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ANNUAL DISTRICT REPORTS
FOREST INSECT AND DISEASE SURVEY
NEWFOUNDLAND - 1966

F O R E S T I N S E C T S A N D T R E E D I S E A S E S

by

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FOREWORD

Forest insect and disease conditions for 1966 are reviewed in the accompanying district reports of the Forest Insect and Disease Survey. Following are a few brief comments on significant changes in staff and facilities of the Survey, weather conditions, the general status of important insect and disease problems, and the damage appraisal investigations including aerial surveys.

S. G. Cochrane was appointed as a Research Officer; E. C. Banfield assumed the duties of district technician in District 1, Western Newfoundland. W. J. Sutton, D. M. Stone and D. O'Brien were assigned as seasonal assistants to district technicians in Districts 1, 2, and 3 respectively.

The transfer of Survey personnel from the Corner Brook Laboratory to Regional Headquarters in St. John's began in 1966 with the removal of W. C. Parrott and L. J. Clarke during July. Separating of Survey personnel has placed a strain on communications within the establishment but this should be eliminated when the remainder of the Survey staff are transferred from Corner Brook to Regional Headquarters by September, 1967.

Annual aerial surveys were continued in 1966 and 40 hours were flown in fixed-winged aircraft on detecting and mapping flights and for broad coverage of otherwise inaccessible areas. A helicopter was used for 22 hours to map the expanding boundaries of balsam woolly aphid infestations and for testing the use of an aerial scanning technique for estimating balsam woolly aphid damage.

In addition to their normal insect and disease sampling program, Survey technicians also collected data on population

levels, dispersal and effectiveness of the introduced shrew, Sorex cinereus cinereus Kerr, and continued balsam fir shoot growth measurements for the seventh consecutive year at phenology study plots in central and western Newfoundland.

A new national system of recording data collected with insect and disease collections was initiated by the Newfoundland Forest Insect and Disease Survey in 1966. With the new system more descriptive and precise information is coded numerically to facilitate processing by modern computer methods. A total of 1,291 insect and disease collections was submitted by district technicians, 180 fewer samples than in 1965. The reduction in the number of collections was attributed partially to the unfamiliarity of technicians with the new system.

The abnormal fluctuations in weather conditions experienced during the spring and early summer period apparently affected both plant and insect development across the Island as there was a noticeable decline in the degree of damage caused by most major forest insect and disease pests from the 1965 season.

The balsam woolly aphid continued to be the principal forestry problem in Newfoundland although only minor changes occurred in its distribution. However, a new spot infestation was discovered at Goodyears Cove, Halls Bay. The larch sawfly was the only insect pest that caused severe defoliation over an extensive area. The infestation around Red Indian Lake increased in size from 35 square miles in 1965 to approximately 100 square miles in 1966. The hemlock looper, an important pest of balsam fir forests, increased in numbers and distribution. Fairly large moth flights were reported in the Little Crabbes, Crabbes and Bottom Brook watersheds in September suggesting the beginning of new outbreaks of this pest. Spruce budmoth numbers were high on immature white spruce, along coastal sections

of eastern and western Newfoundland, and defoliation of current year's foliage was severe around Conception Bay. There was a noticeable increase in population levels and distribution of the European spruce sawfly from 1965. Light to moderate outbreaks of the balsam fir sawfly occurred in balsam fir stands in the Gallants area in western Newfoundland and near Marystown on the Burin Peninsula. Stands in both of these widely separated areas have a 10 to 15 year history of intermittent attack by this sawfly. The birch casebearer was found in outbreak numbers throughout St. George's District and caused severe browning in localized areas in both St. George's and Humber districts. Black-headed budworm infestations terminated in eastern Newfoundland and populations were reduced to endemic levels in central Newfoundland where severe defoliation of approximately 500 square miles of black spruce - balsam fir forest occurred in 1965.

There was no unusual incidence of disease infection recorded in Newfoundland in 1966. Foliage diseases of both coniferous and deciduous trees were common but light throughout the Island. Armillaria root rot was prevalent in balsam woolly aphid infested stands in western Newfoundland.

SECTION I
FOREST INSECT AND DISEASE SURVEY
DISTRICT I, WESTERN NEWFOUNDLAND

E.C. Banfield

INTRODUCTION

Field activities of the 1966 Forest Insect and Disease Survey commenced early in May and terminated about mid-November in District I. Weather conditions and plant and insect development were about normal for western Newfoundland.

The writer assisted Mr. E.M. Haines to prepare trap lines in the shrew study plot, near St. George's in May, and worked in association with other district technicians to estimate balsam woolly aphid damage along cruise lines in seven 50-acre plots in western Newfoundland during the first two weeks in June. Cruise lines were randomly selected and traversed in the five plots established in 1965 at Bottom Brook, Little Barachois Brook, Flat Bay Brook, Fishells River and Crabbes River and in two plots established in 1966 at Codroy Pond and Pasadena.

The collecting program of the Survey began on June 20 and terminated on September 1. W. J. Sutton was employed as a seasonal assistant during this phase of the Survey. A total of 361 insect and 31 disease samples was collected. Special spruce budworm larval collections were made for Dr. G.H. Stehr of the Sault Ste. Marie laboratory.

Fourteen thousand miles were travelled in departmental vehicles during the season. Boats were used for 150 miles of water travel around the shores of Grand Lake, Parsons Pond, Portland Creek Pond and Ten Mile Lake. Ten and one-half hours were flown on aerial surveys in fixed-winged aircraft and 10

hours in a SJ55 Sikorsky helicopter on a special balsam woolly aphid survey in October. The helicopter was used to map and assess the expanding boundaries of known aphid infestations in western Newfoundland, and to carry out trial damage appraisal estimates using the Esterline Angus Recorder in Flat Bay Brook and Bottom Brook watersheds. The writer and Mr. Sutton conducted ground cruises along sections of the flight lines in November. The results of both aerial and ground cruises will be assessed and examined for use as a practical technique for estimating aphid damage over extensive areas.

The status of the balsam woolly aphid in western Newfoundland changed only slightly from 1965. However, a new spot outbreak was recorded near Goodyears Cove, Halls Bay, and injury symptoms were more conspicuous in the Lower Humber watershed. The hemlock looper was reported over a wider area than in 1965 and larval and adult numbers increased at several locations in St. George's District suggesting the beginning of new outbreaks of this pest. Moderate balsam fir sawfly outbreaks persisted in the Gallants - Spruce Brook area and a small infestation of the larch sawfly was recorded on immature larch east of Deer Lake. European spruce sawfly numbers increased slightly and were distributed over a larger area than last year. Low numbers of spruce bud-moth larvae were found on immature white spruce from the Codroy Valley to Humber Arm. The birch casebearer was the most obvious pest of deciduous trees. It occurred in outbreak numbers and caused severe browning on roadside white birch saplings throughout the southwest portion of District I.

There were no major outbreaks of disease organisms recorded for western Newfoundland in 1966. However, the most common diseases such as white pine blister rust and black knot of cherry were abundant wherever the host trees occurred. Leaf spot of aspen was recorded in White Bay District and leaf and

twig blight of poplar was conspicuous along the Deer Lake Highway. Armillaria root rot was prevalent in balsam woolly aphid infested stands. Red flagging of balsam fir occurred throughout western Newfoundland. Severe moose browsing was recorded in a 3-acre area of balsam fir regeneration on the northeast end of Glover Island.

Growth measurement and plant development observations were continued in the phenology study plots near Corner Brook and at Reidsville. Each plot consisted of 10 balsam fir sapling. The average shoot growth of selected north lateral branches of these trees is summarized as follows:

Location	<u>Date of average growth</u>		
	<u>North lateral</u>		
	<u>25%</u>	<u>50%</u>	<u>Total</u>
Reidsville	June 16	June 23	Aug. 1
Corner Brook	" 11	" 21	" 3
Average	June 14	June 22	Aug. 2

INSECT CONDITIONS

Balsam Woolly Aphid, *Adelges piceae* (Ratz.)-- A new spot outbreak of the balsam woolly aphid occurred near Goodyears * Cove, Halls Bay. Otherwise the status of the aphid appears to be relatively unchanged in District I. A reconnaissance flight of the Bonne Bay area during the aerial survey failed to discover any injury symptoms north of the Deer Arm area. (For additional information on balsam woolly aphid conditions, see Section IV, "Special Survey Balsam Woolly Aphid (*Adelges piceae* Ratz.))."

Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Guen.) --

Population levels of this insect pest have shown a moderate increase in western Newfoundland over the past two years.

The most significant rise in larval populations was recorded in a balsam fir - black spruce stand in the Bottom Brook watershed where quantitative beating samples produced an average of 9 larvae per tree. Looper larvae were also present on white birch and speckled alder. However, loss of foliage was very light.

Only small numbers of larvae were found on pole-size balsam fir, white spruce and black spruce along Little Grand Lake Brook, between Little Grand and Grand lakes, where low to moderate numbers were collected in 1965. A few larvae were also recorded in the Gallants area. Fewer than 1 larva per tree sample was collected from balsam fir and white spruce in the Parsons Pond and Portland Creek area on the Northern Peninsula.

Fairly large moth flights were reported in the Little Crabbes, Crabbes and Bottom Brook watersheds in late summer. Ground investigations were carried out in these watersheds in late September and hundreds of hemlock looper adults were found in pools of water on the logging roads and evidence of light defoliation was apparent on a few mature balsam fir. An aerial survey of the area in October revealed branch-tip browning of about half a square mile of mature balsam fir forest along the height of land between Little Crabbes and Crabbes watersheds. The stand was already severely infested by the balsam woolly aphid and Bowaters were carrying out a salvage cutting operation in the immediate area. The cause of current browning in this stand can no doubt be attributed to feeding by the hemlock looper. The sudden rise in looper numbers, and the degree of defoliation, suggest the beginning of a new outbreak of this pest.

Collections

18

Larvae per tree sample

Av. Dev. from 1965

1.6

+0.4

Balsam-fir Sawfly, Neodiprion abietis complex--Population levels of this sawfly were generally low throughout western Newfoundland. However, moderately high larval numbers were recorded in both mature and immature balsam fir stands in the Gallants - Spruce Brook area. These stands have a 10- to 15-year history of intermittent attack by this sawfly. Defoliation was generally light, averaging less than 25% and could not be detected by aerial survey.

Small numbers of this sawfly also were collected from immature balsam fir near River Brook, Flat Bay Brook, Barachois Provincial Park and Portland Creek Pond.

<u>Collections</u>	<u>Larvae per tree sample</u>	
	Av.	Dev. from 1965
7	7.3	+4.3

Spruce Budworm, Choristoneura fumiferana (Clem.)--Spruce budworm population levels remained low for the third consecutive year. Small larval numbers were collected from white spruce at Searston, Tompkins, and Codroy Pond in the Codroy Valley and along coastal sections of St. Barbe District. Only 37 larvae were taken in 22 collections in the St. George's District while the 15 collections in the St. Barbe District produced 38 larvae. Defoliation was negligible.

<u>Collections</u>	<u>Larvae per tree sample</u>	
	Av.	Dev. from 1965
37	0.7	-

Spruce Budmoth, Zeiraphera ratzeburgiana Ratz.--This insect was recorded mainly throughout the Codroy Valley and at Stephenville Crossing in St. George's District, and at Halfway Point in the Humber District. Spruce budmoth larvae were observed feeding on the current year's foliage of immature white

spruce in association with small numbers of spruce budworm and micro-moth. There was a sharp decrease in population levels of this insect complex as compared to 1965. Light defoliation, up to 15%, was estimated throughout all areas. A summary of damage caused by the spruce budmoth follows:

Location	Host	Average larvae per tree sample	Per cent new shoots infested	Per cent defoliation
Tompkins	WS	1.0	3	2
Searston	"	5.5	7	10
Millville	"	3.3	5	5
South Branch	"	0.7	2	1
St. Fintans	"	6.2	20	15
Stephenville Xing	"	3.3	5	5
Halfway Pt.	"	3.3	5	5

<u>Collections</u>	<u>Larvae per tree sample</u>	
	Av.	Dev. from 1965
7	3.0	-5.7

Black-headed Budworm, *Acleris variana* (Fern.)--Population levels of the black-headed budworm remained low for the sixth consecutive year. Scattered larvae were collected from balsam fir, black spruce and white spruce throughout the southern portion of St. George's District only, with the average numbers of larvae per tree sample slightly less than recorded for 1965.

<u>Collections</u>	<u>Larvae per tree sample</u>	
	Av.	Dev. from 1965
10	0.3	-0.1

European Spruce Sawfly, *Diprion hercyniae* (Htg.)--There was a noticeable increase in population levels of this sawfly and it was recorded throughout western Newfoundland (Fig. 18). The heaviest larval concentrations were found on white spruce near Sops Arm where samples averaged 55 larvae per tree, and on black spruce at Burlington, Adies Stream and Jacksons Arm where samples averaged 25 larvae per tree. One small spot infestation was found between Burlington and Middle Arm and defoliation was estimated at 10%. Defoliation was negligible throughout the remainder of District I. A very high incidence of diseased larvae was recorded in all samples.

<u>Collections</u>	<u>Larvae per tree sample</u>	
	Av.	Dev. from 1965
58	5.6	+3.5

Larch Sawfly, *Pristiphora erichsonii* (Htg.)--Two outbreaks of the larch sawfly were detected along the Trans Canada Highway. One was approximately 3.5 miles east of Deer Lake, and the other near Pynns Brook. These infestations occurred in small, open-grown stands of immature larch and defoliation ranged from 50% to 60% at both locations. Small larval colonies were also found at Little Barachois River, Castors River and Taylors Brook but no defoliation was observed.

