent emergence, and the date of 100 per cent emergence. The differences between the dates of first emergence for the three depths were highly significant (to the one per cent level) with an error of 5.8 per cent. The other analyses did not show significant differences.

Table 14. Number of adults emerging from cocoons planted at 3 different depths below the ground surface.

Depth	1"				3"				5"			
Replicate	3	6	9	Total	2	5	8	Total	1	4	7	Total
Date												
June 11	0	1		1								
15	3	2		5								
18	0	4		4								
22	0	2		2								
27	0	5		5								
29	1	9		10		3		3				
July 2	4	9*	2	15	1	5	1	7				
4	1	5	2	8	0	5	2	7				
6	5	2	5	12	1	4	0	5				
9	5	3	2	10	1	2	0	3				
11	3	2	1	6	1	2	2	5	0			
13	2	4	2	8	0	4	2	6	0	2		2
16	3	2	5*	10	0	4	3	7	0	3		3
18	9*	3	5	17	1	7	8	16	1	0		1
21	7	1	2	10	2	2*	2*	6	0	0		0
23	12	1	4	17	0	9	6	15	0	2		2
25	9	1	1	11	3	10	7	20	1	4*	2	7
27	2	1	2	5	2*	9	2	13	2	4	0	6
31	0	0	3	3	10	10	5	25	0	2	3	5
Aug. 2	0		4	4	2	1	2	5	0	1	5*	6
4			0	0	1	0	1	2	0	0	2	2
6			2	2	1	0	1	2	2	0	1	3
8						0		0	2*	1	0	3
10						1		1	3	2	4	9
14									2		0	2
16									1		0	1
18									1		1	2
20											0	0
22											0	0
24											0	0
27											1	1
29											0	0
31											1	1
Sept. 3											0	0
5											1	1
TOTAL:	66	57	42	165	26	78	44	148	15	21	21	57
Duration of Em. (days)	42	46	35		35	42	35		31	29	42	

* 50% emergence up to this date.

The daily emergence at each depth was plotted as a percentage of the total emergence (Figure 5). The resulting emergence pattern for the three inch depth closely approximates the natural emergence pattern for the Railroad Bog (Figure 2).

After September 15, the cages were removed and the cocoons recovered from the moss. Examination of these cocoons gave data on the mortality that had occurred during the summer, and a check on the recovery of adults and parasites in the cages. The records are given in Table 15.

When the number of cocoons from which adults have emerged was compared with the number of adults taken in the cages a marked difference was noted. Based on the number of cocoons from which adults had emerged, only 38.8 per cent of the adults were recovered from the five inch depth, 64.1 per cent from the three inch depth, and 81.8 per cent from the one inch depth. The percentage recovery for each cage was calculated and the figures were subjected to an analysis of variance to determine whether the differences between recovery of adults at the three depths were significant. The differences were significant to the five per cent level. The differences in the recovery of adults from the different depths suggest that mortality occurs between the time of emergence from the cocoon and the time the adult reaches the ground surface. A suggested explanation can be based on the hypothesis that in natural situations the adult does not force its way to the surface at random but follows the path of least resistance, probably the path used by the larva to reach the cocooning site. When cocoons are moved from their natural location they may be unable to reach the surface unless the moss is porous. In the experimental area the moss was tightly packed and without definite structure below the three inch depth. Mesoleius tenthredinis, the principal parasite recovered, was apparently less affected by the density of the moss.

The mortality factors listed in Table 15 did not show any significant differences in their affect on cocoons at the three different depths.

The date of the appearance of the first adult emergence appears to be directly associated with the temperature of the soil at the cocoon depth. The soil temperature at the cocoon depth of each cage was recorded once a week at two times of the day, between 0830 and 0930 hours and between

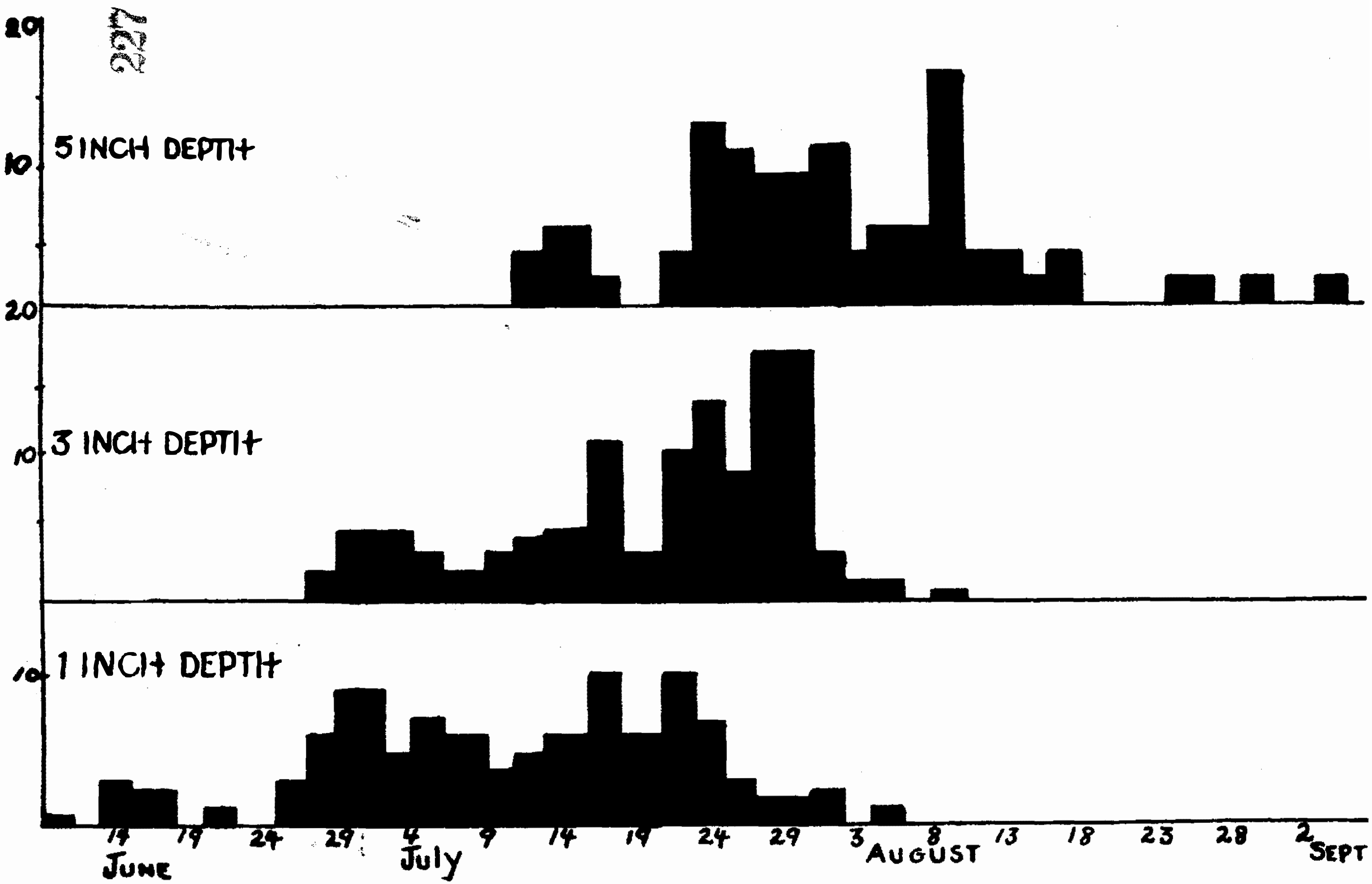


Figure 5. Emergence of larch sawfly adults from cocoons planted at different depths in the Railroad Bog, Prince Albert.

Table 15. Condition of cocoons planted at various depths after emergence of the adults.

Depth	No.	Adults Emerged	Parasites Emerged	Larvae Alive	Mouldy	Water-logged	Elaterid Predation	Cocoons Crushed	Misc. Dead	% Mortality (except Parasites)
		No. of cocoons								
1"	3	90	18	23	28	10	4	10	17	34.5
	6	67	8	77	7	7	10	5	19	24.0
	9	50	10	46	8	29	32	4	21	47.0
Total		207	36	146	43	46	46	19	57	35.2
3"	2	72	21	44	13	19	8	2	21	31.5
	5	87	19	32	15	17	8	6	16	31.0
	8	66	14	66	21	14	5	4	10	27.0
Total		225	54	142	49	50	21	12	47	29.8
5"	1	69	8	52	10	6	2	20	33	35.5
	4	47	8	83	17	28	4	2	11	31.0
	7	42	9	64	20	25	3	9	28	42.5
Total		158	25	199	47	59	9	31	72	36.33

1530 and 1630 hours. MST Three temperatures were recorded for each cage, all from the same depth but located on three sides of the cage. The average soil temperature for each of the three depths was calculated by averaging the nine records for that depth. The average temperatures for each depth were plotted against date to show the relation of soil temperature to the average date of first adult emergence at each depth (Figure 4). Using the average temperatures for each cage, similar temperature curves were drawn to show the soil temperatures and date of first emergence for each cage individually (Figure 5 A-C).

These figures show that the larch sawfly can successfully complete its post-diapause development at temperatures below 50°F. At the one and three inch depths, where radiant heating has a pronounced effect, first emergence occurred in cages where the soil temperatures were relatively higher in the morning than in those where intense radiant heating caused the afternoon temperatures to be higher.

The soil temperature curves suggest that the rate of post-diapause development in larch sawfly larvae is associated with temperature. The breaking of diapause, however, does not appear to be entirely governed by this factor. Although a certain minimum temperature is probably necessary to break diapause, the fact that the total number of adults emerging and the number of larvae remaining in diapause at the end of the summer were not significantly different at the three depths, despite the difference in temperature, indicates that spring and summer temperatures do not control the breaking of larval diapause. Therefore the controlling factor is probably either genetic or some environmental effect on the pre-diapause larvae.

(c) Adult Fecundity and Longevity.

The following observations were made to obtain preliminary information on the length of adult life and the number of eggs laid by larch sawfly females.

Five cages with dimensions of 5 x 2 x 2 feet were constructed. The top and sides of these cages were screened and the bottom was closed by a cloth sleeve. A smaller cloth sleeve was set in one side of the cage. Each cage was placed over a single tamarack seedling and the bottom sleeve tied firmly. Figure 8 shows a cage in position covering tamarack seedling.

A single newly-emerged female larch sawfly adult was put in each cage and left there until it died. The number of days it lived and the number of eggs found on terminal

Figure 6. Temperature of the moss in the Railroad Bog at different depths with the date of first adult emergence from cocoons placed at these depths.

