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QUEBEC REGION

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INTRODUCTION

In 1970 mean monthly temperatures were below average except for May, June and September, and above normal during the remaining months. Precipitation was low in April but was above normal for the remainder of the growing season. Exceptionally high precipitation was recorded in May and September.

During the year, emphasis was placed on spruce budworm surveys and a red-headed pine sawfly control project in cooperation with the Quebec Department of Lands and Forests. This had an effect on the general insect and disease sampling, and the number of samples was considerably reduced. However, the Department of Lands and Forests kindly contributed valuable information on several insect species dealt with in this report, and their assistance is gratefully acknowledged.

The current spruce budworm outbreak in western Quebec increased in both severity and extent in 1970. It now covers an area of 5 million acres, about 70% of which supports moderate or severe infestations. Populations of the budworm also increased elsewhere in the Province and infestation foci were found in central and eastern Quebec. The area of distribution of the gypsy moth increased in south-central Quebec and numbers of the fall webworm increased markedly. The eastern hemlock looper was more common and infestations of the Bruce spanworm, birch casebearer, green-striped mapleworm and orange-humped mapleworm occurred locally. In contrast, populations of the jack-pine budworm and the red-headed pine sawfly declined. The outbreak of cedar leaf miners regressed and population levels of numerous other insect species remained static.

The distribution of the smaller European elm bark beetle, a vector of the Dutch elm disease, remained unchanged but six new infestations of the beech scale, part of the beech bark disease complex, were found in south-central Quebec.

Adverse weather conditions were responsible for winter drying of conifers and frost damage for the second consecutive year, particularly in central and eastern Quebec. Weather conditions apparently favored the development of Dutch elm disease and sclerodermis canker. Symptoms of the latter were especially conspicuous and a special effort was made to determine its distribution particularly on jack pine seedlings and saplings. Nectria canker of balsam fir continued to spread at the same rate as last year. Damage from the root rot caused by *Polyporus tomentosus* occurred over a wider area. Extensive trappings for *Fomes annosus* basidiospores gave negative results.

IMPORTANT FOREST INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)—In 1970 spruce budworm populations increased considerably for the third consecutive year in Quebec and the insect has now reached outbreak proportions in three different areas namely: the Dumoine—Gatineau in western Quebec, the Saint-Maurice in central Quebec and Lac Témiscouata in eastern Quebec (see page 7). These infestations are discussed separately below. Conditions in each were established through aerial and ground surveys, with responsibilities being shared by prov-

vincial and federal organisations. Generally, the Quebec Department of Lands and Forests was responsible for aerial spraying operations and aerial surveys, while the Forest Insect and Disease Survey of the Canadian Forestry Service was mainly concerned with ground observations.

Dumoine-Gatineau Infestation. The Dumoine-Gatineau infestation is by far the most extensive of the three infestation areas. It was first discovered in a mature balsam fir and white spruce stand, 4 square miles in area, at Low, Gatineau County, in 1967. At that time, the insect was also found in surrounding localities but in low numbers. Later observations on past defoliation led to the conclusion that another center of infestation had developed at the same time on the Dumoine River. In 1968 the infestation spread considerably and by 1969, moderate and severe defoliation was recorded over an area of 560,000 acres, some of which had been defoliated for three consecutive years. Provincial and federal authorities agreed to the spraying of 24,000 acres of infested balsam fir stands in the Gatineau watershed in 1970 in an attempt to protect foliage and/or prevent tree mortality. Budworm populations were reduced in the sprayed areas in general but the objective of the spraying was not completely achieved, and some tree mortality occurred. Outside the sprayed areas budworm populations were favored by dry warm weather and important moth flights were observed from July 10-15. An aerial survey carried out by the Province over an area of 12 million acres in western Quebec in July and August indicated that moderate and severe defoliation of the current year's growth had occurred over an area of 3,350,000 acres, an increase of 2,790,000 acres over 1969. Ground observations in late August and early September revealed that severe defoliation had occurred for three consecutive years in areas totalling 660,000 acres, and considerably more had experienced 2 years of severe defoliation. Egg-mass surveys carried out at 297 localities in the main infestation and adjacent areas, gave a high egg count at 89% of the sampling stations. The forecast is, therefore, for severe defoliation over most of the infestation area in 1971. The following table gives a summary of the results of the egg-mass surveys.

Area	No. of localities sampled	Egg masses/100ft ² of foliage			Damage forecast for 1971*
		Min	Max	Avg	
Pomponne Depot.....	36	221	3385	1164	S
Nigault Lake.....	22	400	4077	1110	S
Lower Dumoine.....	16	248	2380	868	S
Ottawa—Lower Noire.....	21	50	2200	995	S
Lower Coulonge.....	24	15	3492	891	S
Ottawa—Lower Gatineau					
Unsprayed.....	29	0	2988	890	S
Sprayed.....	22	10	1800	326	S
Central Gatineau.....	89	0	7133	1083	S
Baskatong—Cabonga.....	38	0	1777	646	S
	297			940	

*S=Severe; 313 egg masses per 100 ft² of foliage are sufficient to produce severe defoliation on balsam fir the following year.

The high egg-mass counts obtained in the sprayed portions of the Ottawa-Lower Gatineau area resulted from reinvasion from the outside. Several meetings were held with provincial authorities to study the spruce budworm situation in western Quebec, and it was finally decided that high hazard areas, that is, areas where balsam fir had suffered three consecutive years of moderate and

severe defoliation and having a high egg population, should be recommended for treatment in 1971. Serious consideration is also being given to including in the 1971 spray program, certain areas showing 2 years of severe defoliation located within the range of operational airfields and that would require protection in 1972 should the infestation continue.