<u>Collections</u>	<u>Larvae per tree sample</u>
4	9.8

Larch Casebearer, *Coleophora laricella* (Hbn.)--Larch casebearer population levels remained low in western Newfoundland, except at Upper Ferry in the Codroy Valley where a 20-tree sample produced 92 larvae and browning was moderate. Sampling throughout the remainder of the District produced from 0 to 14 larvae per tree sample and browning was recorded as a trace to

light. A summary of sampling data based on the number of case-bearers on 30 fascicles per tree at 20-tree sampling stations follows:

Location	*Stand vigor	Stand defoliation	No. cases on year- old shoots (Corr.)	
			Avg.	Dev. from 1965
Mt. Moriah	MV	Nil	0.82	+0.82
O'Regans	MV	Trace	1.62	-0.88
Upper Ferry	V	Moderate	5.53	-3.97
Tompkins	V	Trace	1.58	+0.48
Lockleven	MV	Light	0.70	-
Barry Brook	U	Trace	0.68	-
2 mi. E. Little Barachois River	U	Trace	0.31	-
Dribble Brook	V	Trace	1.06	-
Lookout Brook	MV	Trace	0.93	-
Carters Road	MV	Light	1.11	-
Whale Back Brook (T.C.H.)	V	Trace	0.0	-
4 mi. N. Belldowns Pt.	U	Trace	0.31	-
4.5 mi. E. Hawkes Bay	U	Light	0.48	-
7 mi. W. St. Anthony	U	Nil	0.0	-

* U = Unthrifty; V = Vigorous; MV = Moderately vigorous.

Birch Casebearer, *Coleophora fuscedinella* (Zell.)--

The birch casebearer was found in outbreak numbers on roadside white birch saplings throughout the St. George's District as far north as Stephenville Crossing, and in the Corner Brook area (Fig. 19). One collection was made in St. Barbe District at Roddickton where very low numbers of larvae were recorded. This is a new record of distribution for the Northern Peninsula.

Defoliation ranging from 25 to 90% was recorded in the area between Tompkins and Robinson's River. The highest concentration of larvae was recorded at St. Fintan's where two 3-foot branch sections produced 91 larvae. Defoliation was estimated at 75% in outbreaks along local roads near Jeffreys, McKays, and the Barachois River. Medium defoliation was also recorded on white birch saplings along the Stephenville Crossing - Stephenville highway. Damage to speckled alder foliage was recorded in the Robinson's River and Flat Bay Brook areas as 15 and 5% respectively. High population levels and severe defoliation occurred on white birch in and around the City of Corner Brook where one collection produced 300 casebearer larvae and defoliation of sample trees was estimated at 50%.

Table 1

Birch Casebearer Defoliation and Population Level Estimates in Western Newfoundland

Location	Host	% Stand defoliation	No. cases per sample ^x
Tompkins	wB	25-35	57.0
O'Regans	"	10	5.0
South Branch River	"	25	7.3
Codroy Pond	"	40	15.0
Crabbes River	"	25	10.5
St. Fintan's	"	80	45.5
Heatherton	"	30	7.3
Robinson's River	Al	15	18.0
Steel Mountain Road	wB	10	5.0
Steel Mountain Road	Al	5	5.0
Steel Mountain Road	M	Trace - 5	6.0
Stephenville Xing	wB	10	11.0
Abrahams Cove	"	Trace	1.7
Corner Brook Area	"	50	103.3
Roddickton	"	Trace	1.0
Three Mile Dam	"	"	3.3

^x

A sample = all leaves from one 3-ft. branch from each of 3 trees.

OTHER INSECTS RECORDED

Species	Host(s)	Locality	Average per tree sample	No. of collections
<u>Anomogyna perquiritata</u> (Morr.) Grey spruce cutworm	wS,bS,bF	St. George's and Green Bay districts	0.3	4
<u>Anoplonyx luteipes</u> (Cress.) Marlatt's larch sawfly	L	Throughout District	1.4	13
<u>Aphidae</u> Aphids	wS,bPo,bF	St. George's, Humber and Green Bay districts	98.0	5
<u>Campaea perlata</u> (Guen.) Fringed locper	wB,Al,yB	St. George's and Humber districts	1.0	8
<u>Caripeta divisata</u> Wlk. Grey spruce looper	bF,wS,bS	St. George's and St. Barbe districts	0.5	7
<u>Cerambycidae</u> Long-horned beetles	bPo,bF,wB	St. George's and St. Barbe districts	0.3	4
<u>Chrysomela falsa</u> Brown Willow leaf beetle	pCh	Coachman's Cove	1.0	1
<u>Cicadellidae</u> Leaf hoppers	L,wB,bF	O'Regan's, Codroy Pond, Baie Verte	3.0	3
<u>Cimbex americana</u> Leach. Elm sawfly	Al,wB	St. Barbe District North	0.4	6
<u>Croesus latitarsus</u> Nort. Dusky birch sawfly	Al,wB	St. George's District	7.0	3
<u>Ctenicera triundulata</u> Rand. A click beetle	wS,bS	Cheeseman's Provincial Park, O'Regan's	1.0	2

OTHER INSECTS RECORDED (Cont'd.)

Species	Host(s)	Locality	Average per tree sample	No. of collections
<u>Curculionidae</u>				
Weevils or snout beetles	wS, bF, wB	St. George's, Humber St. Barbe and Green Bay districts	0.8	9
<u>Dendroides concolor</u> Newm.				
Fire-colored beetle	pCh	Codroy Pond	0.3	1
<u>Dioryctria reniculella</u> (Grote)				
Spruce coneworm	wS, bS	River Brook, River of Ponds	0.8	2
<u>Elateridae</u>				
Click beetles	wB, bF, bS, wS	St. George's and Humber districts	0.5	7
<u>Eucordylea atrupictella</u> Dietz.				
A spruce needle miner	wS, bS	River Brook, Flat Bay Brook, Robinson's River	1.0	4
<u>Eupithecia</u> sp.				
A brown spruce looper	wS, bF, L, bS	St. George's, Humber and St. Barbe districts	0.5	36
<u>Fenusa pusilla</u> (Lep.)				
Birch leaf miner	wB	Deer Lake	15.	1
<u>Feralia jocosa</u> (Guen.)				
Green-striped caterpillar	bS, bF, wS	St. George's, Humber and St. Barbe districts	0.5	23
<u>Griselda radicana</u> Wlshm.				
Micro-moth	wS, bF	Humber and St. George's districts	1.0	7
<u>Nyctobia limitaria</u> (Wlk.)				
Green balsam looper	wS, bF	St. George's and St. Barbe districts	0.4	17

OTHER INSECTS RECORDED (Cont'd.)

Species	Host(s)	Locality	Average per tree sample	No. of collections
<u>Nymphalis antiopa</u> (L.) Mourning cloak butterfly	tA	Barachois Prov. Park, Bear Cove	29. 29.	4
<u>Orgyia antiqua</u> (L.) Rusty tussock moth	tA,wS,bF,wB	St. George's and White Bay districts	0.3	5
<u>Pentatomidae</u> Stink bugs	yB,wB,bF,Al,wS	Throughout district	1.0	8
<u>Phratora purpurea purpurea</u> Brown A leaf beetle	bPo	Robinson's River area	0.7	1
<u>Phyllocnistis populiella</u> (Chamb.) Aspen leaf miner	bPo,tA	St. George's, White Bay and Green Bay districts	4.0	4
<u>Pikonema alaskensis</u> (Roh.) Yellow-headed spruce sawfly	wS,bS	Humber and St. Barbe districts	1.0	8
<u>Pikonema dimmockii</u> (Cress.) Green-headed spruce sawfly	wS,bS,bF	St. George's and St. Barbe districts	1.0	22
<u>Pristiphora lena</u> Kincaid A spruce sawfly	wS, bS	St. George's, Humber, Green Bay and St. Barbe districts	0.6	8
<u>Semiothisa</u> sp. A looper	bF,wS,L,bS	Throughout district	1.0	47
<u>Solenobia walshella</u> Clem. A bagworm	bS,wS,bF,L,wB	" "	7.0	32

OTHER INSECTS RECORDED (Cont'd.)

		Locality	Average per tree sample	No. of collections
<u>Stilpnotia salicis</u> (L.) Satin moth	LPo, W	Stephenville	7.0	2
<u>Syneta</u> sp. A beetle	bF, wS, tA, Al	Humber and St. George's district	2.0	7
<u>Syngrapha alias</u> (Ottol.) Spruce climbing cutworm	bS, wS, bF	South Branch, Searston, Portland Creek	0.3	3
<u>Tethida cordigera</u> (Beauv.) Black-headed ash sawfly	BAS	Barachois Prov. Park	9.0	1
<u>Tetraphleps</u> sp. A predator	wS, bF, bS, L	St. George's, Humber, White Bay and St. Barbe districts	1.0	9
<u>Trichiocampus irregularis</u> (Dyar) A willow sawfly	W	Coachman's Cove	2.0	1
<u>Zeiraphera diniana</u> Gn. Douglas fir cone moth	L	St. George's and St. Barbe districts	0.2	6

DISEASE CONDITIONS

Red Flag of Balsam Fir, *Fusicoccum abietinum* (Hartig) Prill. and Delacr.--This disease was very prevalent throughout western Newfoundland from St. Anthony south to the Codroy Valley, including the Baie Verte Peninsula. Damage, however, was estimated as light because only individual balsam fir trees were affected. The most conspicuous injury was observed along 2 miles of road around Pistolet Bay on the Northern Peninsula.

Ink Spot of Aspen, *Ciborinia whetzellii* (Seav.) Seav.--This foliage disease caused medium to severe browning of trembling aspen leaves in the Adies Stream and Birchy Lake areas. A small stand of trembling aspen was infected near Bear Cove on the Baie Verte Peninsula and 20% browning of foliage was recorded.

Leaf and Twig Blight of Poplar, *Pollaccia radiosa* (Lib.) Bald. & Cif. *P. elegans* Serv.--This disease caused light to medium injury of trembling aspen along the Trans Canada Highway between Corner Brook and Deer Lake. Another small outbreak was recorded on aspen at Coachman's Cove on the Baie Verte Peninsula but damage was light.

OTHER DISEASES RECORDED

Organism	Host(s)	Locality	Remarks
<u>Arceuthobium pusillum</u> Pk. Eastern dwarf mistletoe	bS	Throughout district	Common
<u>Armillaria mellea</u> (Vahl. ex Fr.) Kummer Armillaria root rot	bF, bS	Humber and St. George's districts	Prevalent in balsam woolly aphid infested stands
<u>Bifusella faullii</u> Darker Needle cast of balsam fir	bF	Daniels Harbour	Light
<u>Chrysomyxa ledicola</u> (Pk.) Lagerh. and <u>C. ledi</u> (A. and S.) de Bary Needle rust on black spruce	bS	Hawkes Bay	Light
<u>Coccomyces hiemalis</u> Higg. Shot hole of cherry	pCh	South Branch	Light to medium
<u>Cronartium ribicola</u> J.C.Fischer White pine blister rust	wP	Adies Stream and Birchy Lake	Common on white pine regeneration
<u>Cylindrosporium betulae</u> Davis Leaf spot	wB	Portland Creek, St. George's and South Branch	Light to medium
<u>Dibotryon morbosum</u> (Schw.) Theiss and Syd. Black knot of cherry	pCh	Throughout district	Severe in Codroy Valley
<u>Gymnosporangium cornutum</u> Arth. ex Kern Leaf rust	Mo	Isle aux Morte Barr'd Harbour	Light

OTHER DISEASES RECORDED (Cont'd.)

Organism	Host(s)	Locality	
<u>Hypodermella laricis</u> Tub. Needle cast of larch	L	Throughout district	Throughout range of larch. Most conspicuous near St. George's
<u>Melampsorella caryophyllacearum</u> Schroet Yellow witches broom of balsam fir	bF	Throughout district	Light
<u>Pucciniastrum pustulatum</u> (Pers.) Diet. Needle rust of balsam fir	bF	Carter's Road	Light
<u>Rehmiellopsis balsamea</u> Waterm. Tip blight of balsam fir	bF	Portland Creek	Light
<u>Taphrina confusa</u> (Atk.) Gies. Leaf blister	cCh	St. Fintans	Light
<u>Taphrina robinsoniana</u> Gies. Catkin hypertrophy	yB	Steady Brook	Light

