Forest insect and disease survey

Annual report 1977

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of the

FOREST INSECT AND

DISEASE SURVEY, 1977

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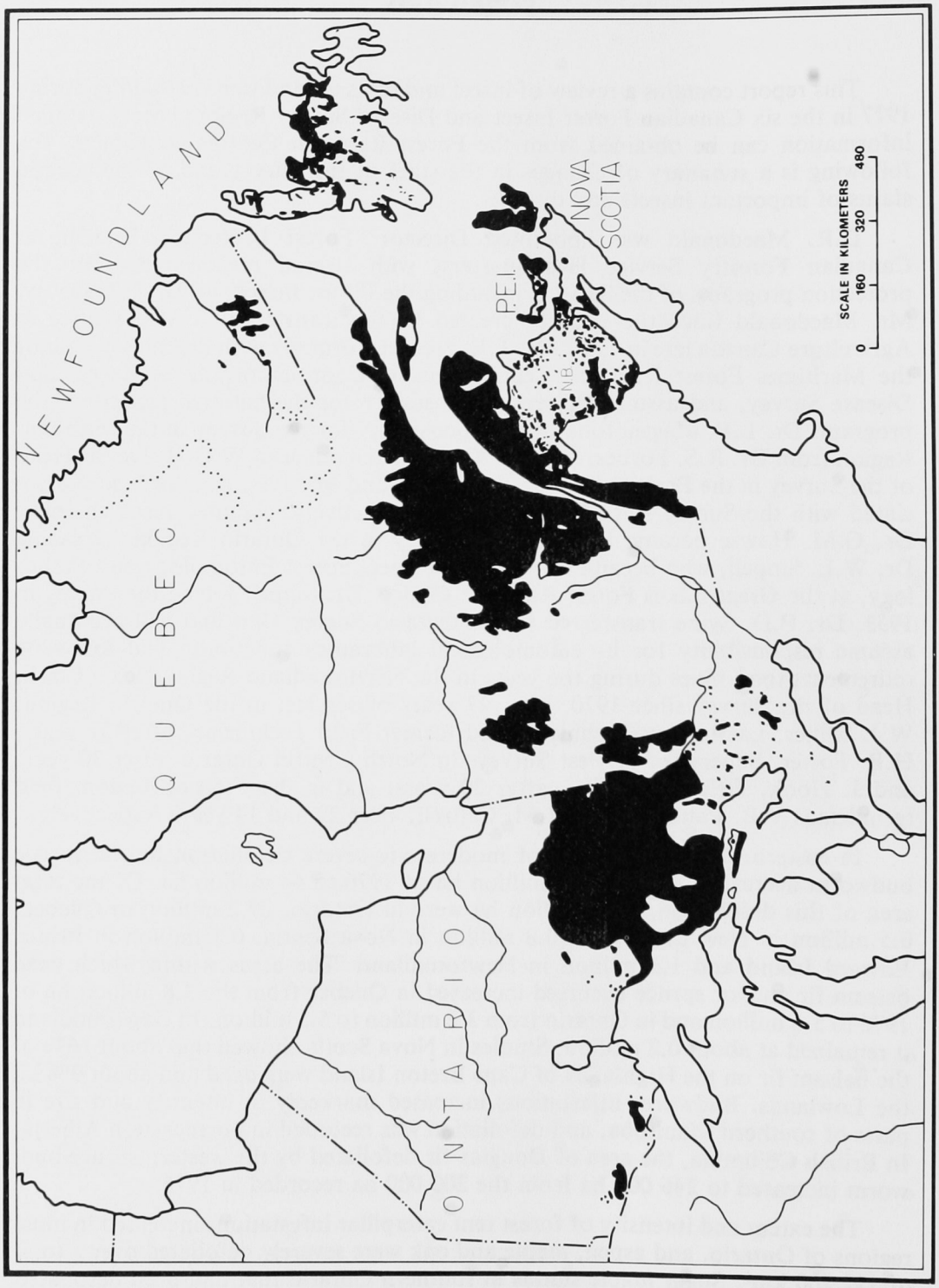
FOREWORD

This report contains a review of insect and disease conditions prevailing during 1977 in the six Canadian Forest Insect and Disease Survey Regions. More detailed information can be obtained from the Forest Research Centres concerned. The following is a summary of changes in the staff of the Survey and of the general status of important insects and diseases.

D.R. Macdonald was appointed Director, Forest Protection Branch, at Canadian Forestry Service Headquarters, with overall responsibility for the protection programs of the Service, including the Forest Insect and Disease Survey. Mr. Macdonald filled the vacancy created by the transfer of R.M. Prentice to Agriculture Canada late in 1976. Dr. T.E. Sterner, formerly with the Survey Unit of the Maritimes Forest Research Centre, became Coordinator, Forest Insect and Disease Survey, and assumed direct responsibility for the national aspects of the program. Dr. L.P. Magasi took over responsibility for the Survey in the Martimes Region from Dr. R.S. Forbes, and Dr. Y. Hiratsuka replaced W.G.H. Ives as Head of the Survey in the Prairies Region. Dr. Forbes and Mr. Ives, who have been associated with the Survey since 1944 and 1967 respectively, assumed research roles. Dr. G.M. Howse became Head of the Survey in the Ontario Region, replacing Dr. W.L. Sippell, who became Program Manager, Forest Entomology and Pathology, at the Great Lakes Forest Research Centre. Dr. Sippell joined the Survey in 1953. Dr. P.D. Syme transferred to the Ontario Survey Unit and will eventually assume responsibility for its entomological laboratory functions. The following retirements took place during the year: in the Newfoundland Region, R.C. Clark, Head of the Survey since 1970, after 27 years of service; in the Ontario Region, W.J. Miller, Laboratory Technician and former Field Technician, after 31 years, H.R. Foster, Supervisor of Pest Surveys in North Central Ontario, after 30 years and J. Hook, Field Technician, after 20 years; and in the Prairies Region, field technicians V.B. Patterson and R.M. Caltrell, after 29 and 14 years respectively.