Saint-Maurice Infestation. The Saint-Maurice infestation which developed in a semi-mature white spruce plantation was discovered in 1966. The population increased in 1967, and in 1968 an area of 3,350 acres was sprayed from the air in an attempt to bring that infestation to an end. The objective was not completely achieved as evidenced by the surveys of 1969, and in June 1970, 4,500 acres of white spruce plantations that were still infested were sprayed. Unfortunately insect mortality due to the treatment could not be determined accurately because of the lack of check plots, the whole infested area having been treated. However pre- and post-spray population counts indicated that a reduction of 89% of the budworm population occurred. An aerial survey conducted in the area in August 1970 located two areas of light defoliation, the first consisted of 450 acres inside the sprayed area and the second, 2,600 acres south of the sprayed plantations in a mixed-wood forest containing white spruce and balsam fir. Eleven localities were sampled for eggs and four gave a high count of which three were in the mixed-wood infestation area.

Lac Témiscouata Infestation. The first sign of an increase in spruce budworm populations in the Témiscouata region was noted in 1968 in the Green River watershed. In 1969 light defoliation was observed in the same area and in an additional area north of Lac Pohenegamook, 50 miles to the southwest. In the spring of 1970 defoliation was again reported in additional localities and it was decided to gather more detailed information on conditions prevailing in the Témiscouata region. An area of approximately 3,000 square miles was surveyed by helicopter and budworm defoliation was recorded in 10 different foci totalling 42,500 acres. In these, defoliation was estimated as light except in one, north of Lac Pohenegamook where it was moderate. These observations were confirmed by ground surveys except for one area, southeast of Lac Témiscouata where defoliation was also moderate. Egg surveys were carried out in 51 localities throughout the area. Eggs were found in 24 localities with four of them giving high egg counts. The average number of eggs per 100 square feet of foliage was estimated at 102 (8-615). The only area where moderate to severe defoliation can be expected in 1971, is located southeast of Lac Témiscouata. Aerial spraying of all infested areas is being considered to suppress these isolated foci, which could give rise to a widespread outbreak.

Other areas. Outside the infestations referred to above, populations of the insect are generally on the increase. The number of budworm collections received each year by the Department of Lands and Forests have increased progressively from two in 1965 to 210 in 1969. Light traps located outside of the main areas of infestation that caught only a few budworm moths in 1969, captured up to 5,600 adults in 1970. Important moth flights were reported in the cities of Hull and La Tuque. In addition defoliation and egg-mass surveys revealed the presence of one small focus of moderate to severe infestation near Cap-à-l'Aigle, Charlevoix County; in that area, the egg count was high and severe defoliation is expected in 1971. Elsewhere, defoliation was either light or negligible and egg counts were low.

Red-Headed Pine Sawfly, Neodiprion lecontei (Fitch)—An experimental trial with a nuclear polyhedrosis virus to control the red-headed pine sawfly was undertaken in the Saint-Jovite area in 1970 at the request of entomologists

in Quebec. The project also included parallel experiments to determine the effectiveness of several chemical insecticides against this sawfly. The project was a cooperative one between four organizations: the Quebec Department of Lands and Forests, and the Forest Insect and Disease Survey, the Chemical Control Research Institute and the Insect Pathology Research Institute of the Canadian Forestry Service. In 1969, two areas appeared suitable for the tests, the Shawville area, Pontiac County and the Saint-Jovite area, Terrebonne County. Preliminary sampling in early June 1970 led to the selection of the second area, due to the relatively low egg populations in the Shawville area. Numerous plantations in the Saint-Jovite area contained up to one egg cluster per tree (4-5 feet high) and were considered suitable for the project. Some of the plantations later had to be dropped from the trials due to egg parasitism by *Tetrastichus* sp. For the same reason, parts of the experiment and more particularly those related to the use of chemical insecticides, were cancelled. Preliminary results suggest that the virus trials were completely successful. Larval mortality began about 10 days after spraying, and most of the larvae eventually died from the virus on the sprayed trees. Toward the end of the experiment some of the larvae on the control trees also became infected and died. Advantage was taken of this experiment to prepare some virus stock for future use. Sampling outside of the Shawville and Saint-Jovite areas, indicated that populations were generally at a low level in 1970.

Cedar Leaf Miners—Damage to cedar stands and hedgerows in southern Quebec by four leaf miners, *Argyresthia thujiella* Pack., *A. freyella* Wlsh., *A. aureoargentella* Brower and *Pulicalvaria thujaella* Kft. continued but to a lesser degree in 1970; browning of the foliage was less striking in many localities within the main area of infestation. In a few localities some of the trees severely affected in 1969, died; others refoliated partially in 1969 and their foliage remained green in 1970. However, numerous areas of moderate and severe browning were again found, particularly along Route 52 in Huntingdon and Saint-Jean counties, in the southern section of Brome County, near Waterloo, Roxton Falls and South Roxton in Shefford County and near Compton and Cookshire, Compton County. Isolated areas of moderate and severe browning were also recorded at Saint-Sébastien, Frontenac County and Saint-Victor, Beauce County. Outside of the main area of infestation browning was either light or negligible.

Jack-pine Budworm, *Choristoneura pinus pinus* Free.—The important jack-pine budworm infestation found in 1969 south of Mercier Dam in Gatineau County was sprayed with insecticide in 1970. The spraying operation was carried out by the Quebec Department of Lands and Forests and covered the entire 2,700 acres of infestation; the objective was to protect the foliage and prevent the insect from spreading. Pre- and post-spray survey reports indicated that population reductions averaged 68%. Egg counts were made in five localities in the fall. The average of 0.1 egg mass per 24-inch branch tip was recorded, which indicates that the population will be low in 1971.

In 1970, the jack-pine budworm was found in small numbers at a few additional localities: Saint-Jovite and Saint-Faustin, Terrebonne County; Arundel, Argenteuil County; Parc de la Vérendrye, Mistassini, Roberval County; and Châte-aux-Galets, Chicoutimi County. According to records obtained from the Department of Lands and Forests, the insect was also present in Courville Township, Abitibi-Est County; Milot, Roberval County; and near Lac-aux-Sables, Portneuf County. In the small infestation area found in 1967 in Ile Calumet, Pontiac County, the larval population was low and only light defoliation was recorded in 1970.