FIGURE 18

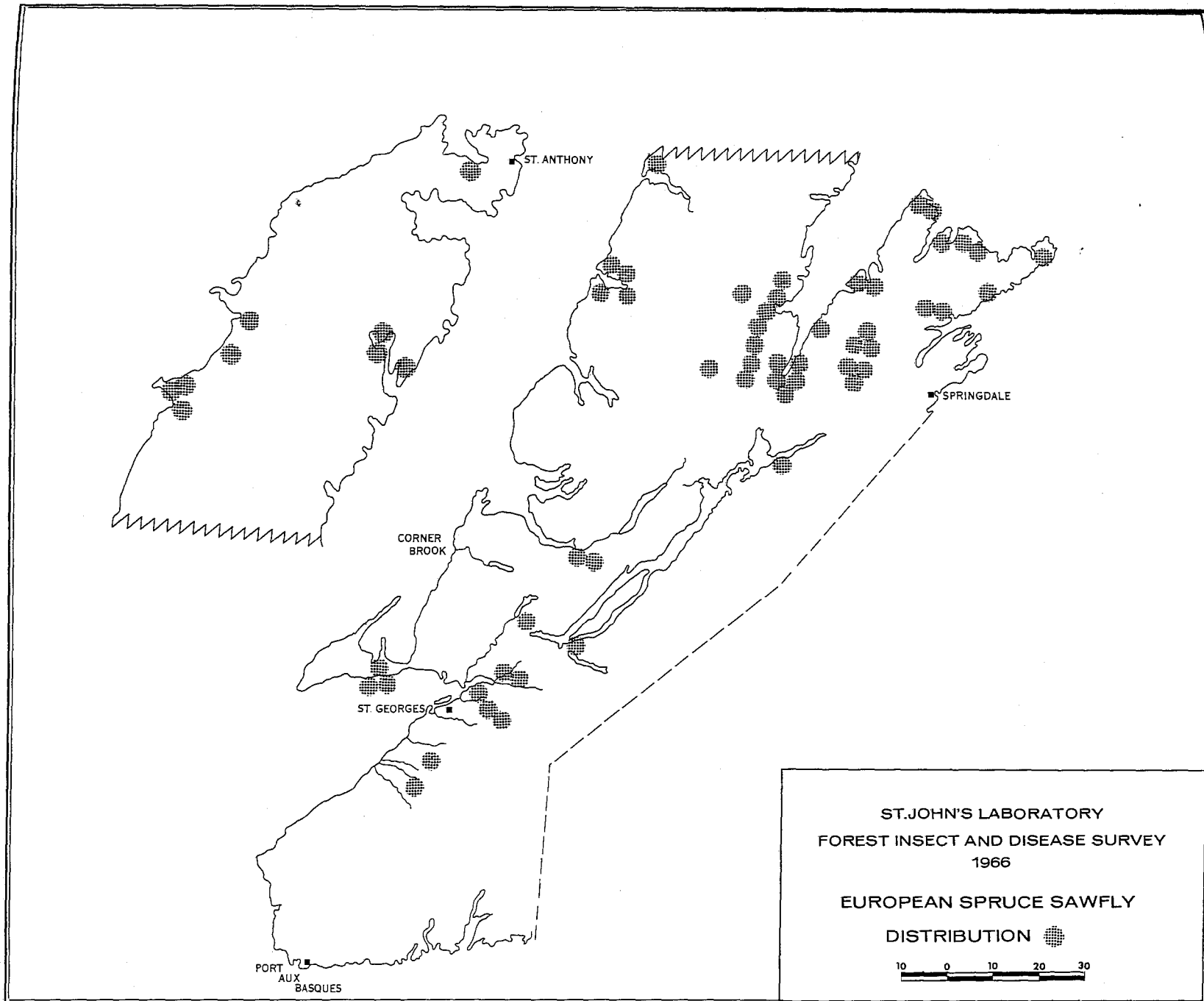
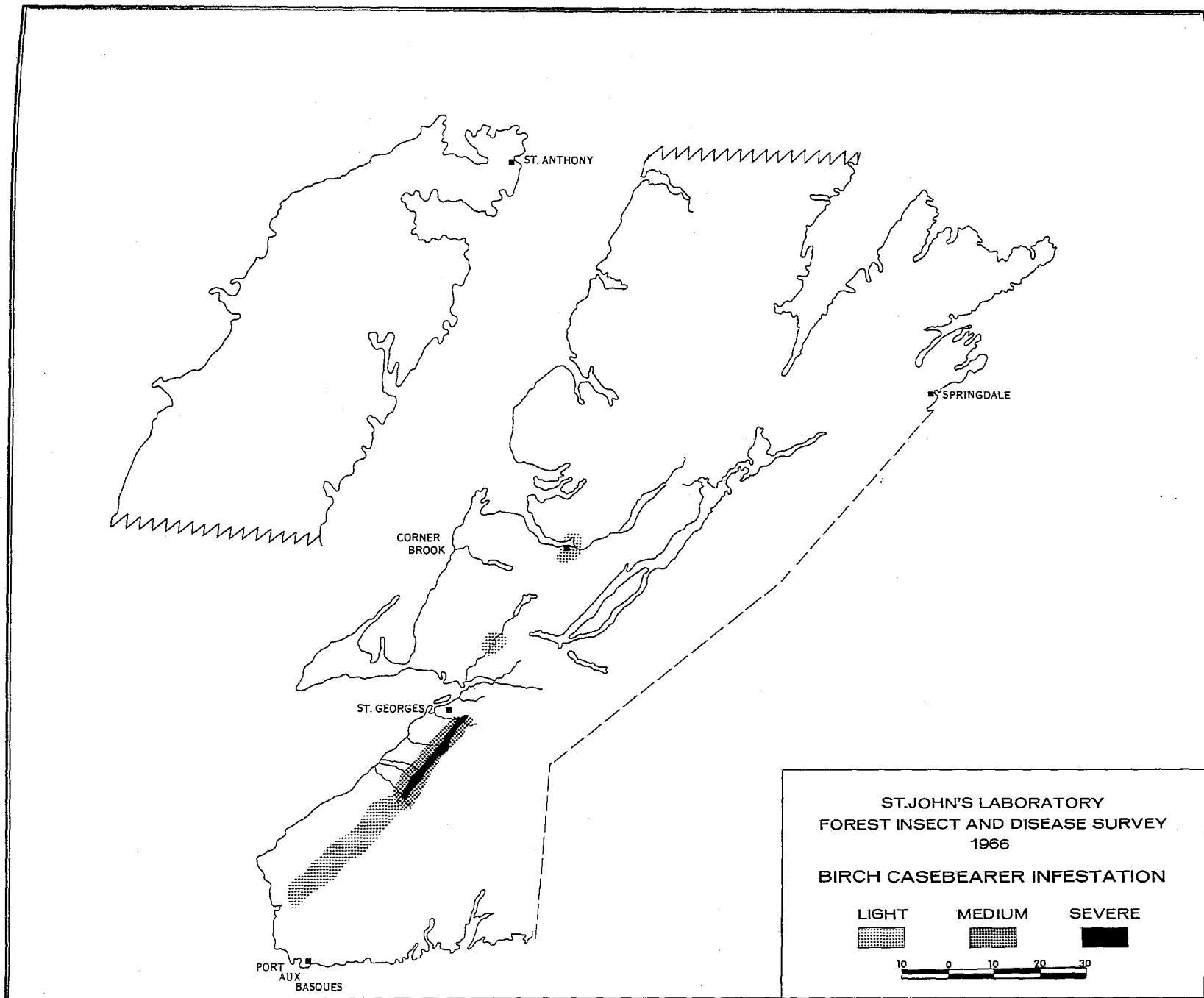


FIGURE 19



SECTION II
FOREST INSECT AND DISEASE SURVEY
DISTRICT 2, CENTRAL NEWFOUNDLAND

L. J. Clarke

INTRODUCTION

In 1966 weather conditions and plant and insect development were similar to those encountered in 1965. Field activities began in early May when the writer, in association with other field technicians, conducted damage appraisal estimates in seven 50-acre, balsam woolly aphid plots in the Lower Humber River, Bottom Brook, Little Barachois Brook, Flat Bay Brook, Fishels River, Crabbes River and Codroy Valley watersheds.

The weather in central Newfoundland was cool and wet during the first two weeks of June and the start of the collecting program was delayed about one week. D.M. Stone, a forestry student from the College of Trades and Technology, assisted with this phase of the Survey during July and August. A total of 410 insect and 32 disease samples was collected. Special mass collections of black-headed budworm larvae were collected for Dr. G.H. Stehr of the Sault Ste. Marie Laboratory and 1,200 larch sawfly cocoons were collected in the Red Indian Lake area for parasite studies.

The annual aerial detection and mapping survey was conducted over District 2 in late August and 13 hours and 15 minutes were flown in a Super Cub aircraft; an additional 16 hours were flown in a Sikorsky helicopter in October. The helicopter equipped with a visual scanner and an Esterline Angus Recorder was used in western Newfoundland to aid in the assessment of aphid injury symptoms along predetermined lines in the Flat Bay Brook and Bottom Brook watersheds and to map the expanding boundaries of aphid infested areas.

In September the writer assisted Dr. J. R. Bider, a Wildlife Biologist from Macdonald College, with a special investigation of the activity patterns of the introduced shrew, Sorex cinereus cinereus Kerr, in the Red Indian Lake area.

The balsam woolly aphid continued to be the major insect pest in the District and spot infestations were clear-cut by Price (Nfld.) Ltd. to check further spread of this pest. Black-headed budworm populations declined to endemic levels in the Lewisporte-Gander area where severe defoliation occurred in 1965. Larch sawfly infestations continued in the Red Indian Lake area for the seventh consecutive year and the area of infestation increased from 35 square miles in 1965 to approximately 100 square miles in 1966. The birch leaf miner, alder leaf miner, and the aspen leaf miner were the principal defoliators of hardwoods.

The more common tree diseases, such as white pine blister rust and black knot of cherry were recorded wherever the host trees occurred in the District. Armillaria root rot disease continued to cause mortality to immature black spruce, balsam fir and larch in the Sandy Lake, Badger area. Needle rusts of black spruce and balsam fir were recorded along the Victoria Lake and Sandy Lake woods roads. Yellow witches broom of balsam fir was common between Exploits Dam and Lake Ambrose. Ink spot of poplar caused severe foliage browning in stands of trembling aspen along Sandy Lake and Northern Arm - Point Leamington roads. Red flagging of balsam fir was very noticeable along the Sandy Lake and Victoria Lake roads.

Growth studies were continued in the special phenology plot near Badger. The average current growth of selected north lateral branches on 10 balsam fir trees was as follows:

Location	Date of average growth		
	North lateral		
	25%	50%	Total
Badger	June 16	June 25	August 9

INSECT CONDITIONS

Balsam Woolly Aphid, *Adelges piceae* (Ratz.)--No major changes were recorded in the 1965 boundaries of this important pest. The spot infestations along the northwest shore of Gander Lake, near Glenwood and near Red Indian Falls along the Badger-Buchans road were clear cut by Price (Nfld.) Limited. There were only minor changes in the infestations around the Bay of Exploits and Norris Arm area and in the Red Indian Lake and Lloyds River watersheds. (For additional information on balsam woolly aphid conditions, see Section IV, "Special Survey Balsam Woolly Aphid (*Adelges piceae* (Ratz.)).")

Black-headed Budworm, *Acleris variana* (Fern.)--Black-headed budworm populations were reduced to endemic levels in the Lewisporte-Gander area where, in 1965, 30 to 80 per cent defoliation was recorded in 500 square miles of black spruce - balsam fir forest.

An intensive mass sampling program was carried out in the Indian Brook watershed where high larval numbers caused severe defoliation in 1965. Although 200 immature black spruce were sampled, only 10 larvae per tree were collected and defoliation of current year's foliage was less than 15%.

Light defoliation occurred in a small 3-acre stand of immature black spruce near First Pond, Boyds Cove, where 20 to 25% of the current year's needles on the top portion of the trees were defoliated.

About 20% defoliation was estimated on immature black spruce and balsam fir in a 5-acre stand along the Point Leamington and West Arm Brook road. A moderate infestation occurred in this stand in 1965.

Collections	<u>Larvae per tree sample</u>
	Av.
18	3

Larch Sawfly, *Pristiphora erichsonii* (Htg.)--Infestations of this sawfly caused severe defoliation of larch stands in the Red Indian Lake area for the seventh consecutive year. The area of the infestations increased from 35 square miles in 1965 to approximately 100 square miles in 1966, and defoliation ranged from 50 to 100%. Although sawfly defoliation has been severe during this period, tree mortality has been negligible.

A small spot outbreak of this sawfly also occurred in an immature larch stand near Long Pond, Halls Bay. Defoliation averaged 50% over 1 square mile.

Aerial surveys indicated the boundaries of infestation in central Newfoundland (Fig. 20) and defoliation was recorded as follows:

<u>Location</u>	<u>Area infested</u>	<u>Defoliation (%)</u>
Harbour Round - Hungry Hill	65 sq. miles	95
Little Sandy Brook	3 sq. miles	50
Clench Brook - Sandy Brook	32 sq. miles	95
Long Pond, Halls Bay	1 sq. mile	50

<u>Collections</u>	<u>Larvae per tree sample</u>
	Av.
14	29

European Spruce Sawfly, *Diprion hercyniae* (Htg.)--Although sawfly population levels were extremely low in all areas sampled, larvae were collected over a much wider area than in 1965 (Fig. 21). Only low numbers were found in the Rattling Brook and Rushy Pond areas where light to moderate populations had persisted for the past three years.

<u>Collections</u>	<u>Larvae per tree sample</u>	
	Av.	Dev. from 1965
68	0.7	-1.3

Larch Casebearer, *Coleophora laricella* (Hbn.)--Population levels of the larch casebearer continued to be low in all areas except in the Grand Falls sample station where 10.5 larvae per shoot sample were recorded and light browning of foliage occurred. A summary of sampling data based on the number of casebearers on 30 fascicles per tree at 20-tree sampling stations follows:

Location	Stand vigor	Stand defoliation	<u>No. Cases on</u>	
			<u>Year-old shoots (Corr.)</u>	
			Av.	Dev. from 1965
6 miles from Badger (Buchans Road)	V	Light	0.1	+0.1
Buchans	V	"	0.0	--
4 mi. S.W. Buchans Jct.	V	"	0.1	+0.1
1 mi. W. Badger (Halls Bay Road)	V	"	0.0	--
Roberts Arm	MV	"	0.0	-0.2
Grand Falls	MV	"	10.5	+8.5
Notre Dame Jct.	V	"	0.5	--
Gambo	V	"	0.0	-0.1

V = Vigorous; MV = Moderately vigorous.

Birch Leaf Miner, Fenusa pusilla (Lep.) and Birch Leaf-Mining Sawfly, Heterarthrus nemoratus (Fall.)--These leaf miners combined to cause severe browning of roadside white birch along the Trans Canada Highway for the sixth consecutive year. The most severe browning occurred in the Bishops Falls area between Jumpers Brook and Sandy Point, and in the Gander area between Gambo and Benton, where 70 to 90% of the immature white birch was affected.

Collections

40

European Alder Leaf Miner, Fenusa dohrnii (Tisch.)--Severe browning of speckled alder was observed along the Trans Canada Highway and secondary roads throughout the District. The most noteworthy browning occurred at the following locations: Charles Brook, Victoria Cove, Horwood and Rattling Brook roads 60 to 80 per cent; Badger to Buchans 80 to 90 per cent; Glenwood to Gander Lake woods road, 60 per cent; Gander Bay South and Lewisporte roads 80 per cent.