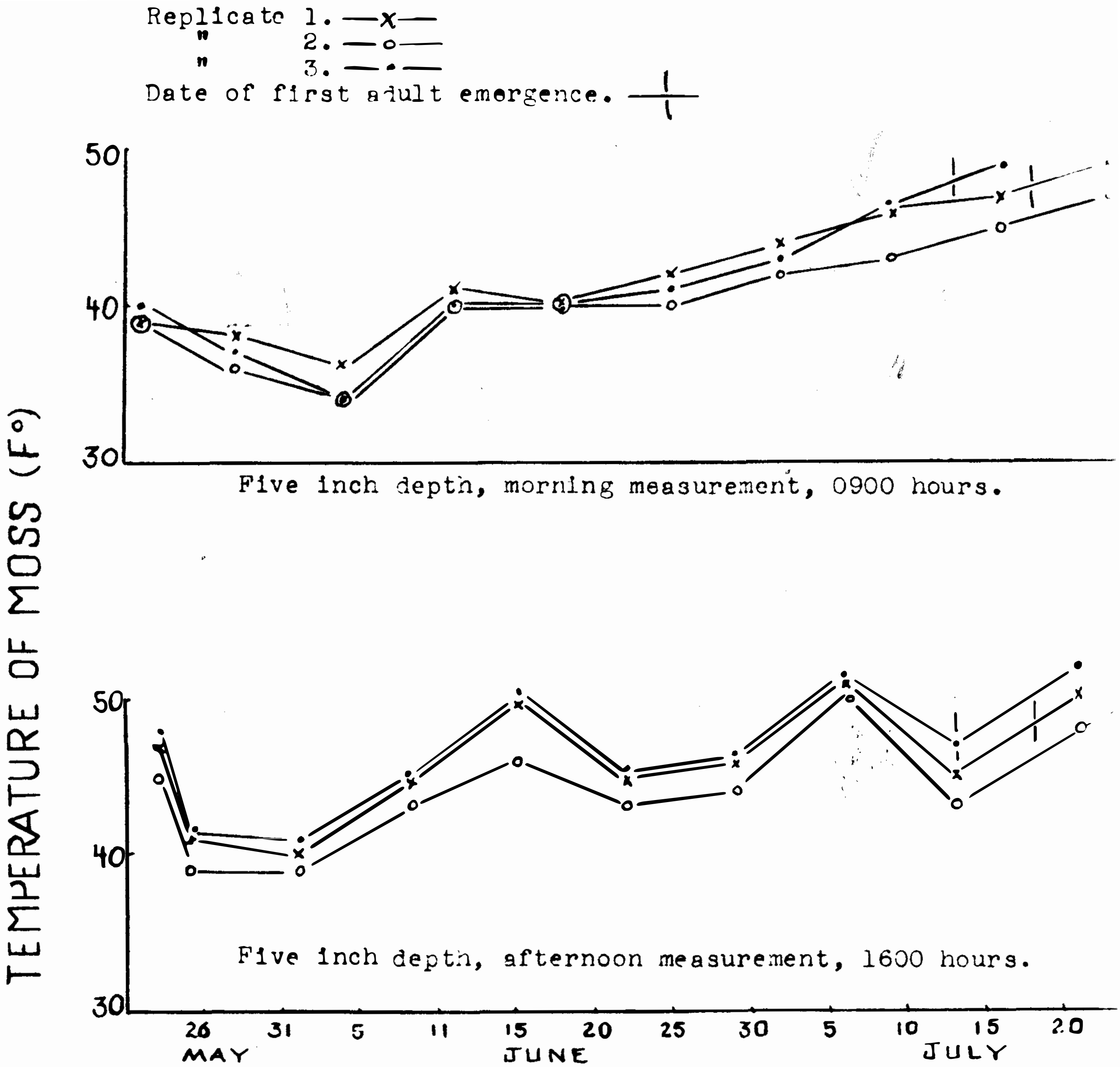


Figure 7. Comparison of the temperatures in three replicates of each depth below the moss surface. The date of first adult emergence in each replicate is shown on the temperature curve.

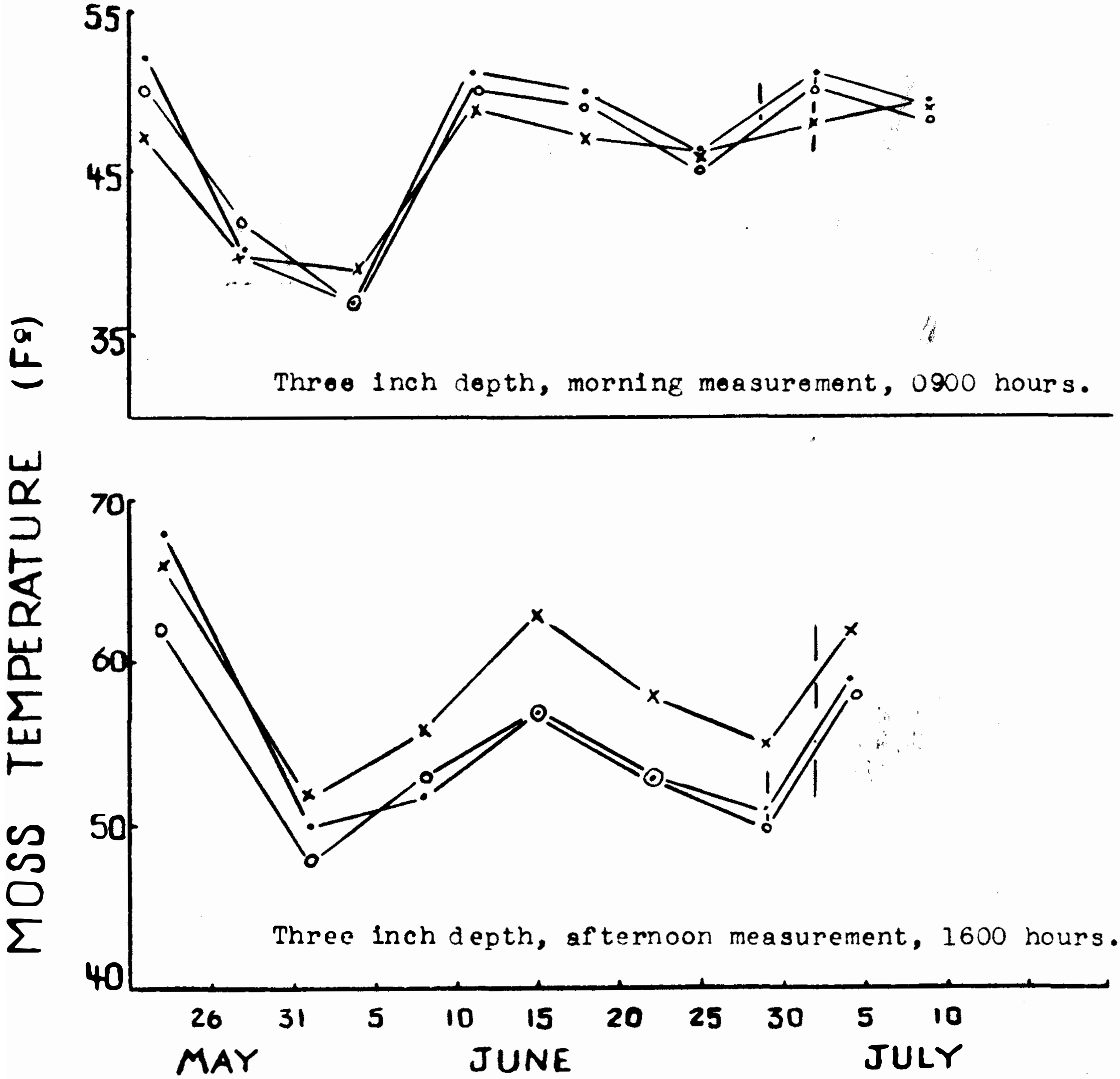


Figure 7. cont.

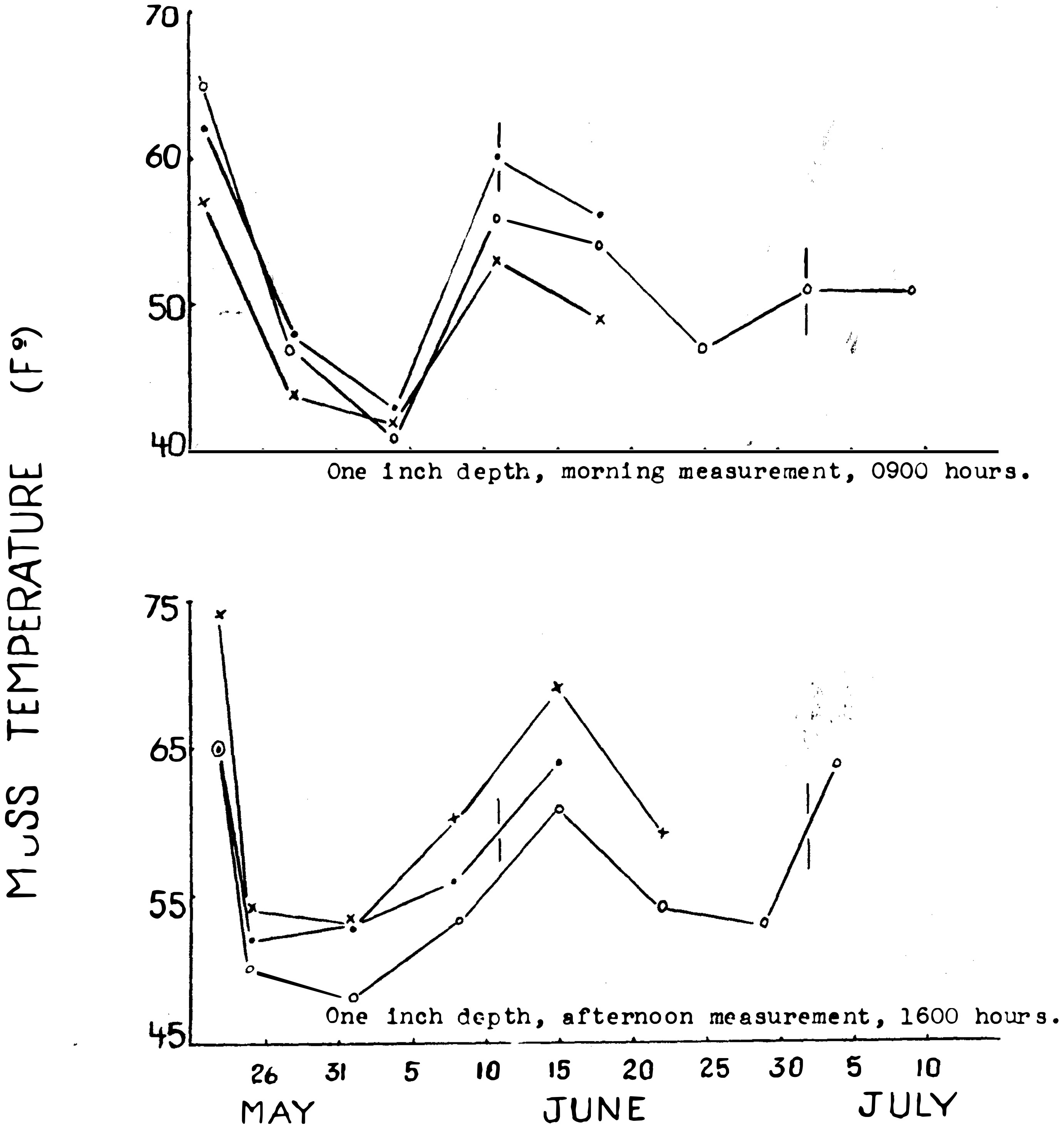


Figure 7. cont.

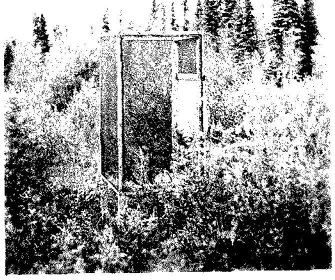


Figure 8. Cage used in adult fecundity study.

shoots in the cage were recorded. The egg clusters were removed after the death of the adult and another newly-emerged adult placed in the cage. Records of the life span and the number of eggs laid by 17 females were accumulated between June 2[illegible] and August 1 in the summer of 1951. These records are summarized in Table 16.