Jack-pine Sawflies, *Neodiprion* spp.—Special sampling conducted during the past 2 years by Dr. D. R. Wallace, Forest Research Laboratory, Sault-Sainte-Marie, Ontario, to clarify the distribution of the sawfly complex on jack pine was discontinued in 1970. In addition, sampling of jack pine by the survey staff was considerably reduced due to pressure of other work.

In 1970, the population of the Swaine jack-pine sawfly, *Neodiprion swainei* Midd., was generally low in Quebec. Local infestations of light to moderate intensity were, however, reported at Mistassini and vicinity, Roberval County, and Saint-Léon, Chicoutimi County. Quebec Department of Lands and Forests reported two local infestations: a light one at Ferland, Chicoutimi County, a few miles east from the previous infestation on the Rivière-à-Mars watershed and a severe one along Susy road in the upper Gatineau watershed. In the Saint-Maurice watershed the population was low except at Lac Rond, where it was moderate.

The moderate to severe infestation of the red-pine sawfly, *N. nanulus nanulus* Schedl, reported on Ile Calumet in 1968 that had declined in 1969, collapsed completely in 1970.

Birch Casebearer, *Coleophora fuscadinella* (Zell.)—As predicted by casebearer counts made after leaf fall in 11 permanent sample plots established in 1969, defoliation by this insect was light except in some localities of Témiscouata County. It became evident, however, through ocular observations made in August 1970 that the population of the insect was increasing. This was confirmed by counts of the overwintering populations made in the fall. The data obtained in 1969 and 1970 are presented in the following table.

Locality	County	Average number of casebearers per bud*	
		1969	1970
Sainte-Germaine.....	Kamouraska	0.8	0.8
Estcourt.....	Témiscouata	6.6	6.6
Saint-Jean-de-la-Lande.....	Témiscouata	2.3	3.6
Cabano.....	Témiscouata	2.1	6.1
Saint-Mathieu.....	Rimouski	1.4	1.6
Bic.....	Rimouski	1.8	8.5
Saint-Anaclet.....	Rimouski	2.3	4.4
Metis Beach.....	Matane	2.4	3.1
Routhierville.....	Matapédia	1.1	2.5
Oak Bay.....	Bonaventure	0.2	0.6
New Richemond.....	Bonaventure	0.9	1.4

*It is estimated that five casebearers per bud will cause severe defoliation of white birch the following year.

These data indicate that some population increase has occurred in nine of the 11 localities sampled and that the increase was particularly significant at Cabano, Témiscouata County and Bic, Rimouski County. On the basis of these counts severe defoliation is expected on white birch in several localities of Rivière-du-Loup, Témiscouata and Rimouski counties in 1971, providing weather conditions during the winter 1970-71 are favorable for the insect. The Department of Lands and Forests received 953 collections from birch from mid-June to mid-September, the period of insect abundance, and 410 contained specimens of this casebearer. Most of the positive collections originated in eastern Quebec. Outside the areas mentioned above, the insect was collected over a band, 50-miles wide north of the Saint Lawrence River and extending from Portneuf County in the west, to Port-Cartier, Saguenay County in the east.

Birch Leaf Miners — The population of the birch leaf miner, *Fenusa pusilla* (Lep.), has generally been high and the browning of birch foliage very striking each year during the last decade. The percentages of leaves affected on white and wire birch were determined from 1967 to 1969 and the results are illustrated by the data presented in the following synopsis.

Year	Wire birch		White birch	
	No. localities	% leaves affected	No. localities	% leaves affected
1967.....	24	42	37	22
1968.....	27	40	34	42
1969.....	17	32	2	21

These data show that a substantial proportion of the leaves of both tree species were affected each year. The percentage of affected leaves was higher on wire birch than on white birch in 1967 and 1969 but in 1968 it was approximately the same for both species. Unfortunately quantitative sampling could not be carried out in 1970 and the information available for this year is based only on ocular observations. Some decrease in the amount of damage was observed in some areas and in other areas the insect was still very common.

The amber-marked leaf miner, *Profenusa thomsoni* (Konow), maintained a high population level in the area of infestation reported in 1969, north of La Tuque, Laviolette County. Sampling in that area revealed that up to 78% of the white birch leaves were affected. In addition an extension of the infestation into the Lac Saint-Jean area was observed. High populations were also reported along the road from Murdochville to Gaspé, in Gaspé-Sud County.

Birch Skeletonizer, *Bucculatrix canadensisella* Cham.—A moderate to severe infestation of this insect was recorded on white and yellow birch along Routes 11 and 58 from Maniwaki to Lac Camatose and along the Clova bush road, from Route 58 to Lac Landron. In this area severe defoliation occurred at Sainte-Famille-d'Aumond, Gatineau County and at Lac Jean-Péré, Lac Retty and Lac Larouche in Parc de la Vérendrye. The insect was present in several other areas but the boundaries of the infestations could not be ascertained because of lack of time.

Forty-two of the 453 collections from birch received by the Department of Lands and Forests from mid-August to mid-September, when larvae are most abundant, contained this insect. The largest number of collections came from the Lac Kipawa area, Témiscamingue County; Sheen Township, Pontiac County; Milot Township, Roberval County; Baie Comeau and Sept-Iles, Saguenay and Duplessis counties; Patapedia River and Nouvelle Township, Bonaventure County; La Potardière and Boisbuisson townships, Gaspé-Nord County.

The last infestation of this insect recorded in Quebec reached its peak in 1962 and persisted until 1965.