Collections

19

OTHER INSECTS RECORDED

Species	Host(s)	Locality	Average larvae per tree sample	No. of collections
<u>Altica ambiens</u> (Lec.) Alder flea beetle	sAL	Point Leamington Road	7	3
<u>Adalia bipunctata</u> (L.) The two-spotted lady beetle	bF	Norris Arm Woods Road	0.3	1
<u>Anacamptis innocuella</u> Z. Poplar leaf roller	tA	Goodyears Cove, Norris Arm	3	6
<u>Anoplonyx luteipes</u> (Cress.) Marlatt's larch sawfly	L	5 miles south of Grand Falls	1	1
<u>Campaea perlata</u> (Guen.) Fringed looper	wB	Great Rattling Brook - Bishops Falls	1	2
<u>Caripeta divisata</u> Wlk. Gray spruce looper	bF, bS	Badger - Red Indian Lake	0.4	3
<u>Cerambycidae</u> A Borer	wB	Exploits River	0.3	1
<u>Choristoneura fumiferana</u> (Clem.) Spruce budworm	bS	Indian Cove - Fortune Harbour	0.3	1
<u>Chrysomela falsa</u> Brown A willow leaf beetle	GA, W	Throughout District	10	9
<u>Chrysomela</u> sp. A leaf beetle	sAL	Northern Arm	4	1
<u>Chrysopidae</u> Green lacewing	W	Grand Falls	0.3	1

OTHER INSECTS RECORDED (Cont'd.)

Species	Host(s)	Locality	Average larvae per tree sample	No. of collections
<u>Cicadellidae</u> Leafhoppers	tA, wB, W	Roberts Arm, Grand Falls	1	4
<u>Cimbex americana</u> Leach Elm sawfly	W	Point Leamington	0.3	1
<u>Coccinellidae</u> A lady beetle	W	Gander Bay South	3	2
<u>Coleoptera</u> sp. A beetle	bF, bS, wB	Throughout District	1	10
<u>Corythucha</u> sp. Lacebugs	W	Victoria Cove, Grand Falls	30	4
<u>Croesus latitarsus</u> Norton Dusky birch sawfly	wB	Badger, Great Rattling Brook	8	2
<u>Curculionidae</u> Weevils	L, Wi	Exploits Dam, Bishops Falls	0.5	2
<u>Dioryctria reniculella</u> (Grote) Spruce coneworm	bS	Horwood	0.3	1
<u>Eucordylea atrupictella</u> Dietz. Spruce needle miner	bS	Throughout District	0.5	10
<u>Eupithecia</u> sp. A looper	bF, bS	" "	0.4	8
<u>Feralia jocosa</u> (Guen.) Green striped caterpillar	bF, bS	" "	0.4	9

OTHER INSECTS RECORDED (Cont'd.)

Species	Host(s)	Locality	Average larvae per tree sample	No. of collections
<u>Geometridae</u>				
A looper	W, WB, tA, bF, Do	Throughout District	0.4	33
<u>Griselda radicana</u> Wlsh.				
Micro moth	bS	Badger, Sandy Brook	0.7	11
<u>Herculia thymetustis</u>				
Spruce coneworm	bF, bS	Sandy Brook	0.5	2
<u>Hymenoptera</u>				
A sawfly	bS, W, WB	Grand Falls, Halls Bay	0.3	5
<u>Lambdina fiscellaria</u>				
<u>fiscellaria</u> (Guen.)				
Hemlock looper	bF, bS	Throughout District	0.5	6
<u>Lepidoptera</u>				
A moth	tA, W, bS	Badger, Fortune Harbour, Halls Bay	1.7	3
<u>Liparidae</u>				
Tussock moth	bF, wS, wB, W	Newstead, Badger, Gambo	0.5	6
<u>Miridae</u>				
Plant bugs	bF, W	Gander Lake, Bishops Falls	0.7	3
<u>Notodontidae</u> sp.				
A moth	W	Gander Bay South, Badger	0.3	2
<u>Nyctobia limitaria</u> Wlk.				
Green balsam looper	bF	Northern Arm North, West Lake	0.3	2
<u>Crgyia antiqua</u> (L.)				
Rusty tussock moth	tA, wB, W	Halls Bay, Fortune Harbour, Botwood	0.3	3

OTHER INSECTS RECORDED (Cont'd.)

Species	Host(s)	Locality	Average larvae per tree sample	No. of collections
<u>Pabilio glaucus</u> Linn. Tiger swallowtail	tA,W	Badger	0.5	2
<u>Pentatomidae</u> Stink bugs	bF,wS,bS,W,wB	Throughout District	1.4	9
<u>Phalaenidae</u> Owlet moths	bS,L	" "	1	23
<u>Phyllactnistis populiella</u> Cham. Aspen leaf miner	tA	Halls Bay	13	9
<u>Pikonema alaskensis</u> (Roh.) Yellow headed spruce sawfly	bS,wS	Throughout District	0.6	19
<u>Pikonema dimmockii</u> (Cress.) Green headed spruce sawfly	bS,wS	" "	0.5	28
<u>Plecoptera</u> Stone fly	cCh.	Glenwood	0.5	1
<u>Pristiphora lena</u> Kincaid Spruce sawfly	bS,wS	Throughout District	0.5	22
<u>Sciaphila duplex</u> Wlshm. Poplar leaf roller	tA	Buchans Junction, Norris Arm	0.5	2
<u>Semiothisa</u> sp. A looper	bF,L,bS,wS	Badger, Halls Bay, Northern Arm	0.6	22
<u>Solenobia Walshella</u> Clem. A bagworm	bF,bS,wS	Throughout District	0.7	22

OTHER INSECTS RECORDED (Cont'd.)

Species	Host(s)	Locality	Average larvae per tree sample	No. of collections
<u>Sphinx gordius</u> Cram. Sphinx moth	W	Badger	1	1
<u>Syneta</u> sp. A beetle	SAL	Gambo Woods Road	0.3	1
<u>Syngrapha selecta</u> (Wlk.) Verdigris autograph	bS	Badger	0.3	1
<u>Tenthredinidae</u> A sawfly	bF, W, wB, wP	Throughout District	0.6	13
<u>Tetraphleps</u> sp. A predator	bF, bS, wS	" "	1	20
<u>Tortricidae</u> A moth	bS, W, Do, tA, wB	" "	1.1	25
<u>Zeiraphera</u> sp. A budmoth	bS	Rushy Pond - Grand Falls	0.3	1

DISEASE CONDITIONS

Armillaria Root Rot, *Armillaria mellea* (Vahl ex Fr.) Kummer--
Armillaria root rot continued to cause mortality of immature black spruce, balsam fir and larch in the Sandy Lake area. This disease has been reported in this area for the past 4 years. The infected stand extends along 4 miles of the Sandy Lake woods road and consists of 95% black spruce and 5% balsam fir and larch. Mortality has now reached 5% in black spruce, 2% in balsam fir and 2% in larch.

Needle Rust of Spruce, *Chrysomyxa ledicola* Lagerh. and *C. ledi* de Bary--An unusually high incidence of needle rust was recorded on the current year's foliage of 2 acres of stunted black spruce growing in a bog seven miles west of Lake Ambrose on the Victoria Lake road. An estimated 90% of the foliage was infected.

Ink Spot of Aspen, *Ciborinia whetzelii* (Seav.) Seav.--Two small outbreaks of ink spot disease were investigated in District 2. Browning was recorded as 90%, for the second consecutive year, in a 5-acre stand of immature trembling aspen along the Northern Arm - Point Leamington road. Browning was recorded as 90% on 10 mature trembling aspen trees growing along Pamehac Brook, Badger.

Red Flag of Balsam Fir--This disease was conspicuous in several immature stands of balsam fir along the Sandy Lake road, Badger and the Victoria Lake woods road.

OTHER NOTEWORTHY DISEASES

Organism	Host(s)	Locality	Remarks
<u>Bifusella faullii</u> Darker Needle cast	bF	6 miles west of Buchans Jct.	Light damage
<u>Cronartium ribicola</u> J.C. Fischer White pine blister rust	wP	Throughout District	Common
<u>Dibotryon morbosum</u> (Schw.) Theiss and Syd. Black knot	pC	" "	"
<u>Gloeosporium apocryptum</u> Ell. & Ev. Anthracnose of maple	rM	Notre Dame Junction	Light damage
<u>Melampsorella caryophyllacearum</u> Schroet Yellow witches broom	bF	Near Exploits Dam along Lake Ambrose road	Severe over 1 acre of immature bF
<u>Pollaccia radiosa</u> and <u>P. elegans</u> (Lib.) Bald. and Cif. Leaf and twig blight of poplar	tA	Throughout District	Moderate damage
<u>Pucciniastrum pustulatum</u> (Pers.) Diet. and <u>Milesia</u> sp. Needle rusts of balsam fir	bF	Southside of Exploits (near Badger)	20% of current year's foliage of 10 mature bF

113000

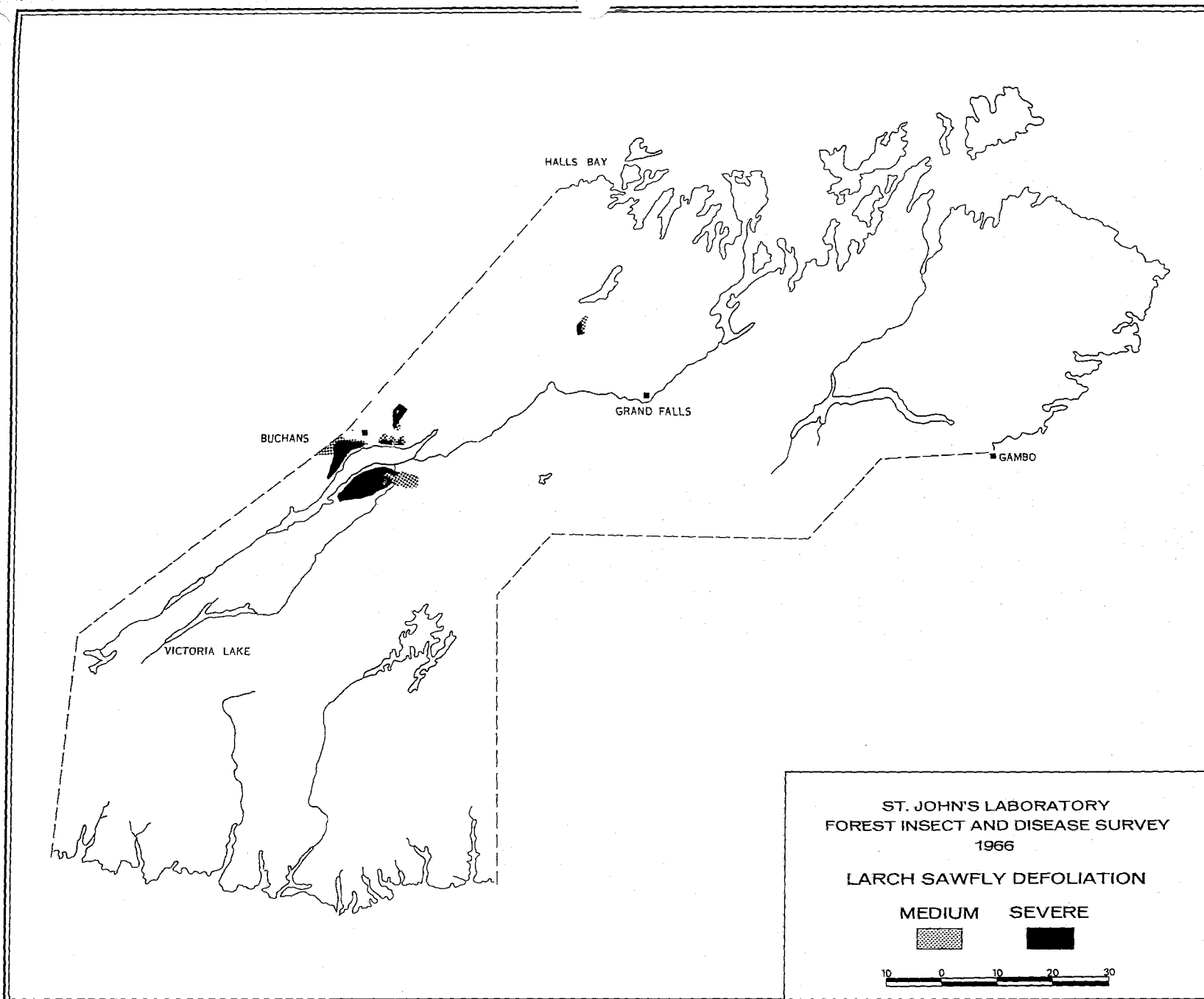
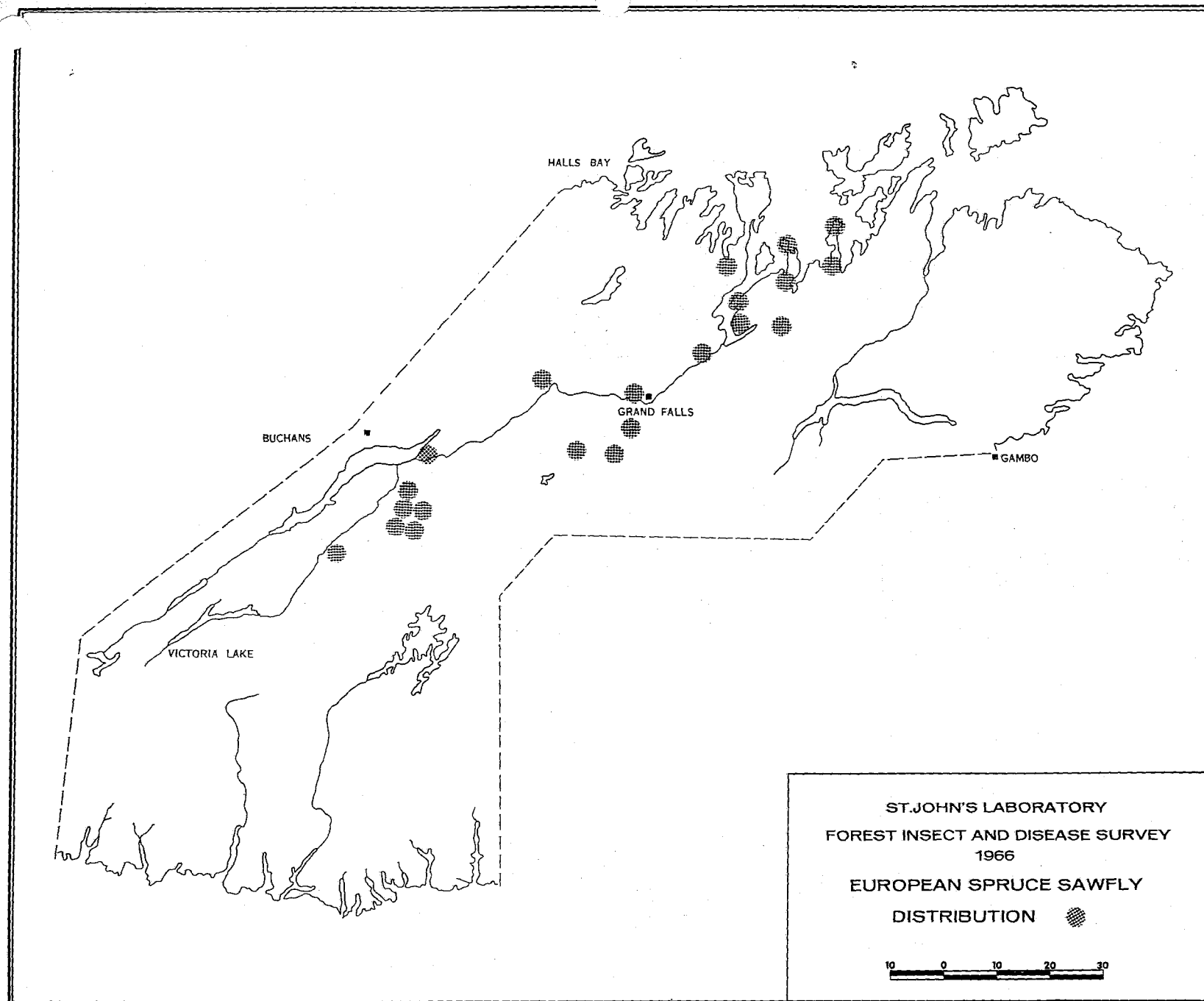