The location of the cages was such that they were exposed to direct sunlight for most of the day. The screen probably cut down the air movement around the caged tamarack and increased the air temperature and humidity. It is possible that these conditions shortened the lives of the adults and reduced the number of eggs laid but it is interesting to note that the average number of eggs per female closely approximates the figure given by [illegible] (Proc. Ent. Soc. 1951).

The limited number of observations of this experiment restrict the range of any mathematical treatment but the statistics that are presented have some meaning in discussing this subject. For example, the high correlation co-efficient, 0.[illegible], that was calculated for the relation of the number of eggs produced to the length of adult life is certainly of some significance. The differences in the life span and egg production of adults emerging at different times during the summer appear to be significant and further investigation into the causes of these differences might be of value.

If further work along these lines is planned the procedure might be modified by providing larger cages, so that there would be less difference between the environment in the cage and outside, and determining the life span and fecundity of adults under various controlled conditions.

Table 16. Fecundity and longevity of caged larch sawfly adults in the Railroa Bog.

Date Emerged	No. Adults	No. of Clusters Laid	Clusters-Adult	No. of Eggs Laid	Eggs-Adult	Aver. Life Span
June 29	2	5	2.5	79	38.5	5.0
July 1	3	8	2.7	151	50.3	4.7
" 5	2	10	5.0	137	68.5	6.5
" 10	2	9	4.5	134	67.0	6.5
" 17	2	8	4.0	147	73.5	8.0
" 22	2	5	2.5	114	57.0	4.0
Aug. 1	4	12	3.0	152	38.0	3.0
Total	17	57	3.4	914	53.8	5.2
Standard Deviation	--	--	1.97	--	24.26	2.26
Co-efficient of variability	--	--	57.9	--	45.1	43.5

3. Egg Stage

(a) Oviposition.

The first egg clusters in the Railroad Bog in 1951 were observed June 27. On that date only 25 egg clusters could be found in one hour of searching. At weekly intervals from July 5 to 25 a collection of 50 egg clus ers was made from the Railroad Bog to determine the number of eggs per cluster throughout the season. On August 2 only six egg clusters could be found in one hour of searching and no eggs were located after this date. Each weekly sample of egg clusters was examined closely and the number of eggs and the length of the growing shoot on which the eggs were deposited was recorded. These records are summarized in Table 17.

Table 17. Collections of larch sawfly eggs.

Date	No. of Clusters	Total Eggs	No. Eggs per Cluster	Average Terminal Length (mm.)
June 27	25	284	11.4	22.0
July 5	50	917	18.3	28.9
" 11	50	866	17.3	29.0
" 19	50	930	18.6	33.7
" 25	47	1066	22.7	36.9
Aug. 2	6	158	24.7	44.8

A correlation co-efficient of 0.959 was calculated for the relation of the number of eggs per cluster to the average length of the terminal shoot on different dates.

Changes in the amount of oviposition through the season were recorded by observing thrice weekly the number of new egg clusters appearing on the terminal shoots of five tamarack seedlings in the Railroad Bog. The total number of shoots on these five trees was 326, of which 126, or 38.6 per cent, had eggs laid on them during 1951.

When these observations were begun it was found that it was not possible to locate egg clusters as soon as t ey were laid without spending an impractical amount of time and labour. Therefore, the clusters were recorded when the tip on which they were laid began to curl in the characteristic manner. The time at which this curling begins occurs within a few days after the eggs are laid.

Each cluster was given a numbered tag after the number of eggs and the length of the shoot had been recorded. These data are summarized by dates in Table 18. Figure 6 illustrates the curves of seasonal activity in oviposition by plotting the data as percentages of the total number of eggs and clusters against date. These oviposition curves closely approximate the shape of the natural adult emergence curve for the Railroad Bog (Figure 2) if allowance is made for the lag in observing the egg clusters and the possibility of a preoviposition period.

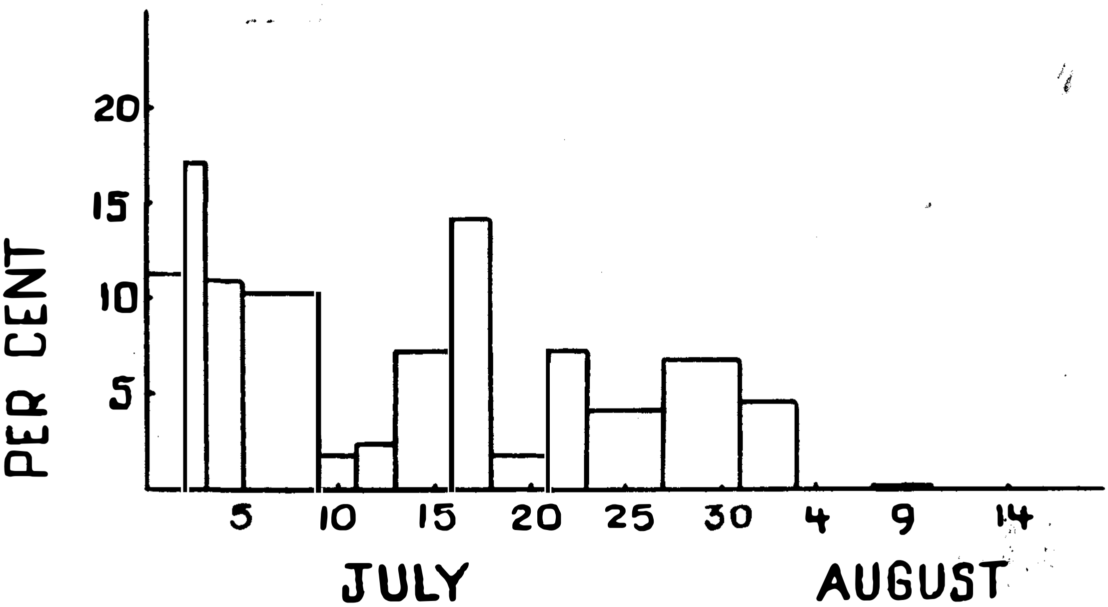


Figure 9. Number of eggs observed on sample trees in the Railroad Bog during the summer of 1951 plotted as percentages of the total number of eggs observed.

Table 18. The number of eggs and egg clusters deposited on tagged terminal shoots during the summer of 1951.

Date	Egg Clusters	Eggs	Eggs per Cluster	Average Terminal Length (mm.)
until July 2	14	231	16.5	28.4
" 3	21	348	16.6	29.7
" 5	16	222	13.9	29.9
" 9	12	209	17.4	41.7
" 11	2	37	18.5	28.5
" 13	3	46	15.3	35.3
" 16	10	150	13.6	27.4
" 18	16	288	18.0	29.4
" 21	1	33	33.0	43.0
" 23	9	148	16.4	36.6
" 27	4	86	21.5	32.0
" 31	9	139	15.4	28.8
Aug. 3	4	91	22.8	39.3
" 7	0	0	0	0
" 10	2	8	4.0	35.0
" 14	0	0	0	0
Total	123	2036	16.6	31.0

The data on number of eggs per cluster and shoot length were analyzed for correlative tendencies. On the basis of 121 individual measurements the co-efficient of correlation was 0.454, considerably less than the co-efficient of 0.959 that was calculated for grouped data of this type. It therefore appears that the relation between shoot length and number of eggs per cluster varies considerably.

(b) Natural Control.

The egg clusters that were tagged to delimit the seasonal distribution of oviposition in the Railroad Bog were kept under observation to determine the date of hatching. The eggs were examined thrice weekly until hatching occurred, thus the date and number of larvae successfully hatching were recorded. An attempt was made to determine the causes of mortality among the eggs but the only one that could be definitely recognized was Mirid predation. Several species of the family Miridae were observed to feed on larch sawfly eggs. A collection of these bugs has been sent to the Systematics Unit or determination. Table 19 shows the amount of mortality that was observed among eggs in the Railroad Bog during the summer of 1951.

Table 19. Egg mortality by date observed.

Date	No. Eggs Laid	No. Hatch	Per cent Total Mortality	Per cent Mirid Predatorized	No. Clusters
July					
2-3	550	319	42.0	10.4	30
" 5	229	182	20.5	0	16
" 9	209	125	40.2	0	13
" 11	24	15	37.5	0	1
" 13	36	13	63.9	16.7	3
" 16	150	53	64.7	14.7	10
" 18	291	157	46.0	10.0	16
" 21	33	10	69.7	0	1
" 23	148	60	59.5	0	9
" 27	86	44	48.8	0	4
" 31	139	41	70.5	5.8	9
Aug.3	91	27	70.3	0	4
" 10	8	0	100.	0	2
Total	1956	1046	46.5	6.2	118

4. Larval Stage

(a) Hatching of the Eggs.

The seasonal distribution of the hatching of larvae from the egg clusters tagged in Section C.3 is shown in Table 20. These figures were obtained by examination of the egg clusters at thrice weekly intervals. Hatching occurred in 89 of the 123 egg clusters under observation.

Table 20. Hatching of larvae in egg clusters at the Railroad Bog.

Date	No. Clusters Hatched	No. Larvae Hatched	Larvae/ Cluster	Date	No. Clusters Hatched	No. Larvae Hatched	Larvae/ Cluster
July				July			
" 11	12	150	12.5	" 23	9	81	9
" 13	11	99	9	" 27	10	123	12.3
" 16	15	276	18.4	"31	22	204	9.27
" 18	2	22	11	Aug.3	3	24	8
" 21	4	53	13.25	" 7	1	3	3
				Total	89	1035	11.63

The amount of hatching on each date was plotted as a percentage of the total hatch to give a seasonal distribution curve (Figure 10) which could be compared to similar curves for adult emergence and time of oviposition. The similarity of form of the adult emergence and oviposition patterns has already been mentioned. The pattern of hatching resembles the other curves in its bimodal distribution but lacks the tail that follows the peaks of the other curves.

(b) Larval Development.

The investigation of larval development in the field raised the problem of sampling the larval population without disturbing the natural conditions. Information on the instar composition of the larval population throughout the summer in definite areas was desired. The frass collection method seemed most useful for this purpose.

In the summer of 1951 an experiment was designed to obtain information on the best way of collecting frass from the larval population of a single tree and handling frass to obtain the instar comp sition of the population. The distribution of frass drop beneath the tree was investigated by setting out series of wood and cotton frass collecting trays in each of the cardinal directions from the trunk of the tree. Each series of trays was 7'5" x 1'6" and was divided into five collecting trays, each with an area of two square feet. Figure 11 shows the series of trays beneath a tamarack tree.