Eastern Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Guen.)—Populations of the eastern hemlock looper have remained at endemic levels since 1956, when the last outbreak subsided at Iles-de-Mai, Saguenay County. The insect was more common in 1969. Out of 2,125 collections made on balsam fir at the time of larval feeding and submitted to the Department of Lands and Forests, 312 contained the looper. The average number of larvae per collection was 2.5. The corresponding number of collections in 1970 was 2,208, of which 197 contained this insect with an average of 2.4 larvae per collection. The collection points were well distributed throughout the area south of the 51th parallel of latitude but

areas with the greatest number of loopers were located in eastern Quebec. Those of particular interest were Anticosti Island, Duplessis County; Lac Squatec, Témiscouata County; Saint-Aubert, L'Islet County; and a moderate to severe infestation (50 acres) in Whitworth Township, Rivière-du-Loup County. Observations in the latter area following larval feeding, showed that balsam fir trees and the hardwood understory were completely defoliated over approximately 1 acre. A few dead larvae were found and analyses revealed the presence of an *Entomophthora* species, a microorganism considered of little importance. This infestation will be kept under close observation. Sampling will be done in the spring to evaluate larval abundance and treatment with an insecticide will be recommended if necessary.

Linden Looper, *Erannis tiliaria* (Harr.) and Bruce Spanworm, *Operophtera bruceata* (Hulst)—The linden looper was found in 70% of the maple stands sampled for larvae, but in all cases populations were low. However, this year in a few areas, there was a slight increase in the number of females caught on banded trees in the fall. The Province received 22 collections of this insect in 1969 and 23 in 1970; the average number of larvae per collection increased from 1.4 to 4.6.

Populations of the Bruce spanworm increased markedly in several maple groves of the Eastern Townships in 1970. Larval populations varied from light to moderate; higher counts were obtained at a few localities in Beauce, Frontenac and Mégantic counties. The population increase was more evident in counts of females on banded maple trees in the fall. In most of the 25 maple groves sampled, the number of females averaged twice that of 1969. Although the population is on the increase, it is still considered to be at a low level, except at Saint-Benoît-Labre, reported as moderately infested last year, Saint-Ephrem and Saint-Honoré, Beauce County, and Inverness, Mégantic County. In two sample plots established at Saint-Benoît-Labre, the average number of females caught per tree in 1970 was 306 and 167 respectively, compared with 117 and 124 obtained in 1969. Severe defoliation is therefore expected in these two maple groves and in adjacent areas in 1971.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.)—The moderate to severe outbreak of this insect persisted around Lac Saint-Jean and along the Saguenay River. In the other areas infested in 1969, only traces of defoliation were recorded, except in one locality north of Saint-Urbain, Charlevoix County, where it was moderate. In 1970, however, the insect was recorded in small numbers at several additional localities in eastern and central Quebec, namely: at Notre-Dame-du-Lac and Sainte-Rose-du-Dégelis, Témiscouata County; on Route 19 from La Tuque to Chambord; on the Croche River watershed and at Lac Blanc, Laviolette County; Notre-Dame-des-Anges and Saint-Raymond, Portneuf County; and Lac Boucher, Shefford County. Low populations were also found in western Quebec, in Parc de la Vérendrye and at Laniel, Témiscamingue County.

Green-striped Mapleworm, *Anisota rubicunda* (F.) and Saddled Prominent, *Heterocampa guttivitta* Wlk.—Red and sugar maple stands were severely defoliated for the second consecutive year in the lower Ottawa River watershed. The areas most severely affected were around Tee Lake, Témiscamingue County, and Lac-de-l'Indienne, Pontiac County and in Gatineau Park. On the basis of aerial observations made by the Department of Lands and Forests, the area defoliated in the Gatineau Park was estimated at 5,280 acres. Because the infestation was discovered late in 1969, sampling could not be carried out in the main area of infestation, and it was tentatively identified as an extension of the infestation of the saddled prominent occurring south of the Ottawa River in Ontario.

Larval sampling made at the time of larval abundance in late July 1970 revealed that in Quebec, both the green-striped mapleworm and the saddled prominent were present but the former was by far the most abundant species and responsible for most of the damage. The two species were also recorded in central Quebec, but only in small numbers.

Orange-humped Mapleworm, *Symmerista leucitys* Francl.—The orange-humped mapleworm caused very severe defoliation in four sugar maple groves at East Broughton, Beauce County, three of which had been seriously defoliated in 1969. In addition to sugar maple, the few beech trees present in the stand were also stripped of their foliage. Part of the population died before completion of larval development from the action of a bacterial disease associated with a food shortage. Sugar maple severely defoliated early in the season usually refooliates; in the present case, however, defoliation occurred late in the season and the trees did not refooliates.

Tent Caterpillars—The decline of populations of the forest tent caterpillar, *Malacosoma disstria* Hbn., reported in 1969 continued in 1970. The insect has now become rare and is at the lowest level recorded since 1962.

The status of the eastern tent caterpillar, *M. americanum* (F.), did not change in 1970 and tents of this insect were again fairly common throughout southern Quebec. However populations were generally low throughout the area of infestation except in one locality, near Lac-du-Cerf, Labelle County.

The western tent caterpillar, *M. californicum pluviale* Dyar, was found in 23 localities in four counties of northwestern Quebec; Abitibi-Est, Abitibi-Ouest, Rouyn-Noranda and Témiscamingue. In addition the insect was collected for the first time in five localities in Roberval County, Lac Saint-Jean region. This represents a 250 mile easterly extension to the known distribution range of the insect. Collections were made on white birch, choke and pin cherry, serviceberry, trembling aspen and willow but in all cases tent counts were low.

Ugly-nest Caterpillar, *Archips cerasivoranus* Fitch—Populations of this insect increased markedly for the second consecutive year. The insect is now abundant throughout south-central and southeastern Quebec. In 1970 web counts were made at 71 localities and 70% belonged to the moderate to severe category as compared with 52% in 1969. In a few areas, webs were so numerous that they could not be counted. Areas where several high counts were recorded were located in the Richelieu watershed and in Labelle, Terrebonne, Portneuf and Beauce counties.

Beech Scale, *Cryptococcus fagi* (Baer.)—The small infestation found at Saint-Augustin, Portneuf County, in the fall of 1969, was sprayed from the ground with Diazinon in late May 1970 to eliminate the insect. This objective was not completely achieved but pre- and post-spray population estimates in two plots of different population densities indicated that some reduction in insect numbers occurred. This is illustrated by the data in the following table.