FIGURE 21



SECTION III
FOREST INSECT AND DISEASE SURVEY
DISTRICT 3, EASTERN NEWFOUNDLAND

E. M. Haines

INTRODUCTION

The 1966 field season began in early May when the writer, accompanied by other district technicians, prepared trap lines in the larch sawfly-shrew study plots near St. George's and in Terra Nova National Park. In early June, field technicians cruised seven 50-acre balsam woolly aphid damage appraisal plots at Pasadena, Bottom Brook, Little Barachois Brook, Flat Bay Brook, Fishels Brook, Crabbs River and Codroy Pond.

A record 201.8 hours of sunshine were recorded in eastern Newfoundland during the month of May, 54 hours above normal. Record high temperatures of 75 and 76 degrees also were recorded during the last week of May and both plant and insect development were advanced from a week to 10 days. Otherwise, weather conditions were about normal for the remainder of the season.

The regular forest insect and disease collecting survey commenced on June 20 and continued until August 18. David O'Brien, a forestry student from the College of Trades and Technology, St. John's, assisted in this phase of the survey during June and July. A total of 504 insect and disease samples was collected and the new enclosure slip was used for the first time under field conditions. Special collections of black-headed budworm and spruce budmoth were forwarded to Drs. G.H. Stehr and J.M. Cameron respectively of the Sault Ste. Marie laboratory. Tetrphleps species were collected for Mr. D.G. Bryant of the Corner Brook laboratory.

Eighteen thousand miles were travelled in Government vehicles and 13 hours were flown on aerial surveys in a Supercub aircraft on charter from the Provincial Department of Mines, Agriculture and Resources.

In September, assistance was given Dr. J.R. Bider, Wildlife Biologist, Macdonald College, who spent two weeks in central Newfoundland conducting an investigation on the activity pattern of the introduced shrew, Sorex cinereus cinereus Kerr. The writer continued shrew population level and dispersal studies throughout central and western Newfoundland in September, October and November.

Special visitors to District 3 during the season included Messrs. W.A. Reeks and R.M. Prentice, Program Coordinators for Forest Entomology and the Forest Insect and Disease Survey respectively, and Dr. J.R. Clark of the Maritime Forest Research Laboratory who is working on the physiology of balsam fir in relation to attack by the balsam woolly aphid.

Only minor changes were recorded in the size and degree of injury in established infestations of the balsam woolly aphid. Larvae of the spruce budmoth and associated feeders were common on white spruce throughout coastal areas. A general increase in European spruce sawfly numbers was apparent as were larvae of the hemlock looper. Small, localized infestations of the balsam fir sawfly continue on the Burin Peninsula. Larch case-bearer numbers showed an increase in the Terra Nova National Park with indications that a population build-up may be taking place. The combination of birch leaf miner and birch leaf-mining sawflies caused considerable browning of birches throughout eastern Newfoundland.

The incidence of foliage diseases on deciduous trees increased over 1965 while there were no noticeable changes on coniferous trees. Anthracnose of red and mountain maple, and leaf spot of red maple caused severe damage in some areas; and leaf and twig blight of aspen blight was again common in the northern part of the District. Catkin hypertrophy of speckled alder was more prevalent and caused severe damage in small, localized areas. Needle rusts of spruce and balsam fir persisted on a reduced scale on the Avalon Peninsula.

INSECT CONDITIONS

Balsam Woolly Aphid, *Adelges piceae* (Ratz.)--There were no significant changes in the status of the balsam woolly aphid in District 3 in 1966. However, injury symptoms were much more conspicuous at Placentia, Bellevue Beach, Swift Current and in the Marystown-Red Harbour-Boat Harbour area, and there were minor changes in infestation boundaries at each location. The Terra Nova National Park infestation remained relatively unchanged. Minor boundary changes also were recorded around Southwest and Northeast arms, along the highway to Colinet and 1 mile up the Northeast River watershed in the Placentia area. Gout was the main form of attack. (For additional information on balsam woolly aphid conditions see Section IV, "Special Survey Balsam Woolly Aphid (*Adelges piceae* (Ratz.))").

European Spruce Sawfly, *Diprion hercyniae* (Htg.)--Larvae of this insect pest were common on white and black spruce throughout eastern Newfoundland (Fig. 22). However, populations were low and defoliation negligible. Diseased specimens have been common in most collections for the past several years.

<u>Collections</u>	<u>Larvae per tree sample</u>	
	<u>Av.</u>	<u>Dev. from 1965</u>
30	1.7	+1.4

Birch Leaf Miner, Fenusa pusilla (Lep.) and Birch Leaf-mining Sawfly, Heterarthrus nemoratus (Fall.)--A slight but general decrease in the abundance of these insects was evident in 1966 although distribution remained about the same as in 1965. Browning was spotty throughout the District and confined to white and yellow birch reproduction. A trace to medium injury was recorded on white birch along the Trans Canada Highway from Gambo to Clarenville; on the Bonavista Peninsula; and in the Terra Nova, Triton Brook and Random Island areas. A maximum of 10% browning occurred on both white and yellow birch in the Freshwater Pond- Winterland region of the Burin Peninsula. The following summary shows the status of these pests:

<u>Location</u>	<u>Degree of browning</u>
Terra Nova	Medium
Terra Nova National Park	"
Port Blandford	Trace
Shoal Harbour River	Light
Clarenville	Trace
Harcourt	"
Burgoynes Cove	"
Portland	Medium
Winter Brook	Trace
Lethbridge	"
Port Rexton	"
Plate Cove	"
Freshwater Pond	Light
Winterland	"
Little Barasway River	Trace
Great Barasway River	"
Hickman's Harbour	"

Balsam Fir Sawfly, Neodiprion abietis Complex--Population levels of this sawfly were high in an even-aged stand of immature fir between Winterland and Marystown and defoliation ranged from 2% to 10% of old foliage over an area of about 5 acres. Low populations and light damage were also recorded in predominately mature balsam fir stands. Outbreaks of this insect have persisted in this general area since 1961 and populations reached their lowest levels in 1965 with the termination of the Freshwater Pond outbreak. Elsewhere, scattered larvae were collected near Harcourt on the Bonavista Peninsula and in the Terra Nova National Park. Damage was negligible in these areas.

<u>Collections</u>	<u>Larvae per tree sample</u>	
	Av.	Dev. from 1965
7	7.6	+6.9

Larch Casebearer, Coleophora laricella (Hbn.)--Larch casebearer numbers remained relatively low throughout most of eastern Newfoundland for the fourth consecutive year. However, an increase in larval numbers caused moderate browning of larch for the second year, in a small stand, in the central part of Terra Nova National Park. A summary of sampling data based on 20 trees per plot and 30 fascicles per tree follows:

Location	*Stand vigor	Stand defoliation	No. cases on year old shoots (Corr.)	
			Av.	Dev. from 1965
1 mi. W. Eastport (R39)	V	L	0.3	+0.3
George's Brook	V	L	0.23	+0.13
3 mi. N. Shoal Hbr. River Overpass (R1)	MV	M	0.15	-0.05
Bellevue	MV	M	0.25	-
Terra Nova National Park (Central)	MV	M	2.8	+1.83
Near Hillview (R1)	V	L	0.98	-
Near George's Brook (R28)	V	L	0.15	0.0
Near Sweet Bay	U	M	1.04	-
Near Trinity (R27)	MV	L	0.0	0.0
5.4 mi. S.W. Bonavista (R10)	MV	L	0.0	-
Laketown (R4)	V	L	0.53	+0.53
3.6 mi. S. Stock Cove (R26)	MV	L	0.0	-

*Stand vigor: V = Vigorous; MV = Moderately vigorous;
U = Unthrifty

OTHER INSECTS RECORDED

Species	Host(s)	Locality	Average per tree sample	No. of collections
<u>Acleris variana</u> (Fern.) Black-headed budworm	bF, wS, bS	Throughout eastern Newfoundland	0.6	23
<u>Anacamptis innocuella</u> Zell. Poplar leaf roller	tA, bPo	Avondale, Clarkes Beach, Port Blandford, Musgravetown	3.7	4
<u>Anoplonyx luteipes</u> (Cress.) Marlatt's larch sawfly	tL	Bonavista, Trinity and Avalon districts	1.7	14
<u>Aphidae</u> Aphids	bF, bS, pCh, Mo, sAl, Do	Throughout eastern Newfoundland	30.8	19
<u>Campaea perlata</u> Guen. Fringed looper	wB, sAl	Goobies, Swift Current, Ocean Pond, Great Barasway River	0.7	5
<u>Caripeta divista</u> Wlk. A spruce looper	bF, bS, wS	Portland, Monroe, Long Beach, Pouch Cove, Bunyans Cove	0.4	5
<u>Cerambycidae</u> Long-horned beetles	bF, bS, wS, moM pCh, wB, sAl	Bonavista, Trinity and Burin districts	1.7	10
<u>Choristoneura fumiferana</u> (Clem.) Spruce budworm	bS, wS	Traytown area	0.5	2
<u>Chrysomela falsa</u> Brown Willow leaf beetle	W, bPo	Harcourt, Hillview, Epworth and throughout Avalon Peninsula	19.4	8

OTHER INSECTS RECORDED (Cont'd)

Species	Host(s)	Locality	Average per tree sample	No. of collections
<u>Chrysomelidae</u> sp. Leaf beetles	Mo, ta	Arnolds Cove, Harcourt	29.5	2
<u>Cicadellidae</u> Leaf hoppers	wB, yB, sAl moM, W	Throughout eastern Newfoundland	3.8	46
<u>Cimbex americana</u> Leach Elm sawfly	sAl, wS	Long Beach, Amherst Cove	1.0	2
<u>Coccinellidae</u>	W, tL	Lethbridge, Windsor Lake	0.3	2
<u>Corythucha</u> sp. Lace bug	sAl, ta	Alexander Bay, Terra Nova National Park	20.5	2
<u>Croesus latitarsus</u> Nort. Dusky birch sawfly	wB	Amherst Cove	0.7	1
<u>Gtenicera triundulata</u> A wire worm	bS, wS, bF, sAl	Throughout eastern Newfoundland	1.0	18
<u>Curculionidae</u> Weevils	bF, bS, wS, tL, pCh, moM	Bonavista, Trinity and Avalon districts	0.6	14
<u>Diprion hercyniae</u> (Htg.) European spruce sawfly	bS, wS, nS	Throughout eastern Newfoundland	1.7	30
<u>Elateridae</u> Click beetles	bF, bS, wS, tL, sAl, wB	" " "	1.0	38
<u>Epinotia solandriana</u> L. Leaf rollers	tL	Alexander Bay	-	-

OTHER INSECTS RECORDED (Cont'd.)

Species	Host(s)	Locality	Average per tree sample	No. of collections
<u>Eucordylea atrupictella</u> Dietz. A spruce needle miner	WS	Chapel Arm, Harcourt, Hickmans Harbour	9.6	3
<u>Eupithecia</u> sp. A brown spruce looper	bF, bS, WS, nS, tL	Throughout eastern Newfoundland	0.5	17
<u>Fenusa dohrnii</u> (Tisch.) European alder leaf miner	sAL	" " "	6.2	16
<u>Feralia jocosa</u> (Guen.) Green-striped caterpillar	bS, bF	Bonavista and Trinity districts	0.3	8
<u>Gracilaria syringella</u> (F.) Lilac leaf miner	Lilac	Throughout eastern Newfoundland	- Trace	
<u>Griselda radicana</u> Wlshm. Micro moth	bF, WS	Bonavista, Trinity and Burin districts	1.5	9
<u>Lambdina fiscellaria</u> <u>fiscellaria</u> (Guen.) Hemlock looper	bF	Northeast, Little Barasway and Great Barasway Rivers (Avalon)	1.5	11
<u>Mindarus abietinus</u> Koch. Balsam twig aphid	bF	Throughout eastern Newfoundland	Trace to medium	
<u>Miridae</u> Plant bugs	bF, WS, WB, tL, sAL	Bonavista, Avalon and Burin districts	0.6	13
<u>Nematus</u> (P.) <u>limbatus</u> (Cress.) Willow sawfly	W	Hickmans Harbour and Salmonier	13.0	4
<u>Nyctobia limitaria</u> Wlk. Green balsam looper	bF, WS	Trinity, Avalon and Burin districts	0.5	10

OTHER INSECTS RECORDED (Cont'd.)