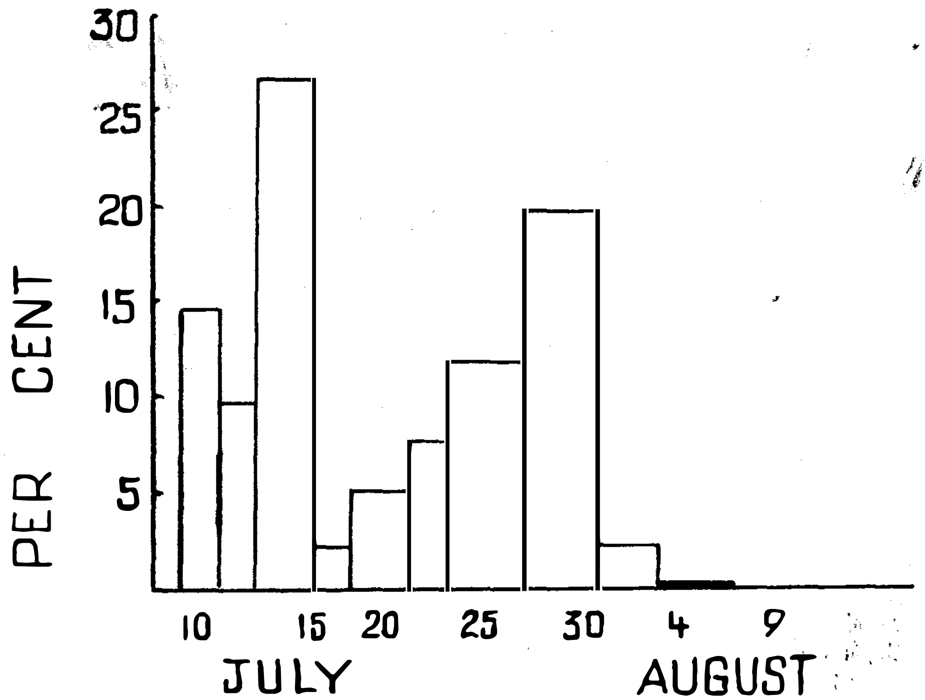


Figure 10. Number of larvae hatching on sample trees in the Railroad Bog during the summer of 1951 plotted as percentages of the total number of larvae hatching.

The sampling experiment was replicated three times, four series of trays were placed under each of three tamarack trees. The trees were selected in the railroad bog for uniformity of crown. The trays were set out about August 1st and left until mid-September. The frass in each tray was collected with an aspirator as shown in Figure 12 at weekly intervals and placed in small labelled tins.

It was planned that the volume of frass collected in each tray would be used in calculations designed to discover any differences in the distribution of frass in regard to cardinal direction and distance from the trunk of the tree. The same samples were to have been used in testing a method of separating frass samples into instar groups by passing the sample through a bank of sieves. A number of U.S. Bureau of Standards sieves were obtained and a suitable combination of meshes set up. Unfortunately one mesh size was not available and had not been delivered as of April 1, 1952. Therefore analysis of the frass has been delayed and will not be attempted until the winter of 1952-53. A report on the results will be made in the 1952 Annual Technical Report.

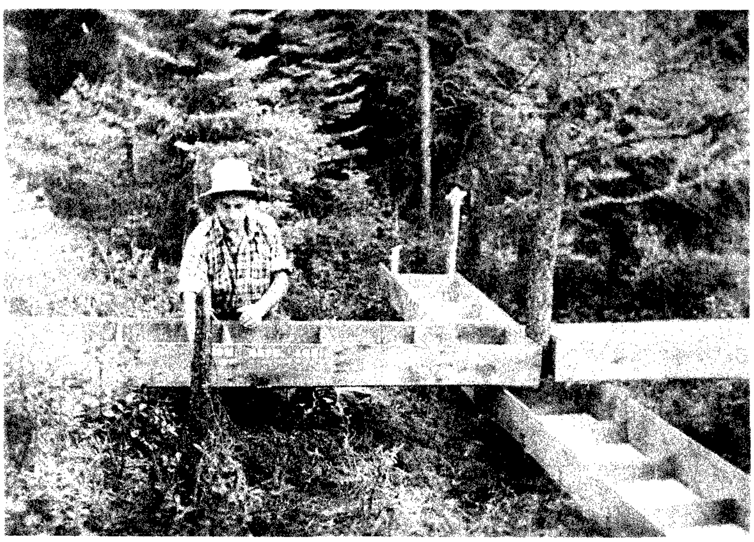


Figure 11. Series of frass trays.

Figure 12. Collecting frass from trays with an aspirator.

(c) Natural Control.

Records were kept on the survival of larvae that hatched from the tagged egg clusters in the Railroad Bog for the first five days after hatching. These records are summarized in Table 21. The factors responsible for this mortality remained unknown. An orb weaver spider, *Neoscona arabesca* Walckenaer*, was found feeding on a newly hatched sawfly larva but this species probably only occasionally attacks larvae. There was some circumstantial evidence that the Mirids that were found to attack larch sawfly eggs

* Identified by Dr. W. J. Gertsch, American Museum of Natural History.

(Section 3.(b)) also feed on newly hatched larvae.

On August 14 a number of trees in the Railroad and Crutwell Bogs were beaten, and the larvae, both dead and alive, were counted. At the Railroad Bog 13 trees yielded 423 larvae, 18.7 per cent of which were dead, but only a very few from disease. At the Crutwell Bog 6 trees yielded 173 larvae, 64.2 per cent of which were dead, nearly all from disease. Despite the prevalence of disease in the Crutwell Bog and its near absence in the Railroad Bog, more larvae completed development and cocooned in the Crutwell Bog.

Table 21. Mortality of larvae during the first five days after hatching.

Date Hatch	Total Larvae Hatched	Per cent Mortality
July 9	3	0
" 11	147	10.9
" 13	99	17.2
" 16	205	14.6
" 18	22	13.6
" 21	53	28.3
" 23	81	24.7
" 27	123	17.9
" 31	204	29.4
Aug. 3	24	16.7
Total	961	16.3

5. Diapause

Larvae of the larch sawfly generally remain in diapause in the cocoon for only a single winter. A certain number, however, do not emerge at this time but remain in diapause for a second winter or perhaps longer. The number of years that larch sawfly larvae remain in diapause is unknown. On the basis of laboratory rearings at the Forest Insect Laboratory, Winnipeg, it appears that the number of larvae remaining in diapause after all emergence is completed differs from year to year in the same bog.

In 1951 the number of larvae remaining in diapause after adult emergence was completed in the bogs around Prince Albert appeared high. This conclusion was reached when the moss under the natural emergence cages (see Section C.2.(a)) was examined for living cocoons. Table 5. shows the number of larvae in prolonged diapause as a percentage of the sum of the number of emerged adults, emerged parasites, and diapause larvae. The figure given for the Railroad Bog is supported by the percentage of prolonged diapause larvae among cocoons used in the temperature experiment (see Section C.2.(b)) which is also given in Table 22.

Table 22. Prolonged diapause under natural conditions in 1951.

Location	Total Cocoons	Per cent in Diapause, Sept. 1951
Crutwell Bog	142	57.0
Railroad Bog		
(a) Natural emergence	95	38.9
(b) Temperature exp.	1192	40.9

The rearing records for cocoons collected from these two bogs in the fall of 1950 were examined and the percentage of larvae remaining in diapause after emergence was over was calculated. The results were 4.6 per cent in prolonged diapause from the Crutwell Bog and 16.7 per cent from the Railroad Bog. No explanation can be offered for these differences.

In 1951 a collection of freshly-formed cocoons was made in attempt to determine the number of years that a larva may remain in diapause under laboratory rearing conditions. Plans are being made to expand this program to include comparisons of degree of prolonged diapause in overwintered cocoons as well as the number of years a larva may remain in diapause and the ultimate survival in both laboratory and field-reared cocoons.

TECHNICAL REPORT 1951
PROJECT NO. NOT ASSIGNED

FOREST ZOOLOGY, WINNIPEG

VII. BIOLOGY OF HYPOMOLYX PICEUS

(in co-operation with Laboratory of Forest Pathology, Saskatoon)

Report by G.L. Warren
Field Work by G.L. Warren and R. Whitney (Saskatoon)

VIII BIOLOGY OF HYPOMOLYX PICEUS (De G.)

A. Introduction

B. Life History

1. Methods

(a) Larval Rearing

(i) Artificial Media

(ii) Transferring larvae.
1st -
2nd -
3rd -
4th -
5th -

(iii) Rearing in open containers

(b) Pupal Rearings

(c) Adult Rearings

(d) Egg Rearings

2. Life History Data

C. Description, Occurrence and Habits of *H. piceus*

1. The Egg

(a) Description

(b) Occurrence

2. The Larva

(a) Description

(b) Occurrence

(c) Habits

3. The Pupa

(a) Description

(b) Occurrence

(c) Habits

VIII BIOLOGY OF HYPOMOLYX PICEUS DE G. (Curculionidae)

A. Introduction

Recently the larvae of a curculionid beetle were found boring in the roots of white spruce, *Picea glauca* (Moench) Voss. This discovery was made by the staff of the Forest Pathology Laboratory, Saskatoon, while they were studying root-rot in Northern Saskatchewan and Manitoba, during the summer of 1949. Because it was felt that a relationship exists between the damage caused by the insect and root-rot in its hosts, a co-operative project was initiated. This study was undertaken at the Riding Mountain National Park in the spring of 1951. It was intended that the biology of the insect be primarily the responsibility of the Forest Zoology Unit, Winnipeg, and that of its relation to root-rots be studied by the Pathology Laboratory. Consequently this report will be confined to such subjects as life history and habits of the insect, nature and extent of the resulting damage, factors influencing the incidence of the insect and sampling techniques.

At first the insect was tentatively identified as *Hypomolyx* sp. and has subsequently been determined, by the Systematic Division at Ottawa, as *Hypomolyx piceus* (De G.) The identification was established on adults that were reared from pupae collected from the field. Although no rearings from egg to adult have been successfully completed, pupae have been reared from larvae and adults from pupae. Comparisons made with similar stages collected from the roots of white spruce make the identification quite reliable.

B. Life History

The detailed life history is still unknown. This is due, partly, to low populations and the habits of the insect and partly because no success has, as yet, been achieved in artificially rearing larval forms. All stages in the life cycle have been collected in the field by critical examination of the root system of white spruce after the trees were excavated.

1 Methods

Certain methods have been attempted in rearing all stages of the insect, some of them appear successful. However, no control of humidity or temperature conditions was available in the field during the past season, and it is felt that these two factors may be very important, especially in the larval stages of *H. piceus*.

(a) Larval Rearing

Two methods of rearing were tried. The methods were not very successful as they were not adaptable to field conditions or not suitable for frequent observation of the specimens.

(i) Artificial media. Following the system used by Beck and Stauffer (1950), artificial medium was prepared and poured in test-tube slants. Various instars were introduced into the slants, but did not live long enough to change into a succeeding instar, with one exception. One last instar larva pupated. However the pupa died. Contamination by bacteria and moulds was prevalent in the test tubes. This factor, plus excessive condensation and no means of controlling the temperature, may have been responsible for the lack of survival. The one pupa made it possible to identify pupae of H. piceus in the field which in turn was responsible for the accurate association of the larvae and adults in the determination of the species.

(ii) Transferring larvae. This method arose as an indirect result of experiment to ascertain the incidence of H. Piceus to root-rot in white spruce. It involves transferring larvae secured from unknown positions in roots to ones which have been made accessible and are, therefore, known. Its uses for rearing larvae are limited because no direct observation of the specimens is readily possible without again digging them from under the bark. Obviously this enhances the possibility of losses of specimens due to mechanical injury. These reasons eliminate the use of "transferring" for life history study. However its use may be valuable for the purpose originally intended and a brief description of techniques and results will be recorded.