In eastern Canada, the area of moderate-to-severe defoliation by the spruce budworm decreased from the 51 million ha of 1976 to 44 million ha. Of the total area of this defoliation, 14.1 million ha were in Ontario, 27.2 million in Quebec, 0.5 million in New Brunswick, 0.8 million in Nova Scotia, 0.1 million in Prince Edward Island and 1.3 million in Newfoundland. The areas within which dead balsam fir and/or spruce occurred increased in Quebec from the 3.8 million ha of 1976 to 5.6 million and in Ontario from 3.2 million to 5.5 million. In Newfoundland it remained at about 0.2 million. Studies in Nova Scotia showed that about 16% of the balsam fir on the Highlands of Cape Breton Island were dead and about 9% on the Lowlands. Budworm infestations increased markedly in intensity and size in parts of southern Manitoba, and defoliation was recorded in northeastern Alberta. In British Columbia, the area of Douglas-fir defoliated by the western spruce budworm increased to 246 000 ha from the 200 000 ha recorded in 1976.

The extent and intensity of forest tent caterpillar infestations increased in most regions of Ontario, and aspen, maple and oak were severely defoliated over a total of 122 200 km^2. Sugar maple stands in southern Ontario that had been defoliated for several consecutive years showed deterioration and tree mortality. Infestations continued at outbreak levels in western Prince Edward Island and southern Manitoba for the fourth consecutive year and expanded in parts of Saskatchewan,



Areas of moderate-to-severe defoliation by the spruce budworm in eastern Canada in 1977.

Alberta and British Columbia. In Quebec, populations were generally low and moderate-to-severe defoliation occurred only in localized areas.

Populations of the eastern hemlock looper increased in Newfoundland, particularly in the western part of the Province, and severe defoliation occurred in areas of Prince Edward Island where mortality of balsam fir and eastern hemlock was recorded. The infestation of the western hemlock looper reported in British Columbia in 1976 collapsed.

The large aspen tortrix declined in numbers in Ontario and British Columbia, and only light defoliation occurred. Heavy defoliation continued in western and central Newfoundland and was recorded in parts of northern Alberta and the Yukon.

Severe infestations of the larch sawfly continued in Labrador and western Newfoundland. In the Maritime Provinces, populations decreased and severe defoliation occurred only in southwestern Nova Scotia. Populations of the sawfly declined in Quebec and were low throughout most of the Province. High populations were present, however, in some areas. Defoliation was more noticeable in Ontario than in 1976, except in the northwestern part of the Province, and moderate-to-severe infestations recurred at numerous locations. There were further indications of a developing epidemic in western larch stands in southeastern British Columbia.

The gypsy moth continued to spread north and east in Quebec, and defoliation occurred in numerous localized areas within a total of 5 180 km^2. Male moths were again trapped in Nova Scotia and New Brunswick, but no egg masses or larvae were found during extensive surveys.

Damage from a number of birch defoliators again attracted attention in eastern Canada. The birch casebearer continued to spread and cause severe damage throughout the island of Newfoundland. Moderate or severe infestations of the birch skeletonizer, birch casebearer and birch leafminer occurred at scattered locations in the Maritime Provinces. Infestations of the ambermarked birch leafminer were present throughout Quebec, and moderate-to-severe infestations were numerous in an area of about 14 000 km^2 in the north-central part of the Province. Numerous infestations of the birch casebearer were present in eastern Quebec. In Ontario, damage from the birch leafminer was more extensive and severe than in previous years.

A number of other defoliating insects of regional significance are worthy of note. Population levels of the eastern blackheaded budworm generally decreased in Newfoundland, but moderate-to-severe defoliation was recorded in the eastern and western parts of the Island. In the Maritime Provinces, all but a few of the previously reported outbreaks of the whitemarked tussock moth collapsed, the remaining ones being in Nova Scotia. Considerable beech mortality occurred in areas severely defoliated in previous years by the saddled prominent, and damage from the maple leafroller was observed at many locations. The redheaded pine sawfly caused moderate-to-severe damage in many red pine plantations in southwestern Quebec, while the maple leafroller caused heavy defoliation over extensive areas in the eastern part of the Province. An outbreak of the Bruce spanworm recurred in northwestern Ontario, as did heavy defoliation by the oak leaf shredder in southern Ontario, where new infestations were recorded. Populations of the

redheaded pine sawfly remained high or increased in some plantations in southern and eastern Ontario, where moderate infestations were common. Numbers of the yellowheaded spruce sawfly remained high or increased throughout much of Ontario. High populations of the jack pine budworm, causing moderate-to-severe defoliation, persisted at locations in southern Manitoba, and heavy defoliation was also recorded in southern Alberta. A number of conifer sawflies caused extensive defoliation in British Columbia. The winter moth was identified as the main cause of the severe defoliation of deciduous trees in the Greater Victoria region that had previously been attributed to the Bruce spanworm.

Bark beetles continued to be a problem in British Columbia. In the Interior, infestations of the mountain pine beetle persisted in mature lodgepole pine stands and both spruce beetle populations and the number of killed trees increased. The Douglas-fir beetle increased in numbers in areas where Douglas-fir had previously been defoliated by the Douglas-fir tussock moth. Elsewhere in Canada, the spruce bark beetle was widespread in Nova Scotia and caused some tree mortality. The larch beetle was common in Nova Scotia and Prince Edward Island and contributed to the decline and mortality of tamarack. The buildup in beetle numbers followed a period of several years of moderate-to-severe defoliation by the larch sawfly. Several isolated infestations of the mountain pine beetle were recorded in southwestern Alberta.