Plot	Population level	Percent of trees	
		Before	After
I.....	Nil	21.1	31.6
	Low	52.1	58.5
	Moderate	17.5	9.3
	High	9.3	0.6
II.....	Nil	74.7	92.9
	Low	25.3	7.1

Several beech stands in central Quebec were examined for the presence of this insect and six new infestation centers were found. Four of these were within 50 miles to the east of the Saint-Augustin infestation, two at Saint-Valier, Bellechasse County, one at Cap-Saint-Ignace, L'Islet County, and one at Sainte-Foy, Quebec County. The two others were found at La-Guadeloupe, Frontenac County and Saint-François-Xavier, Richmond County, some 60 miles to the southeast and 90 miles to the southwest of the Saint-Augustin infestation respectively. It was evident that, in at least two cases, the infestations were of recent origin as the stands had been examined a few years previously and no sign of the insect was found. The possible occurrence of an associated nectria canker in the six new infestation points remains to be established.

Gypsy Moth, *Portheiria dispar* (L.)—In 1969, an effort was made by the Plant Protection Division, Canada Department of Agriculture, to establish the northern limits of gypsy moth infestations and the insect was found at several points north of the Saint Lawrence River in Vaudreuil and Soulanges counties to the west, and 4 miles north of Iberville, Iberville County, to the east. In an attempt to prevent further spread, control measures were applied to all known infestations on Ile de Salaberry and north of the Saint Lawrence River in the Valleyfield area, as well as in nearby infestation areas in Ontario. A total of 7,000 acres were sprayed, 875 of which were in Quebec. Later investigations revealed that the infestation occurred throughout Soulanges and Vaudreuil counties. To the south, except for a slight extension in the areas of moderate and severe defoliation, conditions in 1970 were similar to those in 1969. The control program for 1971 has not yet been determined.

Fall Webworm, *Hyphantria cunea* (Drury)—Populations of this insect again increased in 1970. As in 1969 the webworm was abundant in south-central and southwestern Quebec but in addition, it became common in eastern regions. Tent counts were made along roadsides and infestations at 10 localities were classified as moderate and severe, compared to two in 1969. Higher counts were generally obtained in the area immediately north of the city of Montreal. A maximum count of 400 tents per mile of roadside was made 2 miles west of Joliette, Joliette County. A high count was also made near Wakefield, Gatineau County.

Fall Cankerworm, *Alsophila pometaria* (Harr.)—As expected from counts of females made in the fall, 1969, the population of the fall cankerworm was generally low except in infested stands reported in 1969 in Baie Missisquoi. In these stands larval populations showed some decline; the heaviest defoliation estimated at 70% was recorded on elm. High numbers of the looper were also found on elm and apple trees near Bristol Mines on Ile Calumet, Pontiac County. Counts of females were made in only one area, that is, in the vicinity of Venise in Baie Missisquoi; here insect numbers were comparable to those of 1969 and moderate to severe defoliation is expected again in 1971.

A Noctuid, *Enargia decolor* Wlk.—In 1970, this insect was collected on trembling aspen in 26 localities in Quebec. This is a substantial increase over past years. The first record of this noctuid was obtained in 1961, and only 17 collections have been made since, on three different hosts, trembling aspen, large-tooth aspen and white birch. Although the insect was more common in 1970 than in past years, its population was generally low and it was greatly out-numbered, in the majority of collections, by *Choristoneura conflictana* (Wlk.), the large aspen tortrix, an associated species mentioned earlier. The distribution of the noctuid was approximately the same as that of the large aspen tortrix. Two collection

points in western Quebec, Duparquet, Abitibi-Ouest County and Kipawa, Témiscamingue County, are worthy of note because of their proximity to the infestation reported in 1969 to the west of Témiscamingue County, in Ontario.

Smaller European Elm Bark Beetle, *Scolytus multistriatus* (Marsh.)—The examination of dead and dying elms begun in 1969 that led to the discovery of the smaller European elm bark beetle in Quebec, was continued in 1970. An area of approximately 250 square miles east of the known area of infestation, north of Lac Saint-Pierre and east of the Richelieu watershed, was sampled. No beetles were found at any of the 40 sampling points.

OTHER NOTEWORTHY INSECTS

Insect	Host(s)	Locality	Remarks
<i>Acleris variana</i> Fern. Black-headed budworm	Fir, balsam Spruce, white	All regions	Population low.
<i>Adelges piceae</i> (Ratz.) Balsam woolly aphid	Fir, balsam	Gaspé Peninsula	No change in distribution.
<i>Cecidomyiidae</i> A midge	Pine, Scots	East Angus and vicinity	Falling of top needles.
<i>Cenopsis peltitana</i> (Rob.) A leaf roller	Hardwoods, six species	26 locations in several regions	No change.
<i>Coleophora laricella</i> (Hbn.) Larch casebearer	Tamarack	All regions	Low population.
<i>Dasineura balsamicola</i> Lint. Balsam gall midge	Fir, balsam	Mainly in south-eastern Quebec	Reduction in population.
<i>Diprion hercyniae</i> (Htg.) European spruce sawfly	Spruce, black and white	All regions	Trace to low counts locally.
<i>Epinotia aceritella</i> Clem. Maple trumpet skeletonizer	Maple, sugar	11 localities in Beauce, Frontenac and Lévis counties	More abundant than usual.
<i>Epinotia solandriana</i> L. A leaf roller	Birch, white Aspen, trembling and largetooth	22 localities in eastern Quebec	Common again this year.
<i>Neodiprion abietis</i> Harr. Balsam-fir sawfly	Fir, balsam	Infestation area of 1969	Population again high; some tree mortality observed.
<i>Orthosia hibisci</i> Gn. A fruit worm	Fir, balsam Hardwoods, seven species	13 localities in several regions	Light population.
<i>Petrova albicapitana</i> (Busck) Pitch nodule maker	Pine, jack and Austrian	Jack pine distribution area	Generally present; high counts locally.
<i>Phigalia littea</i> Cam. A geometrid	Basswood Elm, white Maple, Manitoba and sugar Birch, white Oak, red	10 localities in southeastern Quebec	Low numbers.
<i>Pissodes strobi</i> Peck White pine weevil	Pine, jack, Scots and white Spruce, black, Norway and white	All regions	Over 30% of leaders affected at Notre-Dame-du-Laus, Gatineau County, Black Lake and Gatineau Park.
<i>Pikonema alaskensis</i> Roh. Yellow-headed spruce sawfly	Spruce, black and white	40 localities in several regions	Population generally low except near Lac Nicabau and Lac Aigremont in Parc-de-Chibougamau.