It was hoped to develop an aseptic technique to exclude the spores of root-rotting fungie from the incisions. The general procedure required surface sterilization, with 1.1000 mercuric chloride, of the portion of the root to be incised. With flamed knife blade an incision was made to the cambium layer larger enough to accommodate the larva and to cause resinosis. A larva was first washed in cold sterile water and placed on the slit and covered. The modifications of this technique were chiefly concerned with the type and method of covering the larva.

1st - Larvae were placed under bark at the side of the slit. Old spruce resin was softened by heat with the intention of sealing in the larva and slit. However, cooling below the point at which the resin would be injurious to the larva caused it to crystalize too rapidly, and it would not stick to the bark of the root.

Larvae became established under this method, but it obviously could not be aseptic. This was verified as mould soon appeared under the resin cover.

2nd - A small quantity of lanolin was added to the resin and the mixture cooked under 15 lbs. pressure for 10 minutes. The resulting mixture stayed sticky on cooling, but was too sticky to manipulate. Furthermore, it did not hold the bark strip about the larva and thus could not be considered aseptic. From six larvae, two established themselves, but four disappeared, and as before, mould appeared under the cover.

3rd - Six more larvae were transferred, using old larval tunnels which were stuck down with Lepage's liquid glue. Two established themselves and the remainder escaped. As before, mould quickly appeared under the cover.

4th - Seven larvae were transferred, using a half peanut shell dipped in orange shellac and dried on a pan over a Coleman burner, the shell being stuck down with "Miracle Adhesive". Two escaped by boring out from under the shell. Four became established but did not survive. One survived. No mould was found under the shells.

5th - In order to obtain a more suitable material to use as a cover, walnut shells were utilized. When the walnuts were halved, the flat sides presented an even surface. This greatly aided the process of cementing them to the root. They were firmer and thus lent themselves to faster manipulation, and provided more room for the larvae. They were dipped in shellac and burned on a plate as with the peanut shells, but since they had a smooth bottom surface, remained stuck to the plate and were sealed down by the burned shellac. This made it possible to take a whole tray into the field in an aseptic condition. The remainder of the procedure was followed as in the previous experiments. Ten larvae (fig.1) were utilized and all but one became established. No mould was found under the shells.

(iii) Rearing in open containers. In 1952 small petri dishes contained in large dessicators under controlled humidity will be used to hold larvae. Crushed bark and cambium cells will be fed.

(b) Pupal Rearings.

Pupae are reared to adults without much difficulty providing they are left in sealed pupal cells. No success was attained in rearing naked pupae. In all cases pupae were kept in jelly jars on moistened cotton, and the whole buried under moist sphagnum moss. Because only pupae which remained in sealed cells were reared it was impossible to obtain the length of the pupal period. In 1952 it is planned to cut off the end of the pupal cell and then to seal it with some transparent material such as "Scotch Tape".

(c) Adult Rearings.

Adults emerge from sealed pupal cells quite readily. They may be held in jelly jars on moist cotton providing terminal tips are made available for food. Captured adults [illegible] oviposit under similar conditions.

(d) Egg Rearings

Eggs collected in the field or deposited by captured adults will hatch on moist cotton or on bark on moist cotton. One egg hatched on Beeks Medium. No success has been achieved in rearing the larvae after hatching.

2. Life History Data

Although details are still obscure, some observations, that appear to portray certain tendencies, have been recorded.

No concrete evidence is available on the incubation period required by the egg, due to extremely artificial and uncontrollable field insectary conditions. However, 15 of the eggs produced by captive adults hatched. The period required for incubation ranged from 22 to 39 days, with an average of 33.2 days per egg (Table 1).

TABLE I.—Oviposition Record from Miscellaneous Adult Collections 1951

Oviposition Date	Hatching Date	No. Days
July 18	Aug. 21	35
July 20	Aug. 20	32
July 21	Aug. 21	32
July 21	Aug. 27	38
July 23	Aug. 27	36
July 23	Aug. 27	36
July 23	Aug. 27	36
July 31	Sept. 7	39
July 31	Sept. 7	39
Aug. 17	Sept. 7	22
Aug. 17	Sept. 7	28
Aug. 17	Sept. 17	32
Aug. 17	Sept. 17	32
Aug. 2	Sept. 7	37
Aug. 9	Sept. 7	30

Average incubation period 33.2 days

Seven eggs were discovered in the field and they required an average of 29 days for hatching, conditions for this period being the same as with the other eggs. Their date of oviposition was unknown, but it is not unreasonable to assume that they required about the same hatching time as the ones produced in captivity. This places the incubation period at about one month. This period can probably be changed, depending on temperature and humidity conditions. The first eggs were discovered in the field on July 3rd and the last on August 17th, indicating that oviposition takes place, at least, from the beginning of July to mid-August.

Collections, made in the field, indicate that the larval stage lasts about one year. From such collections and records shown in Table I first instar larvae hatch in August and September. As shown in Table II, pupation apparently occurs the following July and August, with adults emerging in August or September.

Various larval instars have been taken from the host, at the same seasonal period, from early spring (May 14th) throughout the summer, until late fall (Oct. 16th). Adults have been recovered from the duff and from pupal cells during the same seasonal periods. No pupae have been discovered either in the spring or fall seasons, although last instar larvae (pre pupal stage) have been found as late as October 16th, after the ground had been frozen for a week. These observations suggest that the adults and various stages of the larval form are cold-hardy and that the insect overwinters only in these stages.

The larvae overwinter in the tissues of the host. The choice of hibernation site for the adults is still uncertain. Adults have been taken from pupal cells in early spring, indicating that some may overwinter as immature adults that have remained within their pupal cells. This observation is supported by the fact that no pupae were found in the field before mid-July (Table II) thus eliminating the possibility of the insect overwintering in the pupal stage.

TABLE II - Pupal Collections and Adult Emergences

Date	No. of Trees	No. Pupae	% Pupae to Trees	Date Emergence	No. Adults
May 15-31	61	0	0		
June 1-15	29	0	0		
June 16-30	15	0	0		
July 1-15	35	0	0		
July 16-31	81	8	9.87		
Aug. 1-15	53	12	22.64		
Aug. 16-31	33	8	24.24	Aug.17-29	2
				Sep 1-15	2
				Sep.16-30	12
				Oct. 19	3
Total		28			

3 dead adults (rotted) removed from pupal cells
9 naked pupae inadvertently removed from their pupal cells desiccated or died of disease. 9

28

As shown in the above table, some adults may emerge from pupal cells, feed and hibernate in the duff. However, most of these emergences may have been activated by artificial conditions as it was necessary to carry them on a road trip, during which excessive heat occurred. Nevertheless, it may be normal for some adults (those transformed from early pupae) to emerge, feed and hibernate, while those from later pupae may remain within the pupal cells during the winter months, emerging in the spring. The length of the pupal period is still unknown, but it must be relatively short as indicated by Table II.

The adults apparently live about one year. They are present as immature adults by mid-July, maturing the following summer to oviposit at least by July 1st, and begin to die off by August 1st (Table III) as new adults emerge (Table II).

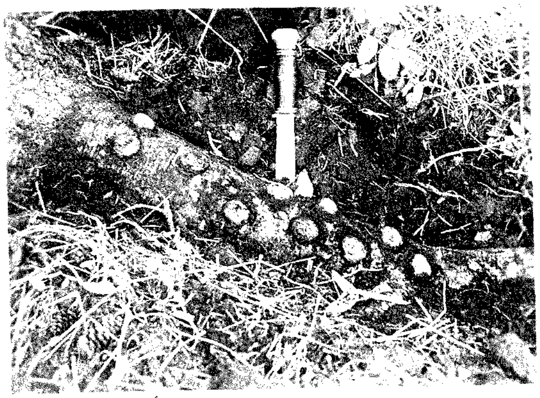


Fig. 1. Walnut shells in larval transfer experiment.

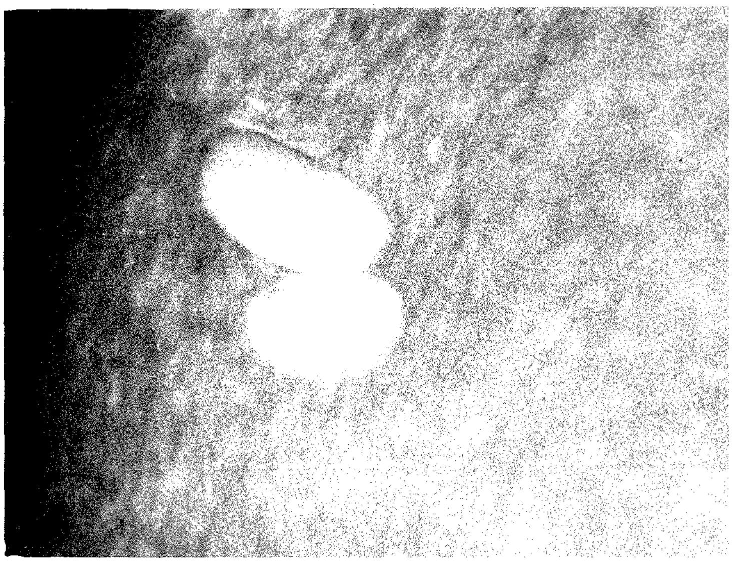


Fig. 2. The egg of [illegible]. *[illegible]iceus* (De[illegible].)

TABLE III - Record of Captured Miscellaneous Adults

Date of Capture	No. of eggs deposited	Remarks
July 4th	6	escaped Aug. 9th
July 18th	7	died Sept. 7th
July 20th	12	died Sept. 27th
July 23rd	none	died Dec. 3rd
July 24th	3	died Sept. 17th
July 27th	none	died Aug. 16th
July 28th	none	died Oct. 19th
July 28th	4	still living Dec. 3rd
July 28th	none(never matured)	died July 31st
July 28th	none	died Oct. 19th
July 31st	none	died Oct. 19th
Aug. 14th	none	died Sept. 7th
	32 eggs	

x - 1 found recently dead in the field on Aug. 3rd
2 " " " " " " Aug. 9th

C - Description, Occurrence and Habits of H. Piceus

Because of the apparent similarity in habits and structure of the larvae of Hypomolyx sp. and Hylobius sp. (Anonymous 1933), an attempt is being made to discover morphological characteristics by which they may be identified in the field. The head and its appendages, spiracles and the body of the larval stage of Hypomolyx piceus have been studied and figured. Recently specimens of the larvae of Hylobius radicis Buch. and Hylobius pales (Hbst) were received from the Smithsonian Institution, Washington, D.C., U.S.A. When these species have been studied and figured a report will be presented.

1 - The Egg

(a) Description.

The egg (fig. 2) is creamy white, large, oval, sometimes slightly indented on one side. The average length is 2.25 m.m.