Species	Host(s)	Locality	Average per tree sample	No. of collections
<u>Orgyia antiqua</u> (L.) Rusty tussock moth	W, tA, sAl	Bonavista and Avalon districts	1.2	17
<u>Pentatomidae</u> Stink bugs	sAl, wB, W, bS, pCh, Mo	Bonavista, Trinity and Avalon districts	1.6	19
<u>Phratora purpurea purpurea</u> Brown A leaf beetle	tA, W	Thorburn Lake, Harcourt	0.5	4
<u>Pikonema alaskensis</u> (Roh.) Yellow-headed spruce sawfly	wS, bS	Throughout eastern Newfoundland	0.6	7
<u>Pikonema dimmockii</u> (Cress.) Green-headed spruce sawfly	wS, bS, nS	" " "	0.9	14
<u>Pristiphora erichsonii</u> (Htg.) Larch sawfly	tL	Bonavista and Kings Cove areas	2.2	2
<u>Pristiphora geniculata</u> (Htg.) Mountain ash sawfly	Mo	Throughout eastern Newfoundland	22.6	7
<u>Pristiphora lena</u> Kincaid A spruce sawfly	wS, bS	Portland, Adeytown, Epworth, Alexander Bay, Hatchet Cove	0.5	5
<u>Semiothisa</u> sp. A looper	bF, tL, wS, bS	Bonavista, Trinity and Avalon districts	0.6	21
<u>Solenobia walshella</u> Clem. A bagworm	bF, bS, wS	Throughout eastern Newfoundland	2.2	69
<u>Stilpnotia salicis</u> (L.) Satin moth	tA, sPo	Clareville	55.0	2

OTHER INSECTS RECORDED (Concluded)

Species	Host(s)	Locality	Average per tree sample	No. of collections
<u>Syneta</u> sp. A beetle	bF, bS, wS, wB, Mo, tL, pCh, sAl	Bonavista, Trinity and Avalon districts	0.7	38
<u>Tetrphleps</u> sp. A predator	bF, wS, tL	Bonavista, Trinity and Avalon districts	1.3	14
<u>Zeiraphera diniana</u> Guen. Douglas fir cone moth	tL	Bonavista and Trinity districts	0.8	10
<u>Zeiraphera ratzeburgiana</u> Ratz. Spruce budmoth	wS	Throughout eastern Newfoundland	-	-

DISEASE CONDITIONS

Leaf and Twig Blight of Aspen, *Pollacia radiosa* (Lib.) Bald. and Cif., and *P. elegans* Serv.--Leaf and twig blight of aspen was widespread and of greater intensity than in previous years, particularly around Trinity and Bonavista bays. Light to medium injury to regeneration and pole-size trees was recorded at Alexander Bay, Port Blandford, Harcourt, Sweet Bay, Plate Cove and Southern Bay. In the village of Trinity 30% of new twigs wilted and turned black, and 90% of new shoots were killed on trees at several locations in the town of Clarenville.

Anthrachnose of Hardwoods, *Gloeosporium apocryptum* Ell. and Ev.--This disease was very common on the foliage of red and mountain maple throughout most of eastern Newfoundland. Medium to severe damage occurred from Alexander Bay to Goobies. In the Port Blandford-Shoal Harbour River area, individual red maples suffered 75% discoloration of foliage. A trace to medium damage was recorded from Boat Harbour to Marystown on the Burin Peninsula and a trace to light damage occurred at Trinity, Port Rexton, Kings Cove, Plate Cove and Southern Bay.

OTHER NOTEWORTHY DISEASES

Organism	Host(s)	Locality	Remarks
<u>Arceuthobium pusillum</u> Pk. Eastern dwarf mistletoe	bS	Throughout eastern Newfoundland	Common
<u>Armillaria mellea</u> (Vahl ex Fr.) Kummer Armillaria root rot	bF	Holyrood, Northeast River (Avalon), Clarenville, Marystown	"
<u>Cronartium ribicola</u> J.C.Fischer White pine blister rust	WP	Throughout eastern Newfoundland	Severe and common
<u>Chrysomyxa ledicola</u> (Pk.) Lagerh. and <u>C. ledi</u> (A. & S.) de Bary Needle rusts of spruce	bS, wS	Eastern part of Avalon Peninsula, Whitbourne, Goobies, Marystown, Fortune, Great Barasway River	Marystown-Fortune 20% of foliage affected
<u>Dibotryon morbosum</u> (Schw.) Theiss and Syd. Black knot of cherry	pCh	Throughout eastern Newfoundland	Severe and common
<u>Gymnosporangium cornutum</u> Arth. ex Kern Leaf rust	Mo	Winter Brook, Port Blandford, Goobies	Winter Brook 15% of foliage affected
<u>Hypodermella laricis</u> Tub. Needle cast	tL	Marystown to Boat Harbour (Burin)	Light damage
<u>Lophodermium</u> sp. Needle cast	bF	Plate Cove-Southern Bay areas (Bonavista Peninsula)	Medium damage on regeneration

OTHER NOTEWORTHY DISEASES (Concluded)

Organism	Host(s)	Locality	Remarks
<u>Melampsorella caryophyllacearum</u> Schroet. Needle rust	bF	Eastern part of Avalon Peninsula, Bonavista Peninsula, Whitbourne, Marystown, Fortune areas	Trace to light
<u>Phyllosticta minima</u> (Berk & Curt.) Ell. & Ev. Leaf spot (purple eye)	rM	Port Blandford and Shoal Harbour River	Medium
<u>Taphrina robinsoniana</u> Gies. Catkin hypertrophy	sAl	Kings Cove, Plate Cove, Southern Bay, Port Blandford, Bloomfield, Burgoyne Cove	Port Blandford and Burgoyne Cove, severe

ST. JOHN'S LABORATORY
FOREST INSECT AND DISEASE SURVEY
1966

EUROPEAN SPRUCE SAWFLY
DISTRIBUTION

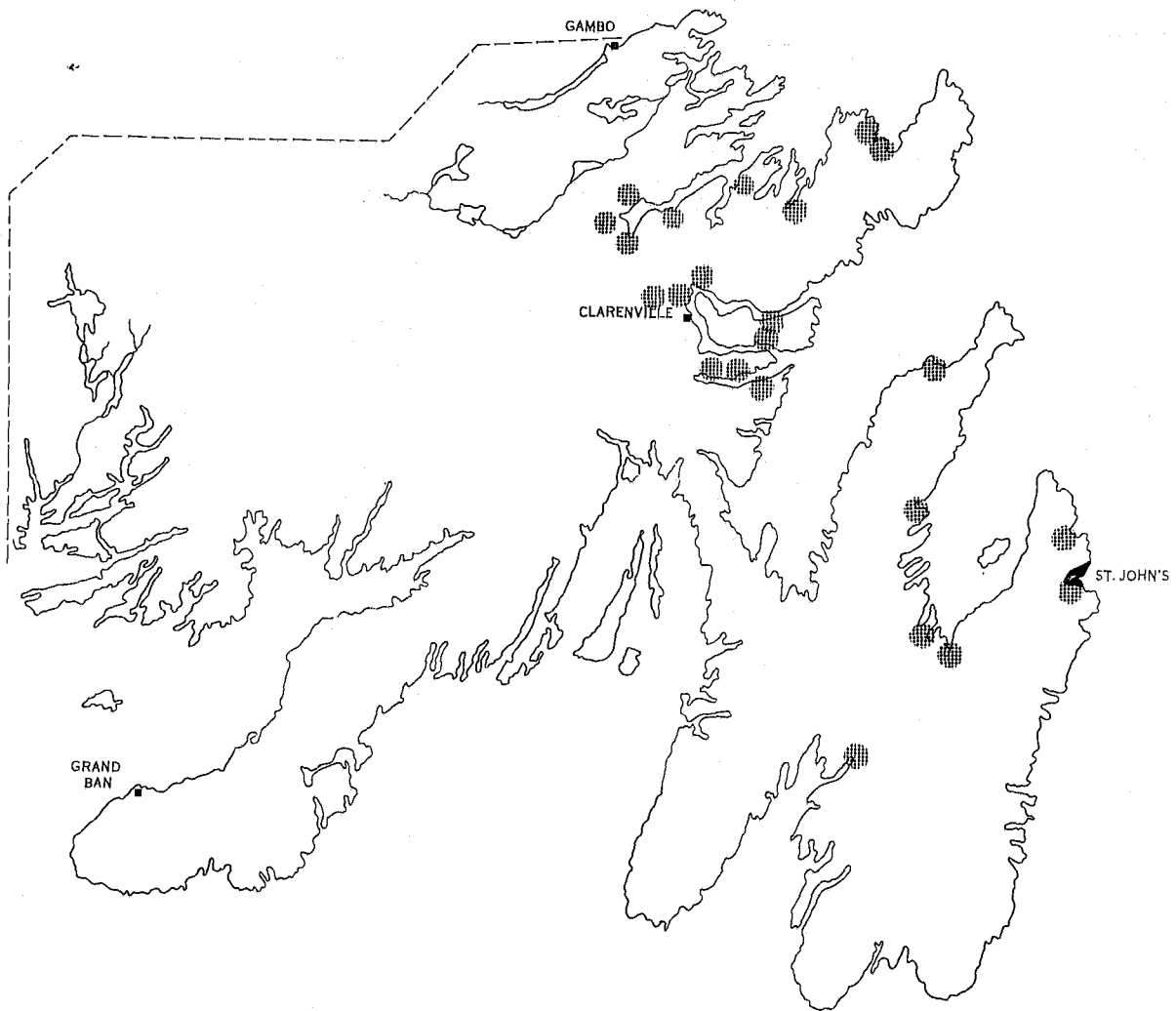
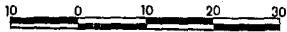


FIGURE 2 2

SECTION IV
SPECIAL SURVEY
BALSAM WOOLLY APHID
(Adelges piceae (Ratz.))

W. C. Parrott

INTRODUCTION

Balsam woolly aphid surveys were continued in 1966 to determine the current status of the aphid. District technicians conducted extensive detection, dispersal and mapping flights over their respective districts in Beaver, Cessna 180 and Super Cub aircraft in August. A S55-Sikorsky helicopter was employed on detection and intensive damage appraisal surveys in Terra Nova National Park, Lloyd's River and Red Indian Lake watersheds.

The helicopter was also used to test the effectiveness, in aphid damage surveys, of an aerial scanning and recording technique used for various types of forest insect surveys by the Departmental laboratory at Sault Ste. Marie, Ontario. Aphid damage was assessed from ground cruises conducted along the flight lines and data from the two methods were compared to determine the variability between the two systems.

Damage estimates were also recorded along randomly selected cruise lines for the second consecutive year in five 50-acre plots in the Bottom Brook, Little Barachois Brook, Flat Bay Brook, Fishels River and Crabbs River watersheds; and one new plot was added at Codroy Pond and one at Pasadena.

DISTRIBUTION

Aerial and ground surveys revealed that more than 4,000 square miles of predominately balsam fir forest on the Island of Newfoundland were infested by the aphid by 1966 (Fig. 17). The

largest and most severe infestation, about 3,200 square miles, occurred on the west coast where balsam fir comprises more than 75% of the softwood stands which supply about 600,000 cords of pulpwood annually to the pulp and paper industry. Only about 100 square miles have been infested in central Newfoundland. The main areas are around Exploits Bay and in the Lloyds River and Red Indian Lake watersheds. There were two principal infestations in eastern Newfoundland, one on the Avalon Peninsula and one on the Burin Peninsula. Smaller spot outbreaks occurred in Terra Nova National Park, at Deep Bight, Swift Current, Bellevue Beach and Placentia. The total infested area in eastern Newfoundland was estimated at 1,000 square miles.

Western Newfoundland

The boundaries of the main aphid infestations in western Newfoundland changed only slightly from 1965. However, a new spot outbreak was discovered near Goodyears Cove, Halls Bay, in June. This infestation was 38 miles due north of the spot infestation near Red Indian Falls, along the Badger-Buchans Junction Road, and 45 miles northeast of the infestation in the Upper Humber River watershed.

Halls Bay--The Goodyears Cove infestation was investigated in late October. Light gout symptoms were recorded on about 30 immature and mature balsam fir, scattered over three to four acres of Price (Nfld.) Limited property, between Goodyears Cove and South Brook Bridge. The infested area was bounded on the west by Halls Bay, on the north by a clear-cut area occupied by Gull Bridge Mining Company, on the east by the Trans Canada Highway and on the south by the local road to Goodyears Cove Camping Park.

Price (Nfld.) harvested about 20 cords of pulpwood from the infested stand in a salvage-control cut in late 1966. All balsam fir in the immediate area was removed in the operation.

Bonne Bay--There was no apparent extension of the boundaries of the aphid in the Bonne Bay area. Surveys of the Northern Peninsula showed no evidence of aphid injury symptoms north of the previously established infestation boundaries near Deer Arm. This area has been kept under close surveillance as it may be developed as a national park.

Humber River Watershed--The most significant development in aphid conditions in the Humber River Watershed was the striking appearance of accumulated gout symptoms. Severe injury and tree mortality were prevalent along the southern slopes of the valley, between Pynn's Brook and South Brook and from Steady Brook to Little Rapids. Bowaters have salvage cut some 30,000 cords of aphid infested wood in this watershed since 1960 (Table 1).

Grand Lake--Severe gout symptoms were recorded on the majority of balsam fir along the southeast shore of Grand Lake, from Harry's Brook to Little Pond Point, and mortality from aphid attack was about 5%. Bowaters Newfoundland Limited commenced cutting operations in the Grand Lake watershed in the autumn of 1965 and have salvage cut over 4,000 cords of aphid infested wood in the vicinity of Grand Pond Point during the past year.