High populations of adult sawyer beetles were reported in western Quebec, and twig and branch mortality caused by these insects was extensive across much of northern Ontario.

As mentioned in previous reports, many perennial tree diseases, such as stem rusts, decays, root rots and cankers, build up rather insidiously and/or are not amenable to routine detection surveys and therefore not to annual census. Consequently the overall status of these diseases is not reviewed annually by all regions. However, additional information is presented as it becomes available, and reference is made to many of these diseases in the accompanying regional reports. Information on several of the more important perennial diseases is summarized in the following paragraphs.

The known distribution of Dutch elm disease was extended in New Brunswick, Ontario and Manitoba. In Ontario, a diseased tree was found in the city of Fort Frances and the disease now extends through all major concentrations of elm in that Province. Although decreases in the number of new infections were noted in some locations, increases were noted in others and the disease continued to cause extensive mortality of surviving elms in previously infected areas.

Scleroderris canker was found in additional pine plantations in New Brunswick, and the severity of existing infections continued to increase rapidly in parts of Quebec. In Ontario, the status of the disease remained essentially unchanged. The presence of the European race of the causal fungus, more virulent than the North American race, was reported in the United States near the Canadian border. The European race, however, was not detected in Canada.

Armillaria root rot affected more than 25% of the trees examined in balsam fir stands defoliated by the spruce budworm in Quebec. The disease continued as one of the main causes of immature pine mortality throughout Ontario and as a cause of significant damage throughout British Columbia. Black-stain root disease, first

recorded in 1976, was detected in lodgepole pine and Douglas-fir at many locations in the latter Province.

Pathogenic foliar diseases were generally less prevalent than in 1976, but there were notable exceptions. Dothistroma needle blight of pine was more obvious and widespread in British Columbia than in recent years, and leaf and twig blight of poplar caused conspicuous foliar discoloration in much of the central and northern interior of that Province. Damage from needle rusts increased in frequency and intensity in Quebec, and ink spot of aspen was unusually conspicuous in some parts of Newfoundland.

Damage from abiotic diseases was recorded in all regions. The following is noteworthy. Winter drying of conifers was widespread in eastern Newfoundland, occurred at numerous locations in the Maritime Provinces and was severe in areas of British Columbia and the Yukon. Damage from late frosts was more common and severe in Quebec than in 1976, and in Ontario severe damage occurred to the foliage of many tree species, particularly in the northeastern part of the Province. Drought caused significant damage in southern British Columbia, and damage was common in the southern parts of the Prairie Provinces, particularly in Alberta and Saskatchewan. Damage caused by drought in previous years was more prevalent throughout Ontario, and parts of southern Ontario experienced drought conditions in 1977.

A.G. DAVIDSON
Forest Protection Branch
Canadian Forestry Service
Ottawa, Ontario

NEWFOUNDLAND REGION

B. H. MOODY, P. SINGH AND L. J. CLARKE
Newfoundland Forest Research Centre, St. John's, Newfoundland

INTRODUCTION

In May, June and early July the weather was variable across the Island. In most areas of western and in parts of central Newfoundland, the weather was cool and wet with occasional northeast winds. These conditions resulted in the late and slow development of insects and diseases, and particularly of the spruce budworm and other softwood defoliators. Warm and dry conditions prevailed in eastern Newfoundland during this period. July and August were only slightly warmer but considerably wetter than normal, especially in western Newfoundland. These conditions favored the development of a fungal disease of softwood defoliators. In Labrador the weather was cool and wet throughout the summer.

The spruce budworm continued to be the main forest insect problem, and the outbreak now covers virtually all of the 3.6 million ha of balsam fir–spruce forests on the Island. The budworm also defoliated an estimated 53 000 ha of merchantable balsam fir and spruce stands in Labrador. Data from the 1977 larval and egg-mass sampling indicate that the outbreak is weakening in most areas of western Newfoundland but that it continues to expand and intensify in central and eastern areas of the Island. Infestations in Labrador will remain about the same in 1978 as in 1977.

Population levels of the eastern hemlock looper continued to increase, particularly in areas of western Newfoundland, where spruce budworm population levels are declining. The birch casebearer, an accidentally introduced insect pest of birch, continued to spread and cause severe damage throughout the Island. Although, at present, birch is primarily an ornamental tree in Newfoundland, its value as a fiber-producing species is increasing rapidly and the impact of the birch casebearer will undoubtedly increase.

No major outbreak of any disease was observed, but broom rusts of balsam fir and black spruce and witches' broom of black spruce continued to be common and severe at several locations on the Island. The incidence and severity of foliar diseases was generally low, but ink spot and leaf blister of trembling aspen and leaf rust of American mountain-ash were unusually conspicuous at some locations. Dothichiza canker of Lombardy poplar continued to be the most serious disease of ornamentals on the Island and was also observed at several new locations. Winter drying was widespread in eastern Newfoundland. Industrial pollutants, such as asbestos dust, continued to have adverse effects on forest vegetation in the central part of the Island.

IMPORTANT FOREST INSECTS

Spruce Budworm, Choristoneura fumiferana (Clem.)—The spruce budworm infestation covered almost all of the balsam fir–spruce forests, about 3.6 million ha, on the Island, and severe defoliation and tree mortality were widespread.

The annual aerial defoliation survey, normally conducted each year to delineate the areas of light, moderate and severe defoliation, was not conducted this year on the Island because, just prior to the survey, heavy rains accompanied by high winds washed off virtually all the damaged and reddened foliage, making it impossible to define areas of defoliation from the air. However, a special aerial budworm damage assessment survey supplemented by ground checks was conducted in late August to determine the areas and merchantable volumes of dead and damaged trees. This survey classified the forests into four major categories: dead standing; moribund, severely damaged and not likely to recover; severely damaged but likely to recover; and very lightly or not damaged.