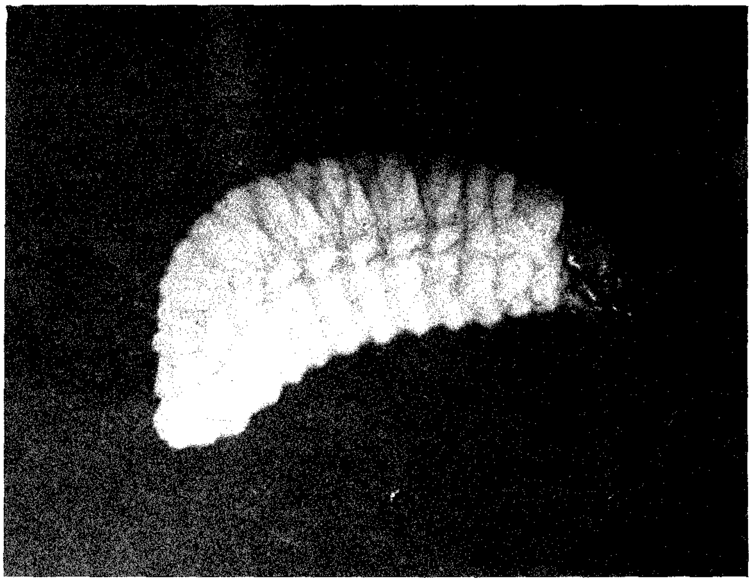


Fig. 3. The larva of H. *piceus* (Ue 2.)

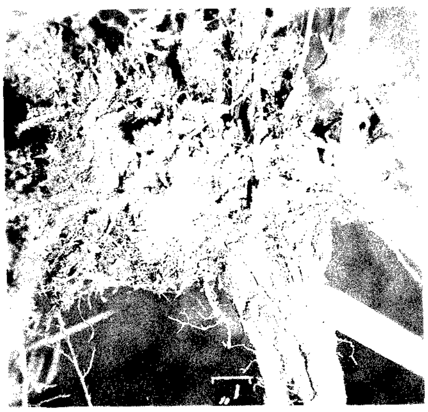


Fig. 4. Boring of larva on root.

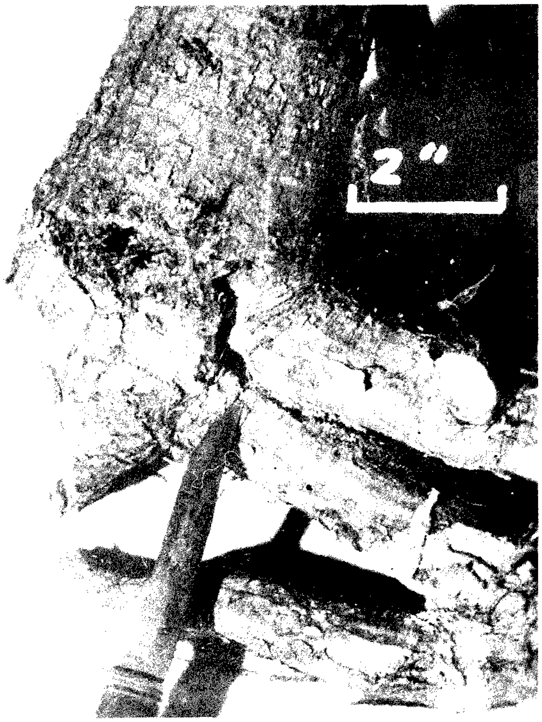


Fig. 5. Larval boring in a root crotch.

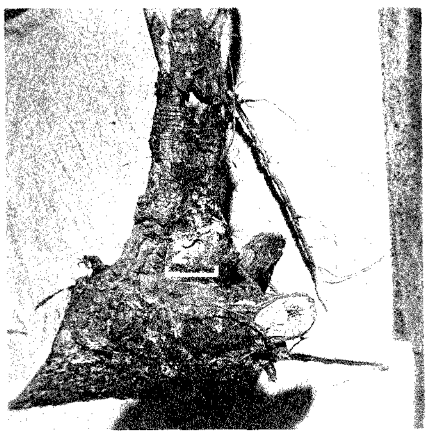


Fig. 6. Root girdling by *H. piceus* (De G.) larvae.

(b) Occurrence.

Eggs are usually found imbedded in a niche or crack in the root-collar or at the base of roots under the duff. They are readily visible to the naked eye except when obscured by dirt.

2 - The Larva

(a) Description.

The mature larva (fig. 3) is from 14-18 m.m. long. It is a somewhat crescent-shaped, creamy-white, legless grub, with an orange-brown head. The body is subcylindrical and most segments show three plicae on the dorsal aspect. The mid-abdominal segments have a greater diameter than the thoracic or caudal segments. Setae are sparse, but fairly long and stiff. Spiracles are conspicuous, annular-biforous, including one thoracic and eight abdominal. One pair of ocelli is present; they are closely applied to the frontal suture in the same plane as the small, one-segmented antennae.

(b) Occurrence.

Larvae are usually found in the bark and along the cambium layer of the root-collar and at the bases of the roots of the host. They may be found further out on roots. Larval tunnels are formed from the resinous exudation of the host.

(c) Habits.

The larval stage of the insect causes the damage to the host. This damage is caused by the boring along the cambium layer. Although larval tunnels may run along the roots indiscriminately, a preference is shown for root crotches at the root bases adjacent to the collar (figs. 4 and 5). This habit causes girdling of roots and root-collars, (fig. 6), when the population of the insect is adequate to circumvent the area attacked. Tunnels are seldom formed on the bottom of the roots in the mineral soil, a preference being shown for those portions surrounded by duff.

In its last instar the larva seals off the tunnel immediately behind and before it, thus forming a cell adequate to accommodate the pupa. This cell may project out into the duff an inch or so away from the host root.

3 - The Pupa

(a) Description

The pupa (fig. 7 A & B) is exarate, from 15 to 17 m.m. long and like the previous two stages, creamy-white in color. It possesses a pair of lateral spine-like tubercles on the last visible abdominal segment.

(b) Occurrence.

The pupal stage is passed in the cell constructed by the last instar larva. As indicated before, it is found on the exterior of the root and may project out from it for an inch or so. The exterior of the cells are covered with dirt and fiber from the duff, which makes them from dark brown to black in color.

(c) Habits.

The pupa is immobile, but on transformation to the adult, emergence is accomplished by chewing an opening in the anterior end of the cell.

4 - The Adult

(a)Description.

The adults (fig. 8) are deep red piceous, robust, elongate-ovate, broadest posterior to the mid-point. The thorax is narrow and thinly clothed with coarse prostrate hairs. The elytra are thickly mottled with small tufts of yellowish hair; striae marked with large, deep, elongate punctures, intervals densely and coarsely granulate-punctate. Tips of elytra just cover the abdomen. Lenth 12-16 m.m. Immature adults distinctly reddish, darkening with age.

(b) Occurrence.

Adults have been collected from the duff about the roots of white spruce and beaten from the foliage of larch (<u>Larix laricina</u> (Du Roi) (K. Koch).

(c) Habits.

Very few adults were discovered in 1951, hence little opportunity was afforded to study their habits. However, it was

Fig. 7.4. Pupa [illegible]. piceus (De [illegible].)
Ventral aspect.

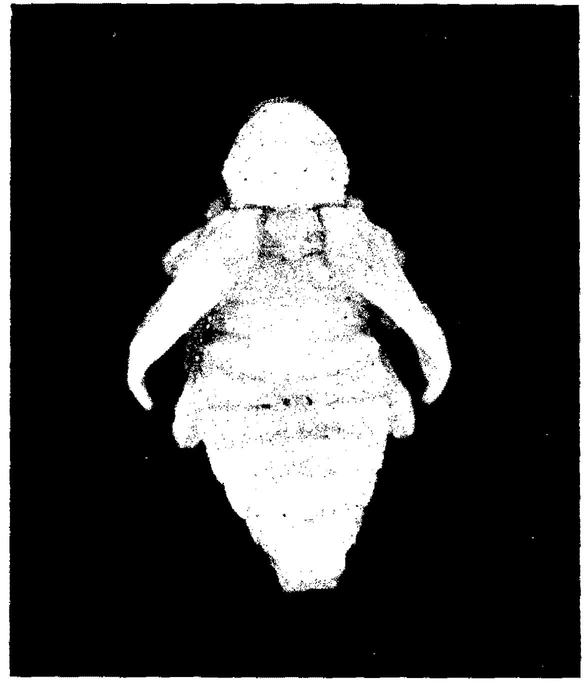


Fig. 7.5. Pupa [illegible]. piceus (De [illegible].)
Dorsal aspect.

[illegible] The adult [illegible] (*[illegible]*)

[illegible] tree. [illegible] caused by [illegible] (*[illegible]*) found that they will chew the needles and bark from twigs and bark from small roots of the host. Evidence of such feeding has been found in the field as well as with caged adults.

Observation of oviposition habits, with captured females show that they may cut a niche with their mandibles and secure an egg in this location, or they may merely select a suitable crack in the bark in which to oviposit. Mating habits are unknown as no males have been captured.

D - Nature and Extent of Injury

It is the boring of the larvae that causes the injury to the tree. The Pathology Unit is attempting to determine the incidence of larval damage to the entrance of root-rot. Damage is also caused by mechanical injury to the host. Small roots are frequently girdled and killed. Such roots are usually less than 1-1/2 inches in diameter. However, considerable barking of large roots and the root-collar, even to complete girdling, may occur. This depends on the number of individuals attacking, the number of attacks and the size of the host. These observations were emphasized during the latter part of the 1951 season, when several dead trees were examined. These trees were completely girdled and killed (fig. 9). Even if death is not immediately imminent, it is felt that vigor is lowered and that continued attacks will result in death to the host.

This discovery initiated the requirement of an assessment of damage to individual trees.

TABLE IV - Damage Assessment.

Rating	Terms	Definitions
0	absent	no tunnels found
1	trace	A few scars, not penetrating to cambium layer
2	slight	Less than 1/4 of the roots girdled or killed or less than 1/4 of the surface of the root-collar girdled to the cambium strip, or any combination of the two forms of injury being less than 1/4 of total surface destroyed.
3	moderate	Less than 1/2 as above
4	heavy	Less than 3/4 as above
5	severe	3/4 to complete girdling of roots and/or root-collar.