Central Newfoundland

The most noteworthy changes in the status of aphid infestations in central Newfoundland occurred as the result of accelerated salvage cutting programs by Bowaters Newfoundland Limited, Price (Nfld.) Limited, and the Department of Mines, Agriculture and Resources (Table 1).

Minor extensions of the Norris Arm infestation were recorded. Small groups of immature trees with light gout symptoms were found between Jumpers Brook and Sir Robert Bond Bridge east of Bishops Falls. This infestation now extends along the Trans Canada Highway from the Sir Robert Bond Bridge to Notre Dame Junction.

Gander--Bowaters conducted a presalvage-salvage operation three miles east of Kings Point along the north shore of Gander Lake. An estimated 3,000 cords of pulpwood were cut in the infested stand during the winter of 1965-66 and cutting will continue in 1967.

Lewisporte--Local pulpwood operators and lumber contractors from the Lewisporte area, under license from the Department of Mines, Agriculture and Resources, salvage cut 7000 cords of aphid damaged timber in the Lewisporte area in 1965-66 and a much larger cut is planned for the Porterville area during the winter of 1966-67.

Badger--Price (Nfld.) cut about 50 cords of pulpwood from the aphid infested stand near Red Indian Falls along the Badger-Buc'ans Junction Road in 1966. Although only a few trees with initial gout symptoms were found, all balsam fir trees over an area of about five acres were cut.

Lloyds River-Red Indian Lake Watersheds--The condition of aphid infested stands in the Lloyds River and Red Indian Lake watersheds remains relatively unchanged from 1965. Price (Nfld.) plan to commence harvesting the infested stands east of Shanadithit River in 1967. This operation will be extended to Quaker's Hat and the mouth of Star River as soon as the partially constructed bridge over Shanadithit River is completed.

Eastern Newfoundland

The status of the balsam woolly aphid in eastern Newfoundland remained relatively unchanged from 1965.

Avalon Peninsula--There has been no change in the size or intensity of the infestation in the St. John's area for the past four or five years. Many of the aphid killed and severely injured trees have been removed for fuel and balsam fir and white spruce reproduction has restocked most of the severely damaged stands. Young balsam fir trees appeared healthy and free from aphid attack.

Placentia--The aphid infestation that was first reported in the Placentia area in 1965 was investigated again in 1966. Intensive ground surveys and branch sampling around Northeast River Arm and along the coastal section of Southeast Arm east of Placentia did not reveal any further extension of infestation boundaries in the area.

Bellevue Beach,--Deep Bight, and Swift Current Areas--There have been only minor expansions in the boundaries of the spot infestations at Bellevue Beach, Deep Bight and Swift Current during the past three years. However, gout symptoms are more conspicuous on a few trees at each location. Routine thinning and cutting for fuel, fencing and sawlogs have removed many infested trees from each infestation and reduced the stands to pole-size and reproduction balsam fir and white spruce.

Burin Peninsula--The erratic aphid dispersal pattern typical of spread in western Newfoundland was apparent on the Burin Peninsula in 1966. Spot infestations north of Marystown coalesced and extended the boundaries of the main infestation. These boundaries are very irregular, mainly because of the physical and vegetative features of the area which include

much bog and black spruce forest type. Several small spot outbreaks near Brookside and Little Harbour East Pond have also coalesced and form two distinct infestations north of the main infested area.

Terra Nova National Park--Detailed helicopter and ground surveys were continued in Terra Nova National Park in September to record changes in aphid conditions in the Park. These surveys indicated no appreciable boundary changes from the previous year. A few infested trees remained in and around the perimeter of the area marked for "control" cut in 1964, and scattered balsam fir trees with initial gout symptoms were observed as far east as Dunphys Pond Road but no injury symptoms were apparent east of this location. Mr. Arnold Brown, Regional Park Forester, and Mr. John Heppes, Park Superintendent, were taken on a helicopter flight over the Park in September to examine aphid conditions in the Park.

The Survey continued aphid investigations in October. Four 1/10-acre aphid research plots were established along Dunphys Pond Trail, east of Platter Cove, opposite the Narrows on the north side of Clode Sound, and along the trail to the Ochre Hills Tower. Branches were taken from 100 trees in these plots and examined microscopically. Branch samples also were collected from balsam fir trees along the north side of Clode Sound from Charlottetown to Dumpling Cove but no evidence of attack was observed in any of these areas.

On November 23 the writer accompanied the Park Superintendent and wardens on an inspection of the infested area. Although there was no change in infestation boundaries, injury symptoms were much more pronounced than were previously recorded, especially on immature balsam fir along the Trans Canada Highway near Cobblers Brook.

Branches were taken from the upper crown of several peculiar looking balsam fir in stands near Park Headquarters and along the trail from the Trans Canada Highway to Southwest Arm. These branches were examined microscopically but yielded negative results. The rather unusual appearance of many trees can be attributed to the heavy cone crop in 1966 which produced symptoms somewhat like aphid injury observed from the air or ground level.

Although control cutting has no doubt slowed the spread of the aphid in the Park, it has not contained it. Costs of control cutting have already been high and a relatively small area has been cut (Table 1). A complete sanitation cut would probably cost in excess of \$200,000 and even then there is no assurance that the remaining balsam fir trees would not be attacked from infested stands outside the Park.

It now appears that the most logical approach to the aphid problem in the Park would be to cut badly damaged trees when and where they become unsightly. This measure also would help to slow the spread of the insect but such a procedure would require very close annual surveillance. Some non-susceptible native species could be used to restore the aesthetic value of areas where large numbers of balsam fir trees have to be removed.

DAMAGE APPRAISAL

Ground Cruises

Strip cruises were carried out in the five 50-acre aphid damage appraisal plots in the Bottom Brook, Little Barachois Brook, Flat Bay Brook, Fishels River and Crabbes River watersheds; in two additional plots established near Codroy Pond and at Pasadena in 1966; and along 144.0 chains of aerial cruise line in the Lower Flat Bay Brook watershed.

Cruise lines were selected at random in each of the original plots in 1965. Cruise strips were 8 feet wide and 22.3 chains long. All trees within these strips were classified and tallied for tree size and aphid damage. The same procedure was continued in 1966. Results of these cruises are summarized as follows:

Location	Length of cruise lines	Number trees	Percent *U	trees L	by damage M	class S	D
Bottom Brook	44.6 chains	403	41	35	7	14	3
Little Barachois	44.6 chains	519	13	50	3	23	11
Flat Bay Brook	22.3 chains	160	1	27	21	36	15
Fishels River	44.6 chains	105	22	45	18	13	2
Crabbes River	44.6 chains	232	2	38	21	27	12
Codroy Pond	22.3 chains	200	39	54	3	3	1
Pasadena	22.3 chains	62	89	11	0	0	0
** Flat Bay Brook	144.0 chains	987	47	28	10	12	3

*U - Uninfested, L - light, M - medium, S - severe, D - aphid killed.

** Aerial cruise line - checked by ground cruise.

Survey of Balsam Woolly Aphid Damage Using an Operation Recorder

Experimental flights designed to classify aphid damage along cruise strips, over selected stands, were carried out in a SJ55 Sikorsky helicopter equipped with an Esterline Angus Recorder. The degree of aphid injury was recorded simultaneously, for two strips along the ground, on both sides of the line of flight using two oblique strip viewers mounted on the windows on opposite sides of the helicopter. Each observer-operator was provided with a keyboard for recording data. The navigator used aerial photographs to carry out pinpoint navigation along predetermined flight lines. Results of the aerial survey were compared with those obtained from ground check cruises conducted within portions of the flight lines.

Equipment:

The 20 pens of the recorder, which make continuous lines on a moving chart, are activated electrically and may be used singly or in various combinations. The speed of the chart past the pens, which are held against the chart throughout the recording period, can be set accurately to $\frac{3}{4}$, $1\frac{1}{2}$, 3, 6, or 12 inches per hour or per minute. A chart speed of 3 inches per minute was used in this test. The chart drive is operated by a hand-wound clockwork mechanism. Power for operating the pens is provided by a 12 volt DC power supply, which may be a portable dry cell pack. Keyboards consisted of aluminum boxes, approximately 1 x 4 x 8 inches, mounted with 8 momentary switches wired to the recorder. When a switch is closed, the electromagnet of the appropriate pen is energized and deflects the pen laterally about 1/10 of an inch. When the switch is released, the pen returns to its normal position leaving a rectangular trace on the moving chart.

Planning:

After two areas were selected, flight lines were drawn on aerial photographs (scale 1320' = 1"). Natural landmarks along the flight lines were used as ground check points. These were plotted, coded alphabetically, and marked along each line. Strips were flown at altitudes of 300, 500 and 1,000 feet.

The viewer was mounted on the helicopter so that the operator viewed a ground-strip 1/2 chain wide for each 100 feet of altitude.

Switches on the keyboard were coded as follows:

<u>Left Side</u> (Observer-operator 1)	Switch No.	Pen No.	Code classes	Description of code classes
	1	1	*Light damage	Less than 20%** M. to S. damage
	2	2	Medium damage	20% to 50% M. to S. damage
	3	3	Severe damage	Over 50% M. to S. damage
	4	4	Uninfested	Not detectable from air
	5	5	Bog/scrub	Bog and black spruce
	6	6	Open water	Ponds, rivers, etc.
<u>Right Side</u> (Observer-operator 2)	Switch No.	Pen No.	Code classes	Description of code classes
	1	15	Light damage	Less than 20% M. to S. damage
	2	16	Medium damage	20% to 50% M. to S. damage
	3	17	Severe damage	50% + M. to S. damage
	4	18	Uninfested	Not detectable from air
	5	19	Bog/scrub	Bog and black spruce
	6	20	Open water	Ponds, rivers, etc.
<u>Centre</u> (Navigator)	-	9	Check points	Natural landmarks

relative overall damage to stand.

*M. to S. - medium to severe, relative to trees.

Operations

The crew of the helicopter consisted of a pilot, navigator and two observer-operators. The navigator occupied the co-pilot's seat and assisted the pilot in maintaining track by map-reading. The navigator also recorded the ground check points by sending the appropriate letter in morse code to the recorder by means of a remote control switch. The check points were recorded on the chart and were used to relate ground speed to chart speed when plotting data on aerial photographs or maps.

The two observers were stationed in the body of the helicopter, one on each side. They were equipped with oblique strip viewers attached to the side windows by suction cups. Each observer held a recorder keyboard on his lap which he used to relay data. Data recorded on the charts were transferred to maps, using a proportional divider.

The two aerial cruise lines were located in the Lower Flat Bay Brook and Bottom Brook watersheds. The Flat Bay line was flown both ways at altitudes of 300 and 500 feet and one way at 1,000 feet. Comparisons were made on observations by the same observer at the three selected altitudes, and also between observers flying over the same sections of the line at comparable heights (Tables 2, 3, 4, and 5). Aphid damage was assessed for groups rather than by individual trees.

Ground cruises were carried out along sections of the Flat Bay line in November to compare aerial and ground assessments. A total of 144.0 chains, 8 feet wide, was cruised and the result of this cruise is summarized as follows:

Compass course	**Line section	Length of section	Number of trees per section	Percent trees by damage class			
				*U	L	M	S
S 85 E	B-C	57.0 chains	250	63	23	7	7
N 85 W	C-B	55.0 chains	506	47	31	10	12
S 85 E	D-E	32.0 chains	198	34	31	18	17

*U - uninfested, L - light, M - moderate, S - severe

**
B-C line 72% scrub, bog and water
C-B line 58% scrub, bog and water
D-E line 62% scrub, bog and water

The Bottom Brook line was flown both ways at an altitude of 500 feet. This line was not ground checked because extensive clear cutting had been carried out along the line immediately following the aerial cruise.

RECOMMENDED CHANGES IN TECHNIQUES FOR FUTURE SURVEYS

It was apparent from the first experience with the Esterline Angus Recorder that in order to obtain accurate and more uniform information on aphid damage from strip line cruises some of the techniques will require changing.

Because the aphid normally attacks individual trees or groups of trees rather than large continuous areas it is difficult to assess damage over large areas or watersheds. It is therefore imperative that the ground check cruise cover the same strip as the aerial cruise so that they can be compared. During the 1966 survey the observers, using the oblique viewers,

were actually scanning tracts on each side of the line of flight and the data collected during the aerial cruise could not be compared with detailed ground cruise data recorded along the line of flight. This problem could be eliminated if a technique was developed to allow the observer to record damage directly under the aircraft.

Although flight lines were flown at several experimental heights, an altitude of 500 feet and an air speed of 40 knots appeared to be the best combination for an efficient operation. This gave the observer time to assess damage, the navigator a good view for locating check points, and the pilot sufficient height to manoeuvre the helicopter with safety.

There were differences in opinion, between observers, on assessing the magnitude of balsam woolly aphid damage. One observer classified damage as more severe than was indicated by ground checks, while the other observer underestimated the degree of damage. The relative estimates of stand damage would be more consistent if observers only classified damage on individual trees.

Stands in the Lower Flat Bay watershed were fairly open, and stand composition was about equal part softwoods and hardwoods. The hardwood foliage obscured the lower crowns of many of the medium to severely damaged balsam fir in early October and the conspicuous grey tops gave the impression that the trees were dead. This could result in a higher appraisal of damage than would be recorded by ground cruises. This problem might be rectified, in part, by conducting the aerial cruise in late October after the hardwood leaves had fallen.

Table 1

A summary of control and salvage operations, in balsam woolly aphid infested stands, by forestry agencies during the past 12 years.