The total area of stands killed was about 64 100 ha containing an estimated 5 137 900 m^3 of wood. The area of moribund stands totalled about 110 600 ha with approximately 8 507 309 m^3 of wood. Mature stands severely damaged but likely to recover totalled 773 700 ha.

In Labrador the outbreak covered an estimated 52 700 ha of balsam fir–black spruce forest, of which about 31 800 ha were in the moderate-to-severe defoliation class (see map, page 6) and the remaining 20 900 ha were lightly defoliated. The volume of dead trees scattered within the severely damaged area was about 236 400 m^3, and an additional 531 900 m^3 were classed as moribund.

Damage assessments were also conducted in fir–spruce regeneration. The area of severe damage with some tree mortality was about 692 000 ha. The stands affected were between Stephenville and Hampden in western Newfoundland and near Twin Lakes and Triton Brook in central and eastern Newfoundland respectively. Generally, tree mortality was low, less than 10%, but it was as high as 28% in one plot of larger trees near Trout Brook. Only 10 of the 22 areas sampled had been severely defoliated for 4 years. The Trout Brook area had also been damaged previously by the balsam fir sawfly, the balsam woolly aphid and the eastern hemlock looper. Defoliation by spruce budworm in stands of regeneration also retarded height growth of balsam fir, most of the loss in height resulting from top-killing. In 1977, 1 to 6 years' height growth had been lost in several of these stands, the loss depending on the extent of top-killing.

Combined larval and pupal parasitism increased to about 35% in 1977 but reached as much as 80% in some locations, e.g. Birchy Lake, Sandy Lake and Badger. Parasitism in the late larval and pupal stages would probably have been higher had it not been for the fungal disease caused by *Entomophthora* spp. that became widespread in late summer. The disease affects both parasitized and unparasitized larvae, and the moist, warm weather favored its spread. The disease caused about 30% mortality in the late larval and pupal stages and as much as 60% in some locations, e.g. Barachois Brook, Hughes Brook, Bonne Bay, Hampden and Indian Pond. The disease was generally about twice as prevalent in western and central as in eastern Newfoundland.

Although no regular aerial defoliation survey was conducted, an attempt was made to determine the areas of defoliation during the annual egg-mass survey. Maps were constructed on the basis of aerial observation and ground checks of foliage samples. It was estimated that light defoliation occurred on 1 441 800 ha of productive forest, and moderate and severe defoliation was recorded on 1 288 800 ha. This brought the total on productive forest to 2 730 600 ha (see map, page 6). This estimated area of defoliation is less than 3 500 000 ha of productive forest actually

infested by the budworm because the defoliation that occurred in some areas was nil or trace.

The forecast for 1978 was based on the egg-mass survey conducted in September, during which approximately 920 predetermined locations were sampled on the Island and in Labrador. The results of this survey indicate that the overall size of the outbreak will decrease in 1978 and that budworm population levels will be lower than in 1977, particularly in western Newfoundland. The survey also showed that moderate-to-severe defoliation will occur on about 1.1 million ha distributed from the Codroy Valley to the south end of Grand Lake and from Ten Mile Lake to Roddickton in western Newfoundland, from White Bay along the northeast coast to the Avalon Peninsula and in isolated areas near Bay d'Espoir and Red Indian Lake. Tree mortality will continue in mature stands classified as moribund and the area of these stands may increase by about 10%, particularly where severe defoliation is predicted for 1978. Tree mortality will also continue in regeneration and semimature stands in western Newfoundland. It is forecast that tree mortality will range from 12 to 100% in these stands, where 100% of the current foliage is destroyed and 90% or more whole-tree defoliation occurs.

In Labrador the outbreak is expected to remain the same as in 1977. The bulk of the outbreak and major defoliation and damage will be in the mature balsam fir stands in the Kenamu and Traverspine river watersheds and in the Mud Lake area.

In 1977 the provincial Department of Forestry and Agriculture conducted a limited aerial spray program, using different chemical regimes, on 75 760 ha in five separate areas on the Island and in 24 forest-improvement areas.

Eastern Blackheaded Budworm, *Acleris variana* (Fern.)—Population levels of this budworm and its areas of infestation decreased. Infestations near Paddy's Pond on the Avalon Peninsula and in Terra Nova National Park and the Goose Bay area virtually collapsed. Population levels continued to be high and caused moderate-to-severe defoliation in the Salmonier Valley between Bauline and Pouch Cove on the Avalon Peninsula and from Roddickton to Eddies Cove on the Northern Peninsula.

Eastern Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Guen.)—Larval numbers have increased over the past 2 years where spruce budworm populations have decreased. Approximately four to seven larvæ per tree sample were found in collections in the Salmonier Valley on the Avalon Peninsula, at Twin Lakes and Lake Ambrose in central Newfoundland and at Serpentine Lake, Goose Arm, Rocky Harbour, Daniels Harbour and South Brook Valley in western Newfoundland. The highest larval count recorded was at Cochrane Pond near St. John's, where 45 larvae per tree sample were collected. The infestation on the Bellevue Peninsula collapsed in 1977 because of the disease caused by *Entomophthora* spp. and competition from the spruce budworm.

Balsam Woolly Aphid, *Adelges piceae* (Ratz.)—Population levels remained low and on most of the Island no appreciable change in the extent of infestations and damage occurred. Small infestations were reported near Crabbes River in western Newfoundland, on Random Island, at Bunyans Cove and Swift Current in eastern Newfoundland and in the Norris Arm–Notre Dame Junction areas of central Newfoundland.