OTHER NOTEWORTHY INSECTS (Concluded)

Insect	Host(s)	Locality	Remarks
<i>Pikonema dimmockii</i> Cress. Green-headed spruce sawfly	Spruce, black and white	29 localities in several regions	Trace to low numbers.
<i>Pristiphora erichsonii</i> (Htg.) Larch sawfly	Tamarack	50 localities in several regions	Population generally low; egg counts in 20 localities; all of them were low.
<i>Pristiphora geniculata</i> (Htg.) Mountain-ash sawfly	Mountain-ash	Province-wide	Local infestations.
<i>Pseudexentera oregonana</i> Wlshm. A poplar leaf roller	Aspen, largetooth and trembling	13 localities mainly in eastern Quebec	Low numbers.
<i>Sciaphila duplex</i> Wlshm. A leaf roller on aspen	Aspen, largetooth and trembling Poplar, balsam Elm, white	17 localities in eastern Quebec	Low numbers.
<i>Stilpnotia salicis</i> L. Satin moth	Poplar Willow	Eastern Quebec	Not reported in 1970.

IMPORTANT FOREST DISEASES

Climatic Damage—Winter drying caused severe damage to conifers throughout most of the Saint Lawrence River valley and along the Lièvre and Blanche rivers. Near Duhamel, Papineau County, red spruce was severely damaged; the crowns of many dominant trees are now dying from winter drying that affected not only the current year's foliage but also that of previous years. Damage was also often severe on white spruce, balsam fir, red, white and Scots pine in the Eastern Townships (see accompanying map) at l'Avenir, Drummond County, Windsor, Richmond County, and Sainte-Hélène, Bagot County. South of Quebec City, moderate damage was recorded on red spruce, jack and red pine at Saint-Elzéar and Saints-Anges, Beauce County, Saint-Edouard, Lotbinière County and at Sainte-Hélène de Chester, Arthabaska County; on Scots pine and eastern white cedar at Saint-Romuald, Lévis County, and Notre-Dame-des-Anges, Portneuf County; and on balsam fir at Frampton, Dorchester County.

At Grand-Mère, Champlain County, and at Sainte-Cécile, Frontenac County, winter drying was followed by late frost damage to the buds of white spruce, eastern white cedar, and Scots, jack and red pine.

In a zone north of the area of severe winter drying, opening buds were damaged by late frosts on trembling aspen and white birch, particularly at Saint-Siméon and Saint-Urbain, Charlevoix County, L'Anse-Saint-Jean, Chicoutimi County, Sacré-Coeur, Saguenay County, and Lac Lemay, Gatineau County. Buds on sugar maple were also damaged in Missisquoi, Iberville, and Vaudreuil counties.

In an area between Montmagny, Montmagny County and Saint-Denis, Kamouraska County, low winter temperatures caused moderate to severe damage to the roots of white spruce, balsam fir and sugar maple; some mortality of shallow rooted trees on light soils occurred. Similar trees were damaged by hot, dry weather during the summer.

Heavy snow fall caused the breakage of branches and stems on several coniferous tree species in various localities of Argenteuil, Charlevoix, Joliette and Kamouraska counties.

Hail storms caused moderate damage to red and jack pine at Saints-Anges, Beauce County, and Dolbeau, Lac-Saint-Jean County. At Nicabau, Lac-Saint-Jean County, jack pine seedlings were severely damaged in a young plantation. The foliage of largetooth and trembling aspen was also injured at Champlain, Champlain County.

Scleroderris Canker of Pine, *Scleroderris lagerbergii* Gremmen—*Scleroderris lagerbergii* was observed in natural jack pine stands throughout most of the range of jack pine, as shown on the accompanying map. In 1970, the disease was rated as moderate to severe in three areas. Sixty percent of the jack pine saplings were affected and an additional 5% were killed in an area of several square miles at Nicabau, Lac-Saint-Jean County; within this area, large patches of jack pine saplings showed up to 80% mortality. In a 40-acre area seeded with jack pine at Casey, Laviolette County, 50% of the trees were attacked and 15% were dead. Some mortality was observed in stands of natural jack pine regeneration at Moisie, Saguenay County. Other moderate to severe infections were recorded in red pine plantations at Bourg-Louis and Pont-Rouge, Portneuf County, and near Senneterre, Abitibi-Est County.

The fungus was observed on the stems and branches of jack pine saplings at various localities in the Lac Saint-Jean area where the degree of attack varied from trace to severe; it was also observed on lower branches of young trees. The disease was present in the southern part of Portneuf County, where a number of jack, red and Scots pine plantations were affected. In that particular area, one young red pine plantation showed 80% mortality. Over the past 2 years, more than 60 pine and spruce plantations were examined in the Eastern Townships and along the Ottawa River but the disease is not as common in these regions as elsewhere.