Although no acceptable sampling technique has been devised, a ligited clear cutting program indicates that one would expect to find heavy damage in trees from 2.50 to 3.50 inches in diameter (Table V Fig. 10) and dead trees among smaller diameter trees.

old

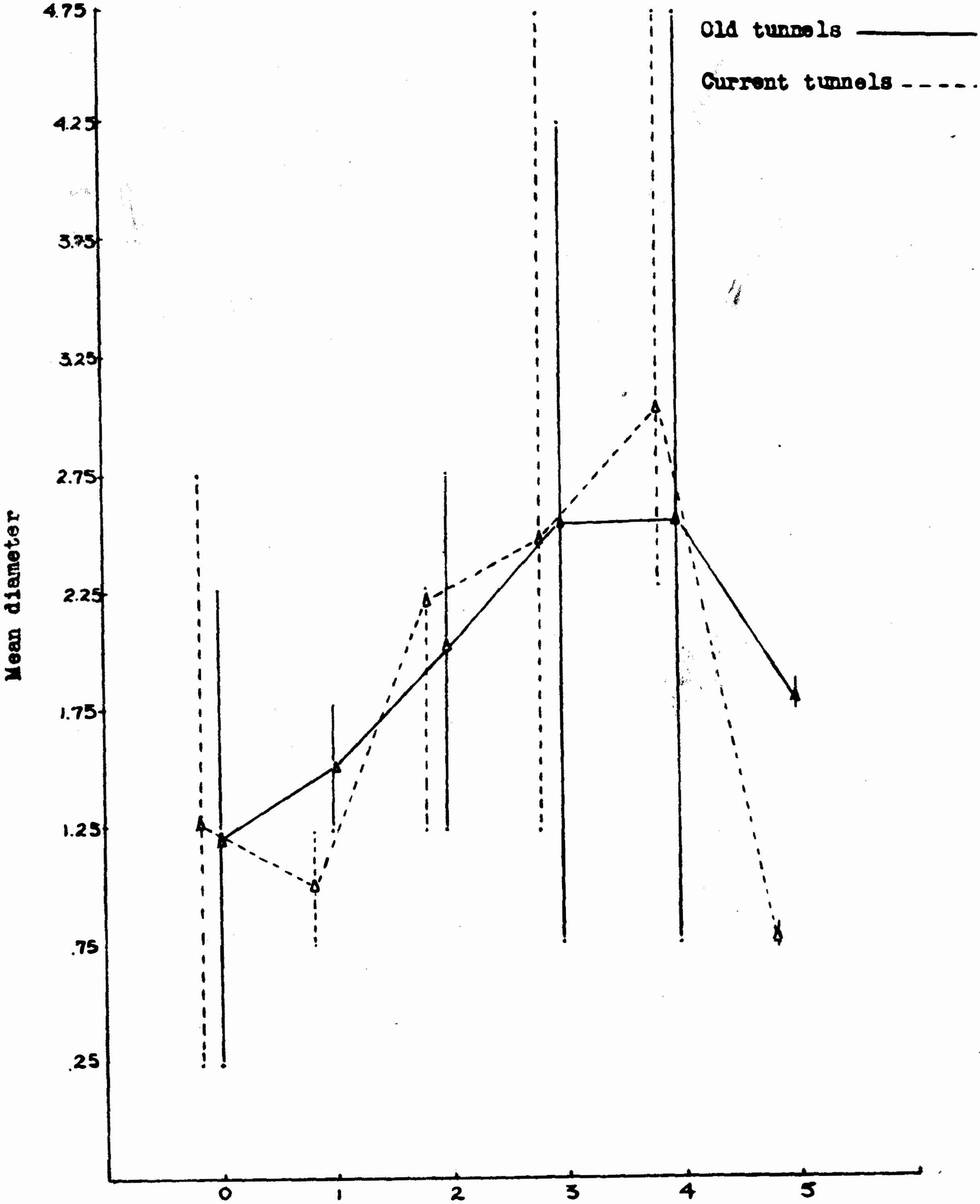
TABLE V - Numbers and size of Trees per degree/damage.

Diam. in inches	Class Mark	0	1	2	3	4	5	Total No. trees.
0-0.5	.25	2						2
0.6-1.0	..75	4			1	3		8
1.1-1.5	1.25	4	1	2	2	1		10
1.6-2.0	1.75	6	1	1	1	2	1	12
2.1-2.5	2.25	1		3	3	1		8
2.6-3.0	2.75			2	3	2		7
3.1-3.5	3.25					1		1
3.6-4.0	3.75				1			1
4.1-4.5	4.25				1			1
4.6-5.0	4.75					3		3
Total Trees		17	2	8	12	13	1	53
Mean. dium. for respective degrees of damage		1.24"	1.50	2.05	2.5	2.5	1.75	

new damage

Diam. in inches	Class Mark	0	1	2	3	4	5	Total No. trees.
0 -0.5	.25	2						2
0.6-1.0	.75	6	1				1	8
1.1-1.5	1.25	5	1	2	2			10
1.6-2.0	1.75	6		2	4			12
2.1-2.5	2.25			2	5	1		8
2.6-3.0	2.75	2			2	3		7
3.1-3.5	3.28					1		1
3.6-4.0	3.75				1			1
4.1-4.5	4.25				1			1
4.6-5.0	4.75			1	1	1		3
		21	2	7	16	6	1	53
Mean. diam. for respective degrees of damage		1.29"	1.00	2.18	2.44	3.06	0.75	

Fig. 10. Range and Mean degree of attack in relation to tree diameter for old and current damage.



This work was undertaken in an area of regeneration so the condition of large trees is not indicated. Of the five trees found girdled and dead, four were in the small size range, averaging 1.1 inches in diameter at a one foot stump. The other was 5.8 inches and 84 years old and was severely girdled and heavily infected with rot. Either factor, or both, may have been responsible for the death of this mature tree.

A limited survey has been conducted and most areas studied have disclosed the presence of H. piceus at varying population levels (Table VI).

TABLE VI - Percent Infestation in the Areas Studied

Designation	Name	Location Sec.	Tp.	Rge.	% Infestation	Brief description of stands
A	Gravel Pit 58 acres) experi-	12	20	19	24	) Uneven age, open, spruce regeneration under poplar; heavy hazel and/or birch (*B. glandulosa*) shrub layer, grey wooded soil with medium A_0 layer (2-8 In. in depth)
B	South Cut-over 76 ") mental	23	20	19	85	)
C	North Cut-over 53") areas	36	20	19	72	)
1	Norgate Road (a)	34	19	17	70	)
2	Norgate Road (b)	34	19	17	50	)
3	Norgate Road (c)	28	19	18	10	)
4	Lake Katherine (a)	34	19	18	50	)
5	Lake Katherine (b)	34	19	18	60	)
6	Thompson Trail (a)	36	20	19	30	)
7	Thompson Trail (b)	1	21	19	80	)
8	Campsite Road	26	20	19	80	)
9	Golf Course	34	19	18	70	)
10	Lake Audy Rd. (a)	30	21	19	0	) Open plain surrounded by poplar, invading) islands of young spruce, grey-black soil) 2" of grass sod.
11	Lake Audy Rd. (b)	5	21	20	0	) Mature poplar stand with islands of) uneven age spruce, immature grey-wooded) soil 2" of duff
12	Lake Audy Rd. (c)	6	21	19	0	)
13	Lake Audy Rd. (d)	15	20	19	0	dense stand of poplar and suppressed spruce, little shrub layer grey wooded soil duff 4"
14	Lake Audy Rd. (e)	15	20	19	10	Open stand regeneration spruce hydromorphic soil

(cont)

TABLE VI (cont)- Percent infestation in the Areas Studied

Designation	Name	Location			Infestation	Brief description of stands
		Sec.	Tp.	Rg.		
15	White Water Lake	17	21	21	0	Mature spruce and poplar, some spruce understory from which sampling was done, 6-8" duff.
16	Duck Mountain, Man.	21	30	24	50	Mature spruce, balsam, fir and poplar, some spruce understory, grey wooded, 6-8" duff
17	Wanless, Man.	1	60	27	50	Poplar with spruce regeneration, grey wooded soil to podzolic.
18	Hudson Bay Junction, Sask.	6	43	3	60	White and black spruce and poplar with white and black spruce understory, hydromorphic soil
19	Torch River, Sask.	14	54	12	40	High graded jack pine with spruce understory, fine sandy soil.
20	Candle Lake, Sask.	35	55	23	50	Logged over spruce and poplar with medium dense spruce understory, grassy open site with bed rock at 20 to 24 inches, probably degrading rendzina soil.

E - Some Factors That May Influence The Incidence of H. Piceus

A. Age or Diameter of Host.

In an attempt to discover at what age or size the host would be likely to become susceptible to attack, two small areas of regeneration were practically clear cut, 129 trees being removed and examined in detail. Tables VII and VIII contain the data collected from these areas.

TABLE VII - Infestation of Trees According to Age at a one-foot Stump

NORTH CUT-OVER

Age Class	Class Mark	Total trees	Present	Absent	% Present
1-5	3				
6-10	8	3	1	2	33.33
11-15	13	8	7	1	87.50
16-20	18	22	14	8	63.63
21.25	23	15	9	6	60.00
26-30	28	2	2	0	100.00
31-35	33	0			
36-40	38	0			
41-over	43	3	3		100.00

SOUTH CUT-OVER

Age Class	Class Mark	Total trees	Present	Absent	% Present
1-5	3				
6-10	8	4	3	1	75.00
11-15	13	19	11	8	57.84
16-20	18	40	36	4	90.00
21.25	23	13	13	0	100.00
26-30	28	0			
31-35	33	0			
36-40	38	0			
41-over	43	0			

TABLE VIII - Infestation of Trees According to Diameter at a one-foot Stump

NORTH CUT-OVER

Diam. Class	Class Mark	Total Trees	Present	Absent	% Present
0 - .5	.25	2	0	2	0
0.6 - 1.0	.75	8	4	4	50.0
1.1 - 1.5	1.25	10	4	6	40.0
1.6 - 2.0	1.75	12	7	5	58.33
2.1 - 2.5	2.25	8	8	0	100.00
2.6 - 3.0	2.75	7	7	0	100,00
3.1 - 3.5	3.25	1	1	0	100.00
3.6 - 4.0	3.75	1	1	0	100.00
4.1 - 4.5	4.25	1	1	0	100.00

SOUTH CUT-OVER

Diam. Class	Class Mark	Total Trees	Present	Absent	% Present
0 - .5	.25	0	0	0	0
0.6 - 1.0	.75	9	3	6	33.3
1.1 - 1.5	1.25	5	4	1	80.0
1.6 - 2.0	1.75	13	11	2	84.61
2.1 - 2.5	2.25	13	9	4	69.23
2.6 - 3.0	2.75	9	9	0	100.00
3.1 - 3.5	3.25	12	12	0	100.00
3.6 - 4.0	3.75	8	8	0	100.00
4.1 - 4.5	4.25	3	3	0	100.00

They show that at a one-foot stump the youngest tree attacked was nine years, and the smallest diameter attacked was 0.6 inches. However, figures 11 and 12 compiled from the same data, infer that one would not expect to find complete infestation before the trees reached an age of from 20 to 25 years, or a diameter of from 2.5 to 3.0 inches. These two areas were heavily infested, 72 and 85 percent. Areas which are more lightly infested might require a higher age and size class to attain maximum infestation. It would

Fig. 12. Per cent infestation by diameter (North and South Cut-over)