Larch Sawfly, *Pristiphora erichsonii* (Htg.)—In 1977 population levels increased and new infestations were reported at Deer Lake, Goose Arm, North Lake,

Lomond River and River of Ponds in western Newfoundland, but in all areas only light defoliation was recorded.

The outbreak between St. Georges and South Branch remained the same as in 1976. In Labrador the outbreak between Sandwich Bay and Winokapau Lake was as in 1976, with severe defoliation averaging 80–90% in all areas, although larval numbers were lower.

The annual masked shrew trapping census was continued in plots at Terra Nova National Park and at Paddy's Pond near St. John's. Population levels averaged 8.13 shrews per hectare in both plots and was 1.86 shrews lower than in 1976.

Larch Casebearer, *Coleophora laricella* (Hbn.)—Infestations by the casebearer continued in eastern Newfoundland. Severe browning occurred on immature tamarack stands for the second consecutive year at Park Headquarters, Saltons Brook and Sandy Pond Junction in Terra Nova National Park. Parasitism was low in these infestations and only four parasites were reared from 134 casebearer larvae. Infestations also occurred near St. John's, where rearing studies have shown that parasitism, caused primarily by the introduced species *Agathis pumila* (Ratz.), had risen to 19% from the 12% shown for 1976.

European Pine Sawfly, *Neodiprion sertifer* (Geoff.)—This sawfly was first recorded in Newfoundland in 1974 in the St. John's area. Since then it has spread throughout the city, infesting a wide variety of native and exotic pines. This year more than 1,100 adults of the pupal parasite *Pleolophus basizonus* Grav. were introduced into infested pine areas at Windsor Lake near St. John's.

Birch Casebearer, *Coleophora fuscedinella* (Zell.)—In 1977, casebearer damage to white birch was the most widespread and severe ever recorded on the Island. The most severe damage observed was on ornamental white birch in most of the towns in central Newfoundland and in Terra Nova National Park. New infestations occurred in the Bay d'Espoir area, and several infested trees were found in the St. John's area. Rearings conducted for parasitism showed that, although native parasites were common, there were no recoveries of the two introduced parasites *Campoplex* and *Apanteles.*

Spotted Tussock Moth, *Halisidota maculata* (Harr.)—Numerous caterpillars of this insect were reported on the Baie Verte Peninsula, along the Halls Bay Road and in Terra Nova National Park. Light damage was reported to have occurred on white birch and speckled alder in all areas.

Rusty Tussock Moth, *Orgyia antiqua* (L.)—High numbers of the rusty tussock moth were collected in Terra Nova National Park and throughout the Avalon Peninsula. Increases in populations of this insect usually precede eastern hemlock looper outbreaks by 1 or 2 years.

Large Apen Tortrix, *Choristoneura conflictana* (Wlk.) and ***Poplar Leafroller,*** *Anacampsis innocuella* Zell.—The high numbers and combined feeding of these two defoliators caused severe damage to aspen stands throughout the Exploits Valley watershed from Millertown to Botwood. Light-to-moderate damage was recorded from Springdale to Birchy Dam in the Upper Humber watershed. The tortrix was found in low numbers along the Churchill Road near Goose Bay in Labrador. This is the first record of this insect in Labrador.

OTHER NOTEWORTHY INSECTS

Insect	Host(s)	Locality	Remarks
Archips cerasivoranus (Fitch) Uglynest caterpiller	Birch, white Alder, speckled Cherry, choke	Flat Bay Brook area	Avg 50.0 larvae/tree; light defoliation.
Chrysomela falsa Brown Willow leaf beetle	Poplar, balsam	Goose River Bridge	Avg 10.0 larvae/tree; trace damage.
Chrysomela mainensis mainensis Bechst. Alder leaf beetle	Alder, speckled Birch, white Dogwood	Throughout Island	Avg 10.7 larvae/tree; light damage.
Compsolechia niveopulvella Chamb. Poplar leaf roller	Aspen, trembling	Square Pond Provincial Park, Southwest River, Terra Nova National Park, Pilley's Island Causeway, Badger, St. Fintans and Mud Lake (Labrador)	Avg 12.0 larvae/tree; trace damage.
Dioryctria reniculelloides Mut. & Mun. Spruce coneworm	Spruce, white, black Fir, balsam	Throughout Province	Avg 7.9 larvae/tree; light damage.
Fenusa dohrnii (Tischb.) European alder leafminer	Alder, speckled	Swift Current, Northwest Gander River Road and Trout River and throughout Grand Falls district	Avg 10.0 larvae/tree; light damage.
Fenusa pusilla (Lep.) Birch leafminer	Birch, white	Throughout Province	Avg 13.6 larvae/tree; moderate-to-severe damage.
Gilpinia hercyniae (Htg.) European spruce sawfly	Spruce, white, black	Throughout Province	Avg 0.9 larva/tree; no obvious damage.
Hyphantria cunea (Drury) Fall webworm	Alder, speckled	Stephenville area	Avg 83.3 larvae/tree; severe damage on a few trees.
Leucoma salicis (L.) Satin moth	Poplar, silver Willow	Avalon District, Clarenville, Squires Memorial Provincial Park, Lomond and west of Hampden Junction	Avg 26.0 larvae/tree; severe damage on ornamentals in eastern Newfoundland and trace damage in western Newfoundland.
Mindarus abietinus Koch Balsam twig aphid	Fir, balsam	Avalon Peninsula Northwest River Road (Labrador)	Avg 13.8 larvae/tree; no obvious damage.
Nematus limbatus (Cress.) Willow sawfly	Willow	North Lake Road, Northern Harbour, Sop's Arm Road, Stuckless Pond Road and Churchill Road (Labrador)	Avg 25.0 larvae/tree; light damage.
Nematus sp. Willow sawfly	Willow Birch, white Alder, speckled Aspen, trembling	New Harbour, Butterpot Provincial Park, Gander, Northwest River Road and Grand Lake Road	Avg 3.3 larvae/tree; light damage.
Neodiprion abietis complex Balsam fir sawfly	Fir, balsam	4 points northwestern Newfoundland and 6 points in Labrador	Avg 0.6 larva/tree; no obvious damage.