Tip Blight of Spruce, *Sirococcus strobilinus* (Desm.) Petr.—This disease affecting 1- to 3-year-old shoots and sometimes killing the leader, was noted in Norway spruce plantations at Saint-Jean-d'Irlande, Mégantic County, Saint-Jacques-des-Piles, Champlain County and Thetford Mines, Mégantic County. In the latter locality, 25% of the 1,000 trees planted 20 years ago were infected. Symptoms were observed on white spruce in a plantation at Vallée Jonction, in Beauce County. Previously, this pathogen has been reported mostly on black and white spruce in natural stands (see Annual Report, 1968).

Nectria Canker of Balsam Fir—For the third consecutive year, 1,000 trees were carefully examined to determine the progress of nectria canker in a sample plot established near Port-Cartier. Fifty-five additional trees were found to be infected in 1970 bringing the number of diseased trees to 323. An annual increase in infection of 20% has occurred during the last 2 years. Resinosis was generally less pronounced than in 1969 and no reddening of the upper part of the crown was observed. Older cankers did not enlarge on 40% of the trees previously infected. No change was observed in the general distribution of this disease, possibly because the symptoms of the disease were less conspicuous than in previous years. The area near Port-Cartier may be the only important outbreak in the North Shore region and control measures should be considered if no other major infection center is detected in 1971.

Root Rots—Fifty percent of the saplings have died in a young red pine plantation at Sacré-Coeur, Saguenay County, and another 30% are expected to die in the future because of poor planting techniques. This particular condition observed in a young plantation confirms previous findings in a semi-mature white spruce plantation at Grand-Mère, Champlain County. Root strangulation due

to poor planting techniques causes important infections courts for root-rotting organisms.

Root rot caused by *Armillaria mellea* (Vahl ex Fr.) Kummer was reported on conifers and hardwoods in several areas. It was associated with the death of jack pine saplings at Casey, Laviolette County, and Nicabau, Lac-Saint-Jean County; soils on which some of the centers of infection were noted had previously been scarified. Severe infections were reported on white spruce at Hérouxville, Champlain County, and on sugar maple at Saint-Ambroise-de-Kildare and Saint-Jean-de-Matha, Joliette County. Trace to moderate infections were also noted on white and yellow birch trees at Sainte-Foy, Quebec County, on red spruce at Sainte-Marguerite, Dorchester County, and Saint-Sylvestre, Lotbinière County, and on white spruce at Grand-Mère, Champlain County.

Polyporus tomentosus Fr. root rot continued to spread in white spruce plantations at Grand-Mère, Champlain County and the causal fungus was reported on the same host at Pont-Rouge and Rivière-à-Pierre, Portneuf County. *P. tomentosus* and *Fomes pini* (Thore ex Pers.) Lloyd were responsible for root rot in a number of dominant red spruce at Duhamel, Papineau County.

Since *Fomes annosus* (Fr.) Karst. has only been collected once in Quebec, and that 30 years ago, airborne basidiospore trapping was carried out from mid-September to mid-October 1970. Stationary and mobile traps were made of freshly cut sections of red or white pine and muslin cloth disks. Traps were located in various localities of Papineau, Soulanges, Beauharnois, Stanstead, Rouville, Portneuf and Lévis counties, most of which are along the southern border of the Province. No spores of the fungus were collected which suggests that the disease is not yet established in Quebec.

White Pine Blister Rust, *Cronartium ribicola* J. C. Fischer—In 1970, white pine blister rust caused moderate to severe damage in white pine plantations at Mayo, Papineau County and Lanoraie, Berthier County. It was also noted on white pine, both in plantations and natural forests in various localities of Portneuf, Champlain and Beauce counties.

Stem and Branch Rusts of Pine—Infections of *Endocronartium harknessii* (J. P. Moore) Y. Hiratsuka were rated as moderate to severe on jack pine at Montcerf, Gatineau County, Saint-Michel-des-Saints, Berthier County, Windigo, Champlain County, Saint-Siméon, Charlevoix County, Sacré-Coeur, Saguenay County, Ferland, Chicoutimi County, and Saint-Méthode, Lac-Saint-Jean County. The rust was noted in many other localities north of the Saint Lawrence River, but the level of incidence was low.

Cronartium comptoniae Arth. infected branches and stems of semi-mature jack pine at Dolbeau, Lac-Saint-Jean County. No mortality was observed.

Needle Rusts—Infections by *Chrysomyxa ledicola* Lagh. and *C. ledi* d By. were slightly more severe than in 1969, especially in young to semi-mature black spruce stands. The intensity was rated as moderate on black spruce at Moisie, Duplessis County, Holliday, Kamouraska County, Saint-Etienne, Lévis County, Nicabau and Lac-des-Commissaires, Lac-Saint-Jean County.

Coleosporium asterum (Diet.) Syd. caused moderate infections in red pine plantations at Ascott Corner, Compton County, and Massawipi, Stanstead County.

Pucciniastrum epilobii Otth was present on almost every balsam fir experimentally planted for Christmas tree production in several small areas at Saint-Julien, Wolfe County; it was also noted on ornamental firs at East Angus, Compton County and in balsam fir stands at L'Ascension, Montcalm County.

Leaf Rusts—Leaf rusts were not as common as in 1969 probably because of the dry, hot weather. *Melampsora medusae* Thuem. caused moderate defoliation of hybrid poplars in one plantation at Saint-Etienne, Lévis County; trembling aspen was also defoliated by this fungus at Lac-des-Iles, Labelle County. *Melampsorium betulinum* (Fr.) Kleb. was reported as moderate on wire birch at Saint-Augustin, Portneuf County.

Canker of Black Spruce—The 4-square-mile area near Holliday, Kamouraska County, reported in 1969, continues to be the only area where black spruce shows deformities from this canker on the stems of both old and young trees. The causal organism has not yet been determined but a *Cytospora* sp. may be responsible. Mortality remained at 2% in 1970 although the canker appears to enlarge rapidly in its initial stages.

Valsa Cankers of Conifers—Cankers were observed on the branches and trunks of balsam fir and Scots pine at Saint-Alexandre, Kamouraska County, and Saint-Jean-de-Cherbourg, Matane County. *Valsa friesii* (Duby) Fckl. was associated with the cankers. Other *Cytospora* spp. caused cankers on the trunks of Norway spruce at Donnacona and Pont-Rouge, Portneuf County.