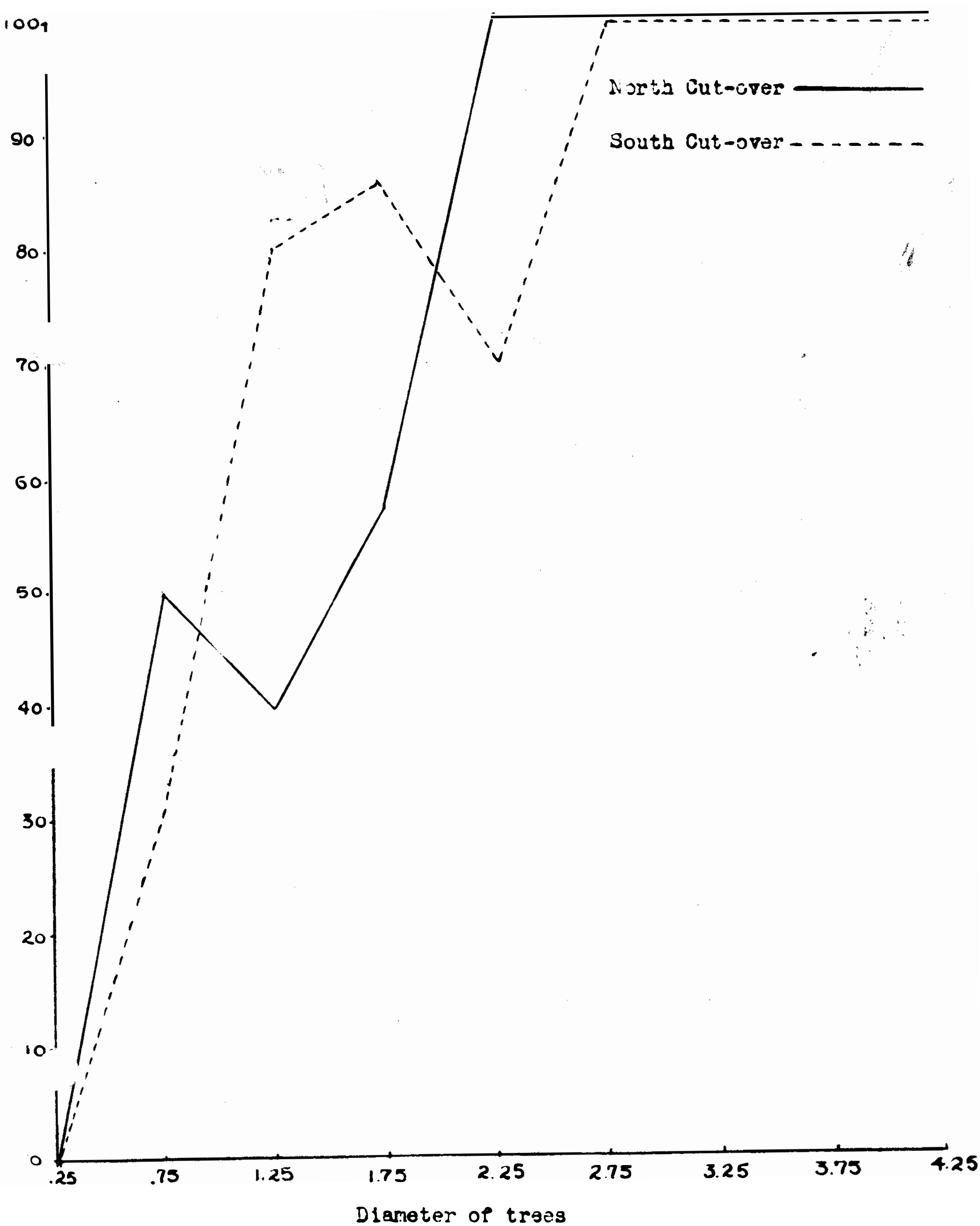
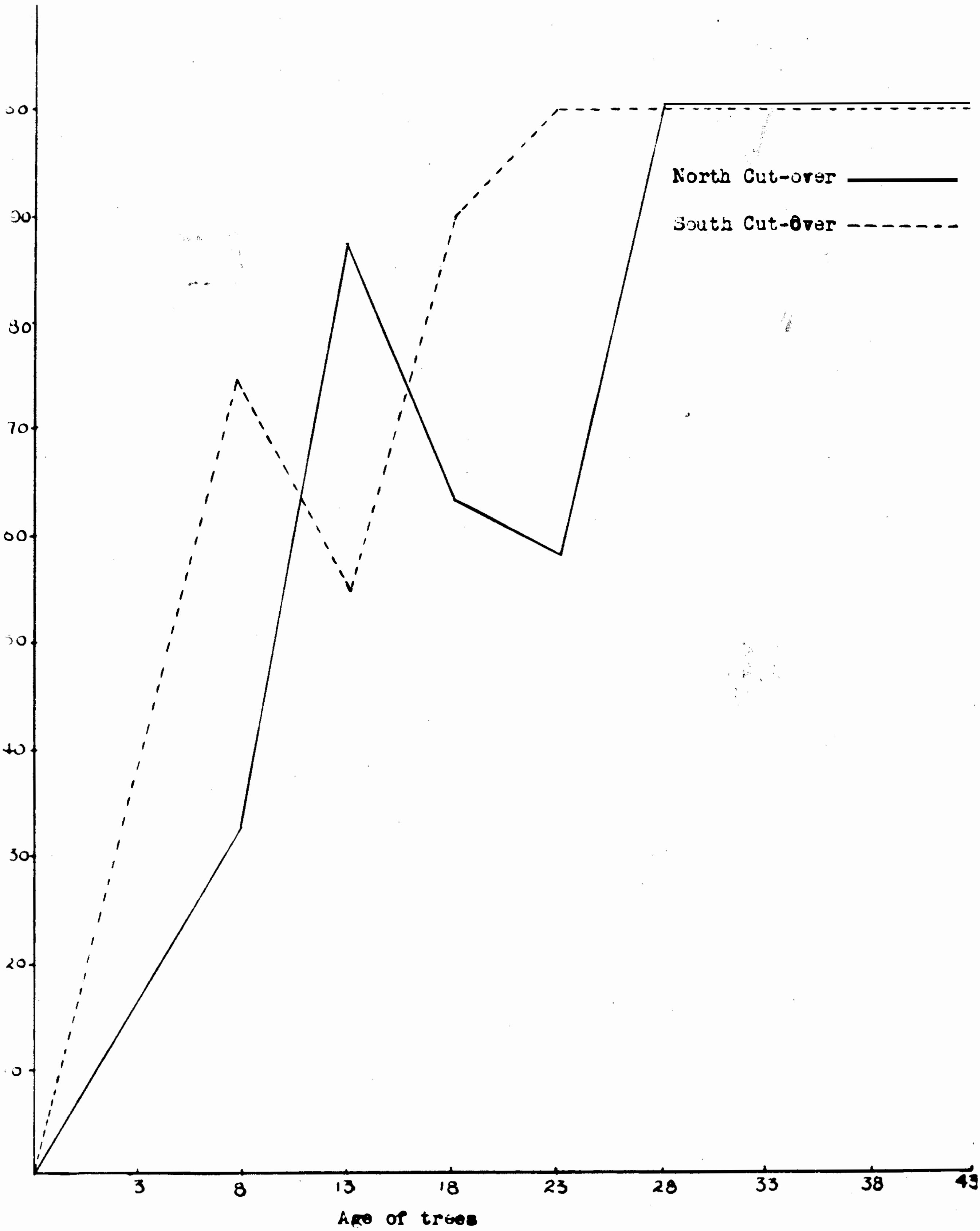


Fig. 11. Per cent infestation by age (North and South Cut-over)



appear that, in heavily populated areas at least, one would expect to find practically all the mature trees infested with H. piceus.

This indicates that the largest number of larvae could be obtained from mature trees. This is not necessarily the case. Because of their greater age, mature trees have been within the susceptible class for a long time and much of the available feeding surface is covered by old tunnels. Since such a condition exists it suggests that the attack has been in progress for many years, but may never have reached an infestation level required to kill large numbers of young trees, or to completely utilize all of the growing surface of mature trees.

B - Site

That site exerts an influence on H. piceus seems probable as it is absent from some areas and has varying population in others, (Table VI). No exact site classification has been established, but in areas investigated to date, the greatest population occurs in mixed stands of spruce and poplar (Populus Tremuloides Michx). No pure spruce stands have been examined to date. Most work has been conducted on spruce regeneration as it lends itself to mechanical manipulation (extracting trees by the roots). Soils underlying the two cut-over areas, where the most intensive study was conducted, and which show heavy populations, are Grey-wooded. These are normally forest or aspen grove soils characteristic of the higher altitudes of Manitoba. Their zonal contours are above the 1900 foot level (Ellis, 1938).

However, on the limited survey undertaken (Table VI) H. piceus was also discovered on spruce in areas of light sandy soil, peat hydromorphic soils and degrading Rendzina soils. The one area in which H. piceus was not found was one of spruce invading an aspen-grassland type on a grey-black soil (Lake Audy district). This soil was characterized by a very limited Ao horizon (1") and a compact A1 horizon of $1\frac{1}{2}$" as opposed to a loose friable Ao of 3" and no A1 in most of the wooded soils. The hard grass-sod horizon may be unsatisfactory to the adults because of their necessity to burrow to the root system of the host.

F. - Sampling

The presence of the insect may be established by merely digging the litter and soil away from the root-collar and the base of the roots. If tunnels appear it means that the particular tree is, or has been, infested. Mature trees may be selected for this purpose. However, it is usually desirable to determine the degree of damage inflicted upon the host or to make population counts. This requires a detailed examination of the complete root system, necessitating the uprooting of the tree. Obviously immature trees must be selected, up to 4 inches in diameter at a one-foot stump being about the largest for convenient use. As sampling of this type is extremely time consuming and poses a labor problem, a limited number of trees can be examined in any area or season. For this reason no suitable statistical method has been developed for this problem. It is hoped, however, that an adequate system can be devised which may reveal a reasonably accurate analysis of any particular site or condition.

A limited survey of various locations in Manitoba and Saskatchewan was undertaken on a 10 tree per location basis, (Table VI). The results merely indicate the populations in these areas, and are not necessarily indicative of the true infestation in the areas. However, it does establish the presence of the insect in these localities. It must be noted that if a negative sample appeared a 10 tree sample would probably not be adequate to establish the absence of the insect from an area.

G. - Conclusions

Although no definite facts have been established the observations to date indicate that H. Piceus undergoes a two year life cycle, one year in the larval stage. In this stage it attacks the roots and root-collars of white spruce, burrowing into and under the bark. This burrowing may inflict serious damage to the host, particularly on young trees 12 - 25 years, and has been shown as responsible for the death of several young trees. It is believed that there may be an important association between the injury caused by H. Piceus and the entry of root rots which becomes more evident in older trees. As yet it has not been found attacking nursery age white spruce.

It seems probable that this insect reduces the vigor of young trees. This aspect will be studied in 1952, comparing tree viger in conjunction with damage assessment.

It is proposed to attempt to rear larvae in open containers by feeding crushed bark and cambium and controlling the humidity sufficiently to prevent desiccation.

BIBLIOGRAPHY

Anonymous -
1933. Twenty-third annual report of the State of New York Conservation Department.

Beck, S.D. and J.F. Stauffer.-
1950. An aseptic method for rearing European corn borer. Journ. Econ. Ent. 43(1): 4-6.

Ellis, J.H. -
1938. The soils of Manitoba. Manitoba Economic Survey Board, Winnipeg, Man.

VIII PUBLICATIONS

VIII PUBLICATIONS

Hildahl, V. Forest Tent Caterpillars, _Malacosoma disstria_, Hbn. Division Forest Biology, B.M.P.R. 7(6): 2-3. 1951.

Lejeune, R.R. Some Ecological Factors Governing Populations of the Larch Sawfly, _Pristiphora erichsonii_ (Htg.) The Canadian Entomologist, 83 (6): 152-156, 1951.

Lejeune, R.R. Research Projects for 1951, Winnipeg Laboratory. Division Forest Biology, B.M.P.R. 7(3); 2, 1951.

Prentice, R.M. and G. Lalor, Spring Activity of the Large Aspen Tortrix. Division Forest Biology, B.M.P.R. 7(3); 2, 1951.

Prentice, R.M. Further Notes On The Large Aspen Tortrix. Division Forest Biology, B.M.P.R. 7(5): 2, 1951

Warren, G.L. and R.D. Whitney. The Spruce Borer, _Hypomolyx_ _sp_. Root Wounds and Root Diseases of White Spruce. Division Forest Biology, B.M.P.R. 7(4): 2-3, 1951.

Northern 1951 Winnipeg Insect and Disease Species Index