OTHER NOTEWORTHY INSECTS (Concluded)

Insect	Host(s)	Locality	Remarks
Phyllocnistis populiella Chamb. Aspen leafminer	Aspen, trembling Poplar, balsam	Highland's River, Grand Lake Road and Lomond	Avg 6.7 larvae/tree; light damage.
Pikonema dimmockii (Cress.) Greenheaded spruce sawfly	Spruce, black, white	Avalon District, Gros Morne National Park, Southwest River and Northern Harbour	Avg 0.7 larva/tree; trace of defoliation.
Pristiphora geniculata (Htg.) Mountain-ash sawfly	Mountain-ash	Throughout Island	Avg 21.9 larvae/tree; severe defoliation.

IMPORTANT FOREST DISEASES

Broom Rusts of Conifers—Broom rust of balsam fir, caused by *Melampsorella caryophyllacearum* Schroet., and of black spruce, caused by *Chrysomyxa arctostaphyli* Diet., continued to be conspicuous diseases of forests on the Island. As in the past 3 years, they were common and widespread and their incidence was moderate to severe in several parts of the Island. New and additional infections were observed in scattered patches on the Avalon, Burin and Bonavista peninsulas, near Gander and near Carmanville in central Newfoundland. Up to 35% of the trees were infected at some locations, but no tree mortality appeared to be associated with the pathogens.

Witches' Broom of Black Spruce—Witches' broom, caused by the eastern dwarf mistletoe, *Arceuthobium pusillum* Peck, continued to be a serious problem of black spruce in several wet and low-lying areas of western Newfoundland. The incidence of the damage varied from moderate to high; the highest percentages of infection and tree mortality recorded were 85 and 15 respectively. An average of 10 brooms per tree was found, although the maximum number of brooms recorded on a tree was 40. In several cases the infection was very old, the oldest broom observed being 41 years old.

Dothichiza Canker of Lombardy Poplar, Dothichiza populea Sacc. & Briard—The stem and branch canker of Lombardy poplar continued to be the most serious disease of ornamental trees in Newfoundland as it was in the two preceding years. Several new and additional infections were recorded in Baie Verte, Springdale and St. John's. The incidence of infection was as high as 35% and that of tree mortality as high as 10%.

Leaf and Twig Blight of Trembling Aspen, Pollaccia radiosa (Lib.) Bald & Cif.—The incidence of leaf and twig blight of trembling aspen was generally low, i.e. up to 20%, and it was observed in scattered patches at Pasadena in western Newfoundland, at a few locations in central Newfoundland and on the Bonavista and Avalon peninsulas. However, a moderate incidence of the disease, affecting up to 55% of the new shoots, was recorded at a few locations along Baie Verte Road and Gander Bay Road in central Newfoundland.

Ink Spot of Trembling Aspen, Ciborinia whetzelii (Seaver) Seaver—This disease was unusually conspicuous at a few locations in central Newfoundland and

Labrador. An average of 70 to 80% of the foliage of aspen trees was affected in an area extending for 4.8 km along Churchill Road in Goose Bay. The disease has been serious in this area for the past 3 years.

Leaf Blister of Trembling Aspen, *Taphrina populina* Fr.—Moderate-to-severe infection caused by this leaf blister disease affected up to 60% of the foliage in an area running for 1.6 km along Churchill Road in Goose Bay.

Leaf Rust of Mountain-ash, *Gymnosporangium cornutum* Arth. ex Kern—Leaf rust of American mountain-ash was recorded in some areas of central Newfoundland and of the Avalon and Burin peninsulas. The incidence of infection was low, however, affecting up to 20% of the foliage of a few trees at each location. A very severe infection of the disease was observed on about 30 trees at Salmon Cove Sands. It affected up to 90% of the foliage and 100% of the trees in the area.

Needle Rust of Balsam Fir, *Pucciniastrum epilobii* Otth—A low-to-moderate incidence of needle rust of balsam fir, affecting up to 45% of the new foliage, was recorded near Marystown and along Sops Arm Road.

Winter Drying—This damage was very common and widespread on the Avalon and Burin peninsulas. It was observed on balsam fir, Scots pine, eastern white pine, tamarack and pin cherry. The damage was most severe on balsam fir and Scots pine, on which it affected up to 55% and 50% of the new foliage respectively.

Frost Damage—Frost damage was less common in 1977 than in 1976. Low-to-moderate (10–55%) incidence of frost damage on balsam fir and black spruce was observed in small areas scattered throughout central and western Newfoundland and on the Avalon and Bonavista peninsulas. Up to 35% of the shoots of Norway spruce and white spruce seedlings were killed in the Canadian Forestry Service nursery at Pasadena. A low incidence of damage, about 20%, was also recorded on Sitka spruce in a plantation at Baker's Steady, south of Badger.

Pollution Damage—A survey of the forest vegetation near and around an asbestos mine at Baie Verte showed heavy deposits of asbestos dust and fibers on trees, shrubs and herbs. These have caused up to 90% mortality and up to 70% defoliation of live softwood trees in most severely damaged areas. Damage was most extensive south and southwest of the mine and extended for a distance of 3.5 km.