District	Period	Agency	Locality	Cords salvaged
Western	1956-66	Bowaters(Nfld.)Ltd.	St.George's & West	400,000
"	1960-66	" " "	Humber Valley	15,000
"	1963-66	" " "	Bottom Brook	33,000
"	1964-66	" " "	Deer Lake	15,000
"	1965-66	" " "	Grand Lake	4,000
Central	1961-63	Price(Nfld.) Ltd.	Norris Arm	300
"	1962-63	" " "	Red Indian Lake	500
"	1965-66	Dept.Mines, Agr., Resources (Local contractors)	Bay of Exploits	7,000
"	1965-66	Bowaters(Nfld.)Ltd.	Gander Lake	3,000
"	1966	Price (Nfld.) Ltd.	Badger-Buchans Rd.	50
"	1966	" " "	Halls Bay	20
"	1966-67 (proposed)	" " "	Red Indian Lake	15,000
Eastern	1964-67	Indian Affairs and Northern Develop- ment	Terra Nova National Park	2,000

Table 2

The following is a summary of data recorded, with the aid of the Esterline Angus Recorder, during an aerial cruise of balsam woolly aphid infested stands in the Lower Flat Bay Brook watershed in October, 1966.

Observer 1 E. C. Banfield Course S 85°E

Line section	Altitude flown	Percent classification of terrain including fir by aphid damage class					
		Water	Bog/Barren	*U	L	M	S
A-B	300 ft.	5	95	-	-	-	-
A-B	500 "	10	90	-	-	-	-
A-B	1,000 "	10	90	-	-	-	-
B-C	300 "	18	10	5	42	25	-
B-C	500 "	20	-	25	20	20	15
B-C	1,000 "	12	75	-	13	-	-
C-D	300 "	30	10	-	-	45	15
C-D	500 "	20	10	-	20	50	-
C-D	1,000 "	-	25	-	25	50	-
D-E	300 "	10	30	-	40	20	-
D-E	500 "	5	10	-	45	40	-
D-E	1,000 "	20	60	-	-	20	-
E-F	300 "	20	65	-	7	8	-
E-F	500 "	20	50	10	-	20	-
E-F	1,000 "	29	64	-	-	7	-
F-G	300 "	10	40	-	40	10	-
F-G	500 "	10	60	10	10	-	10
F-G	1,000 "	10	90	-	-	-	-
G-H	300 "	20	40	3	22	15	-
G-H	500 "	70	15	-	15	-	-
G-H	1,000 "	50	50	-	-	-	-

*U - uninfested, L - light, M - medium, S - severe

Table 3

The following is a summary of data recorded, with the aid of the Esterline Angus Recorder, during an aerial cruise of balsam woolly aphid infested stands in the Lower Flat Bay Brook watershed in October, 1966.

Observer 2 L. J. Clarke Course S 85°E

Line section	Altitude flown	Percent classification of terrain including fir by aphid damage class					
		Water	Bog/Barren	*U	L	M	S
A-B	300 ft.	5	95	-	-	-	-
A-B	500 "	-	83	-	-	17	-
A-B	1,000 "	-	90	-	-	-	10
B-C	300 "	-	37	-	-	20	43
B-C	500 "	-	33	-	-	16	51
B-C	1,000 "	10	30	-	-	-	60
C-D	300 "	15	50	-	-	15	20
C-D	500 "	18	36	-	-	28	18
C-D	1,000 "	25	35	-	-	-	40
D-E	300 "	13	37	-	-	10	40
D-E	500 "	28	28	-	-	-	44
D-E	1,000 "	33	20	-	-	-	47
E-F	300 "	10	62	-	-	-	28
E-F	500 "	7	57	-	-	-	36
E-F	1,000 "	10	70	-	-	-	20
F-G	300 "	15	38	-	-	-	47
F-G	500 "	20	40	-	-	-	40
F-G	1,000 "	15	35	-	-	-	50
G-H	300 "	18	50	-	-	5	27
G-H	500 "	20	40	-	-	-	40
G-H	1,000 "	20	20	-	-	-	60

*U - uninfested, L - light, M - medium, S - severe

Table 4

The following is a summary of data recorded, with the aid of the Esterline Angus Recorder, during an aerial cruise of balsam woolly aphid infested stands in the Lower Flat Bay Brook watershed in October, 1966.

Observer 1 E. C. Banfield Course N 85°W

Line section	Altitude flown	Percent classification of terrain including fir by aphid damage class					
		Water	Bog/Barren	*U	L	M	S
A-B	300 ft.	10	70	-	-	20	-
A-B	500 "	-	75	-	-	25	-
B-C	300 "	20	15	15	30	20	-
B-C	500 "	-	16	-	50	34	-
C-D	300 "	10	35	-	40	15	-
C-D	500 "	18	36	-	46	-	-
D-E	300 "	10	35	-	45	10	-
D-E	500 "	9	18	-	9	64	-
E-F	300 "	15	70	-	5	10	-
E-F	500 "	7	64	-	-	22	7
F-G	300 "	10	35	10	30	15	-
F-G	500 "	-	10	-	10	80	-
G-H	300 "	-	50	-	40	10	-
G-H	500 "	30	40	-	-	30	-

*U - uninfested, L - light, M - medium, S - severe

Table 5

The following is a summary of data recorded, with the aid of the Esterline Angus Recorder, during an aerial cruise of balsam woolly aphid infested stands in the Lower Flat Bay Brook watershed in October, 1966.

Observer 2 L. J. Clarke Course N 85°W

Line section	Altitude flown	Percent classification of terrain including fir by aphid damage class					
		Water	Bog/Barren	*U	L	M	S
A-B	300 ft.	20	80	-	-	-	-
A-B	500 "	-	83	-	-	-	17
B-C	300 "	5	35	-	-	10	50
B-C	500 "	22	45	-	-	11	22
C-D	300 "	25	25	-	-	-	50
C-D	500 "	20	20	-	-	-	60
D-E	300 "	7	23	-	-	-	70
D-E	500 "	28	36	-	-	-	36
E-F	300 "	15	60	-	-	-	25
E-F	500 "	14	66	-	-	-	20
F-G	300 "	15	60	-	-	-	25
F-G	500 "	-	63	-	-	-	37
G-H	300 "	30	20	-	-	-	50
G-H	500 "	33	50	-	-	-	17

*U - uninfested, L - light, M - medium, S - Severe

ST. JOHN'S LABORATORY
FOREST INSECT AND DISEASE SURVEY
1966

BALSAM WOOLLY APHID
INFESTATIONS

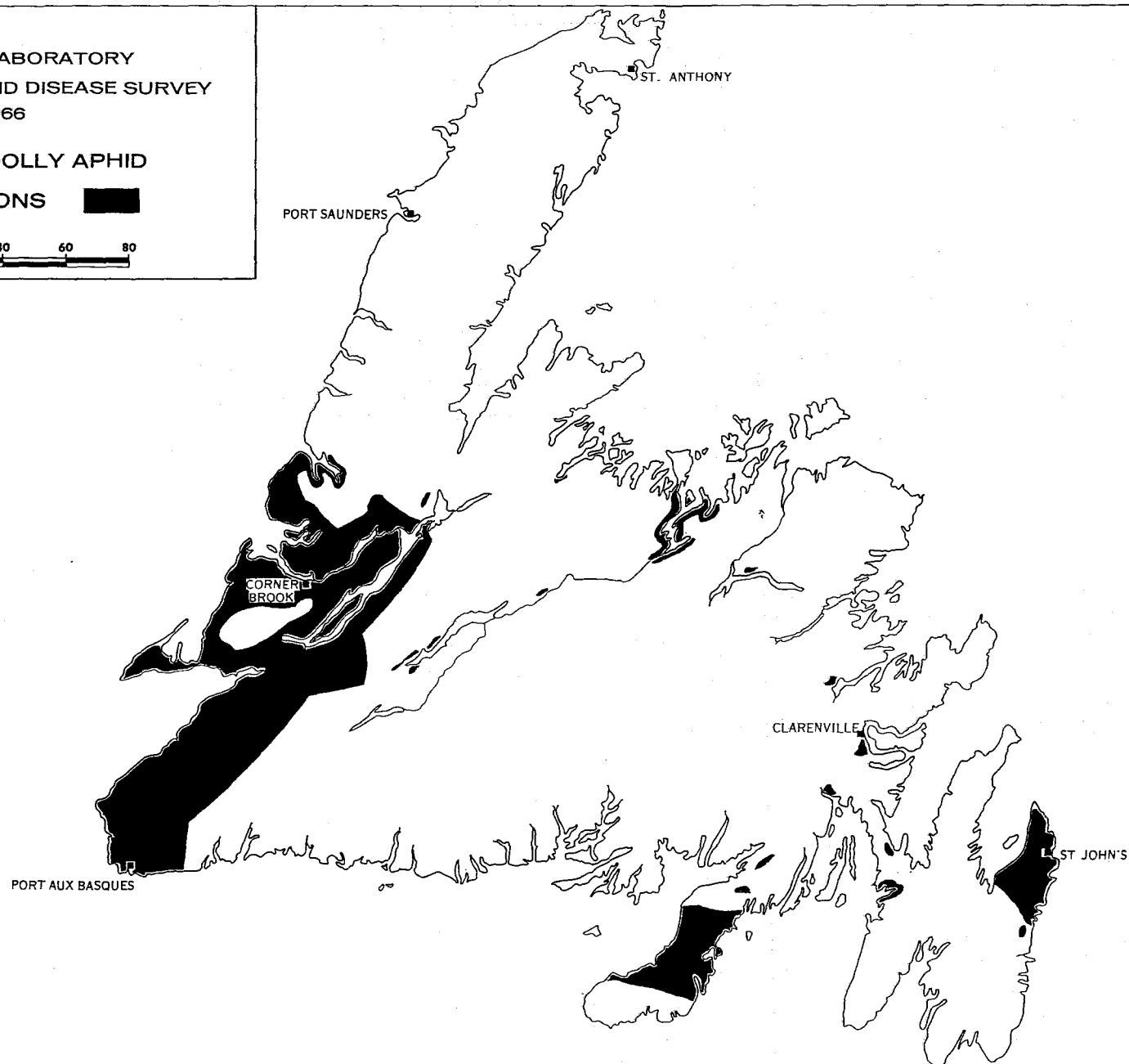
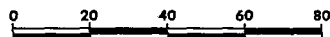


FIGURE 17



Figure 1 Light gout, caused by balsam wooly aphid feeding, swellings distinct on close examination. (side view).

FIGURES 1 - 4 PHOTOS BY W.C. PARROTT
& D.G. BRYANT

FIGURES 5 - 16 PHOTOS BY W.C. PARROTT



Figure 2 Light gout, caused by aphid feeding, swellings distinct on close examination. (front view).



Figure 3 Light gout, caused by aphid feeding, node swellings distinct, stunting and distortion present.

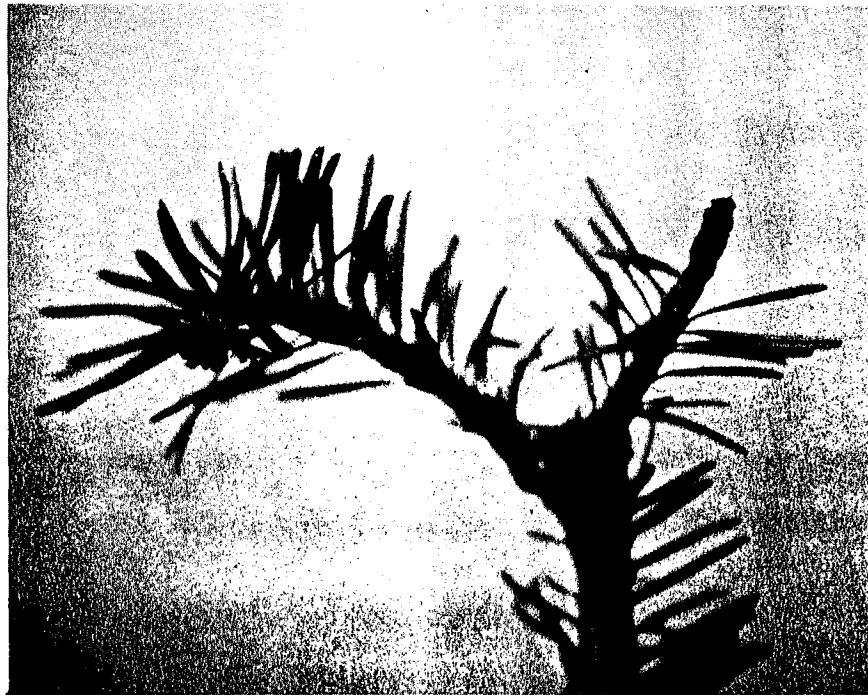


Figure 4 Moderate gout, caused by aphid feeding, node swellings and distortion distinct, some branch tips inhibited, (current shoots missing) and foliage thin at the tips, no obvious mortality. (side view).



Figure 5 Immature balsam fir with moderate gout, node swellings, and distortion distinct, some branch tips inhibited, current shoots missing, foliage thin at the tips and some branch tip mortality.



Figure 6 Immature, pole-size, balsam fir with moderate to severe gout. Note pronounced taper.



Figure 7 Immature, pole-size, balsam fir with severe gout, fair recovery, note: pronounced taper.



Figure 8 Successful recovery of sapling balsam fir, showing subordinate lateral replacing dead leader on three occasions.



Figure 9 Tap mortality caused by prolonged accumulated gout.



Figure 10 Gouty, deformed top, caused by medium to severe, accumulated gout.



Figure 11 Gouty, broken top. This condition is widespread throughout the older aphid infested stands in Western Newfoundland.



Figure 12 This tree succumbs to the aphid after 15 years of moderate to severe gout attack followed by one year of severe stem attack. Note pronounced taper.



Figure 13 Recovery in the apical portion of an immature to mature balsam fir tree, severely damaged by the aphid.



Figure 14 Recovery, flat top, with good lateral growth of immature balsam fir tree, following vertical killing by the aphid.



Figure 15 Recovery, flat top, with good lateral growth of immature balsam fir tree, following vertical killing by the aphid. Note: New leader forming, center-top of tree.



Figure 16 Severely deformed top of mature balsam fir. Typical of many aphid infested trees that have been subjected to prolong gout attack, and that have had subordinate laterals replace dead leaders on several occasions.

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