Ink Spot of Poplar, *Ciborinia whetzeli* (Seaver) Seaver—Ink spot was frequently noted throughout the Province in the spring of 1970 but later observations showed that the incidence and severity were lower than expected. However the disease caused moderate to severe leaf browning in various young stands around Mont-Laurier, Labelle County; it was also reported at Bristol, Pontiac County, Saint-Pacôme, Saint-Gabriel, and Mont-Carmel, Kamouraska County, Baie Comeau and Manic 5, Saguenay County, Val Racine, Frontenac County, Saint-Gérard, Lac-Saint-Jean County, and Louvicourt, Abitibi-Est County.

Animal Damage—Rabbits caused 5% mortality of saplings in a Scots pine plantation at Saint-Gabriel, Kamouraska County. The tips of lateral branches on red pine were eaten by rabbits at Saints-Anges, Beauce County. In these localities, light porcupine damage was also observed on the same Scots pine.

Thirty-five percent of the Norway spruce trees in a plantation at Eatonville, Kamouraska County, died as a result of feeding by mice 2 years previously.

Severe damage by sapsuckers (*Sphyrapicus varius varius* L.) was reported on 20-year-old Norway spruce at Thetford Mines, Mégantic County. Light to moderate damage was noted on white and red spruce, Scots, red and jack pine and on sugar maple in various localities of Beauce, Dorchester, Champlain, and Saguenay counties.

Very high populations of mites caused some mortality of white spruce at Aylmer, Gatineau County. Damage was also observed in Lac-Saint-Jean County.

Dutch Elm Disease, *Ceratocystis ulmi* (Buism.) C. Moreau—On the basis of field observations and requests for diagnosis, the incidence and severity of Dutch elm disease were higher in 1970 than in the previous year. No change was observed in the distribution of the pathogen.

Fire Blight, *Erwinia amylovora* (Burr.) Winsl. et al.—This disease was responsible for the death of many ornamental mountain-ash in a number of localities in the Quebec City area and southwest of Montreal Island, and at Sherbrooke, Sherbrooke County, Saint-Augustin, Portneuf County, Arthabaska, Arthabaska County, and Asbestos, Richmond County.

Dieback of Weeping Willow—A number of weeping willow trees died rapidly in the spring in localities around Montreal and Quebec City. Cankers, wilting or blights possibly caused by fungi, bacteria, or excess of water followed by root and branch freezing were commonly observed symptoms. *Diplodina salicicola* Sacc. & Trav. and a *Cytospora* sp. were among the fungi most commonly isolated from the affected parts.

Yellow Witches' Broom—*Melampsorella caryophyllacearum* Schroet. was common but light on balsam fir throughout the Province. Collections in 1970 were mostly from Montmagny, Témiscouata, L'Islet, Kamouraska, Matapédia and Bonaventure counties.

OTHER NOTEWORTHY DISEASES

Organism and Disease	Host(s)	Locality	Remarks
<i>Acanthostigma parasiticum</i> (Hartig) Sacc.	Spruce, black	Saint-Etienne, Lévis County	Moderate on many trees infected with <i>Chrysomyxa</i> <i>ledicola</i> .
<i>Ceratocystis pilifera</i> (Fr.) C. Moreau Staln	Pine, red	Mayo, Papineau County	Early invader in broken stems following winter damage.
<i>Ciborinia foliicola</i> (Cash & Davidson) Whet. Black rib of willow	Willow	Val Jalbert, Lac-Saint-Jean County	Extension of known distribution; causes a leaf blight.
<i>Cocomyces strobis</i> Reld & Cain	Pine, red	Saint-Etienne-des Grès, Maskinongé County	First host record; on dead branches of living tree.
<i>Diaporthe dubia</i> Nit. Canker	Maple, sugar	Frampton, Dorchester County	First record in Quebec; associated with cankering and dying of branches.
<i>Durandiella fraxini</i> (Schw. ex Fr.) Seaver Twig fungus	Ash, white	Saint-David, Lévis County	First herbarium record.
<i>Godronia multispora</i> Groves Canker	Birch, white	Parc des Laurentides, Montmorency County	First regional herbarium record; associated with branch canker.
<i>Lachnellula occidentalis</i> (Hahn & Ayers) Dharns Canker	Pine, jack	Nicabau, Lac-Saint-Jean County	On branches, associated with <i>Scleroderris</i> .
<i>Lachnellula resinaria</i> (Cooke & Phill.) Rehm	Spruce, white	Grand-Mère, Laviolette County	First herbarium record.
<i>Lachnellula suecica</i> (d By. ex Fckl.) Nannf.	Pine, jack	Nicabau, Lac-Saint-Jean County	First herbarium record. On branches killed by <i>Scleroderris</i> .
<i>Macrophoma sapinea</i> (Fr.) Petr. Gall	Pine, Scots	Lachute, Argenteuil County	New regional host record.
<i>Myxocyclus cenangioides</i> (Eil. & Rothr.) Petr.	Fir, balsam	Saint-Néré, Bellechasse County	First herbarium record.
<i>Rebentischia</i> sp.	Maple, sugar	Saint-Benoît-du-Lac, Brome County	First herbarium record. Associated with a nectria canker.
	Fir, balsam	Saint-Lazarre, Bellechasse County	Associated with a cytospora canker.
<i>Rhizina undulata</i> Fr. Root rot	Soll, humus	Cap-Rouge, Quebec County	On burned areas in mixed conifer stands.
<i>Stereum cinerascens</i> (Schw.) Mass. Tryb. Sap rot	Elm, white	Missisquoi Beach, Missisquoi County	First herbarium record.
<i>Tryblidiopsis</i> sp. Dieback	Spruce, black	Saint-Férol, Montmorency County Causapsal, Matapédia County	Associated with dying back of branches; new regional host record.