OTHER NOTEWORTHY DISEASES

Organism and Disease	Host(s)	Locality	Remarks
Apiosporina morbosa (Schw.) Arx Black knot	Cherry, pin	Pasadena in western Newfoundland	2 to 3% infection.
Armillaria mellea (Vahl ex Fr.) Kummer Armillaria root rot	Spruce, black, Sitka	Jeffrey's and Trout River in western Newfoundland	5% infection.
Chrysomyxa ledicola Lagh. Needle rust	Spruce, black	Foxtrap on Avalon Peninsula	75% infection.
Coccomyces hiemalis Higgins Shot hole	Cherry, pin	Central and western Newfoundland	5 to 25% infection.

OTHER NOTEWORTHY DISEASES (Concluded)

Organism and Disease	Host(s)	Locality	Remarks
Cronartium ribicola J.C. Fischer ex Rabh. Blister rust	Pine, eastern white	St. John's, Manuels, Terra Nova National Park and Grand Falls	About 3% infection.
Cytospora chrysosperma (Pers.) Fr. Stem canker	Aspen, trembling	Central Newfoundland and Pasadena in western Newfoundland	2 to 20% infection.
Cytospora salicis (Cda.) Rabh. Stem canker	Willow, pussy Willow	Avalon Peninsula and Freshwater on Avalon Peninsula	60 to 80% infection on a few trees at each of these locations.
Cytospora sp. Stem canker	Maple, mountain	Pasadena	Less than 1% infection.
Gymnosporangium clavipes (Cke. & Pk.) Cke. & Pk. Quince rust	Serviceberry	Millertown	5 to 15% infection.
Hypoxylon multiforme Fr. Stem canker	Maple, mountain	Pasadena	Less than 1% infection.
Kabatiella apocrypta (Ell. & Ev.) Arx Anthracnose	Maple, mountain	Northern Arm and Grand Falls in central Newfoundland and McIsaacs Brook and Birchy Narrows in western Newfoundland	10 to 50% infection.
Lophodermium pinastri (Schrad. ex Hook.) Chev. Needle cast	Pine, Scots	Tilton Barrens, Windsor Lake and Freshwater on Avalon Peninsula	40 to 80% infection.
Lophodermium sp. Needle cast	Spruce, white	Pasadena	Less than 1% infection.
Phomopsis juniperovora Hahn Phomopsis twig blight	Cedar, eastern white	Pasadena and St. John's	40% infection.
Phyllosticta minima (Berk. & Curt.) Underw. & Earle Purple eye spot	Maple, red, mountain	Rocky Harbour, Pasadena in western Newfoundland, King's Cove on Bonavista Peninsula, Square Pond Provincial Park in eastern Newfoundland and Freshwater on Avalon Peninsula	About 2 to 15% infection.
Pollaccia elegans Serv. Leaf and twig blight	Poplar, hybrid	Pasadena (CFS nursery)	2 to 3% infection.
Rehmiellopsis balsameae Waterman Tip blight	Fir, balsam	McIsaacs Brook in western Newfoundland and St. Catherines on Avalon Peninsula	25 to 45% infection.
Septoria betulae (Lib.) West Leaf spot	Birch, white	Bonne Bay Road in western Newfoundland	About 15% infection.

MARITIMES REGION

L. P. MAGASI

Maritimes Forest Research Centre, Fredericton, N.B.

INTRODUCTION

The spruce budworm caused moderate-to-severe losses of new needles of balsam fir and spruce, with backfeeding in places, over 474 000 ha in New Brunswick, 823 100 ha in Nova Scotia, including areas of mortality on Cape Breton Island, and 108 000 ha in Prince Edward Island (see map, page 6). Larch sawfly populations decreased, and severe defoliation occurred only in southwestern Nova Scotia. The eastern larch beetle was found to be the cause of tamarack mortality in both Nova Scotia and Prince Edward Island and appears to be widespread. Mortality due to the eastern hemlock looper occurred in central Prince Edward Island. All but a few of the previously reported outbreaks of whitemarked tussock moth have collapsed, the ones remaining being all in Nova Scotia. Balsam twig aphid attack rendered thousands of balsam fir Christmas trees unmarketable. The predicted increase in the populations of balsam gall midge did not materialize, and only pockets of infestation occurred. The spruce beetle caused tree mortality in Nova Scotia and is widespread in that Province. Considerable beech mortality occurred in areas severely defoliated in the last few years by the saddled prominent.

No appreciable changes occurred in the outbreak of forest tent caterpillar on Prince Edward Island. Maple leafroller damage was observed at many locations. Multiple catches, in pheromone traps, of male gypsy moth are causing concern, although neither larvae nor egg masses were found in spite of extensive surveys.

No significant changes occurred in the distribution of Dutch elm disease in Nova Scotia. In New Brunswick the finding of diseased trees for the first time in St. John and Kent counties leaves Albert the only county where the disease has not yet been found. Scleroderris canker was found in several more pine plantations in New Brunswick. Many species of fungi affecting foliage of hardwoods caused various degrees of leaf discoloration. Excessive emissions of sulphur dioxide caused severe browning of all trees, shrubs and garden crops at Edmunston, N.B.

Appreciation is extended to all agencies and individuals who contributed to survey operations in the Maritimes in 1977.

IMPORTANT FOREST INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)—In New Brunswick, defoliation of balsam fir and spruce stands occurred on slightly less than 607 000 ha, defoliation being severe on about 342 000 ha, moderate on 132 000 ha and light on 121 000 ha. Most of the severe defoliation occurred in western Charlotte County, along the St. John River valley from Edmundston to Saint John, in patches throughout southern New Brunswick, particularly in Westmorland County, and in small scattered patches throughout the rest of the Province. This represents some decrease in defoliation from 1976, but the area of defoliation is significantly smaller than in 1975, when 3.5 million ha were classed as severely or moderately defoliated. An increase in spruce budworm populations is forecast for 1978. Egg-mass counts indi-

cate that population levels will be high on about 1.9 million ha and moderate on 1.1 million ha. The area of high population represents an increase, over 1977, of 526 000 ha. The area of high-to-extreme hazard to stands (risk of tree mortality and top-kill with further attack) is estimated at 2.3 million ha, up from the 2.0 million ha at which it was rated in 1977.

In Nova Scotia, 769 000 ha of balsam fir, spruce and tamarack stands on Cape Breton Island suffered severe defoliation. On the mainland, defoliation was severe on about 8 100 ha, mostly in Cumberland County, moderate on 46 000 ha and light on 115 000 ha. Egg-mass counts indicate that defoliation will again be severe in 1978 throughout Cape Breton Island. Some areas of Cumberland, Pictou, Antigonish and Guysborough counties are also expected to suffer moderate-to-severe defoliation.

The condition of the forests has been deteriorating on Cape Breton Island because of repeated severe defoliation by the spruce budworm. A recent study by the Forest Insect and Disease Survey showed that about 16% of balsam fir on the Highlands and about 9% on the Lowlands are dead and an additional 10% are expected to die on the Highlands in 1978. By the fall of 1977 more than half the balsam fir trees (38 of 67) classified on permanent plots in the fall of 1976 or the spring of 1977 as having "more than 90% of foliage lost" were dead. Of all the dead balsam fir trees (44) examined, most (38) were in this category when first classified.

On the Cape Breton Highlands, balsam fir mortality has occurred in young thinned stands and was heaviest in stands that had severe current defoliation for the last 3 years, coupled with moderate or severe backfeeding in 1976 and 1977. Mortality ranged from 20 to 69% in the three such stands examined; in areas with less defoliation, mortality ranged from 0 to 27%.

In Prince Edward Island, 136 000 ha of balsam fir and spruce were affected. Of this, defoliation was severe on 69 000 ha, moderate on 39 000 ha and light on about 28 000 ha.

Larch Sawfly, *Pristiphora erichsonii* (Htg.)—This insect was present in tamarack stands at scattered locations throughout the Region, but the area of moderate or severe defoliation declined for the second consecutive year, especially in Nova Scotia and on Prince Edward Island. The decline followed a period of population buildup that took place in the early 1970s and culminated in 1975.

Moderate or severe defoliation occurred only in the coastal regions of Lunenburg, Queens and Shelburne counties (see map, page 31). Elsewhere in Nova Scotia, defoliation was usually very light. On Cape Breton Island, however, tamarack stands in most areas of sawfly infestation had very little foliage left because of feeding by the spruce budworm and possibly because of stem attack by the eastern larch beetle. In Prince Edward Island, light defoliation occurred in the Farmington–Mount Hope area of Kings County. In New Brunswick, defoliation was light or moderate in patches and was found only in southwestern Charlotte County.

Eastern Larch Beetle, *Dendroctonus simplex* Lec.—This beetle was common in Nova Scotia and southeastern Prince Edward Island (see map, page 32) and contributed to the decline and mortality of tamarack trees. Trees of all ages were affected, and dead or dying tamarack were present in 8 of 10 infested stands assessed in central Nova Scotia and in the three examined on Prince Edward Island. No

mortality was observed in New Brunswick, and the beetle was collected only near St. Martins, St. John County.

The buildup of beetle populations followed a period of several years of moderate or severe defoliation by the larch sawfly in most tamarack stands in Nova Scotia and Prince Edward Island. The larch beetle has not been reported as causing damage in the Region for at least 25 years.

Eastern Hemlock Looper, *Lambdina fiscellaria fiscellaria* (Guen.)—In Prince Edward Island, this insect caused severe defoliation in the central highlands region of Queens County and in a few patches southwest of Shamrock, Prince County. The total area of infestation was about 220 km^2, within which numerous 4–8 ha patches of forest were affected. Assessment of tree conditions in affected stands showed that 78% (50–100%) of the living balsam fir and all of the living hemlock examined were in the "more than 90% complete defoliation" class; 35% of the buds examined on midcrown branches of balsam fir in this class were dead. Moderate or severe defoliation by the spruce budworm has occurred in the affected area since 1974, which accounts for the condition of spruce and partly, no doubt, of balsam fir and hemlock. Elsewhere in the Region, no appreciable defoliation was found.

Whitemarked Tussock Moth, *Orgyia leucostigma* (J.E. Smith)—Since last year the status of this insect has changed more than that of any other forest pest. Most of the outbreaks reported in 1976 have collapsed. Few larvae were found; defoliation was not in evidence in Prince Edward Island and occurred only on a few hardwood trees in Victoria County, N.B.

In Nova Scotia, the remaining outbreaks, resulting in moderate-to-severe defoliation of both hardwoods and conifers, covered 104 000 ha in the Stewiacke–Musquodoboit area and westward to Waverley and Grand Lake in Colchester and Halifax counties, 9 700 ha between Parrsboro and Earltown in Cumberland and Colchester counties and 2 500 ha in the Apple River–New Yarmouth area in Cumberland County.

Balsam Twig Aphid, *Mindarus abietinus* Koch—Infestations of this insect were common in both cultivated and wild stands of balsam fir throughout the Region. In New Brunswick, several thousand balsam fir Christmas trees could not be marketed in 1977 and undoubtedly the grades of many more trees were lowered because of shoot and needle distortion by this insect. Young balsam fir (1–3 m high) at many scattered locations throughout the Province had from 50 to 100% of their shoots infested. Furthermore, many balsam fir Christmas trees were unsightly because of the black sooty mold fungi that developed on the insect residues, especially in central New Brunswick. In southwestern Nova Scotia, moderate or severe shoot injury occurred at several locations on balsam fir grown for Christmas trees, but damage was usually light elsewhere in the Province. Injury was generally light and scattered in Prince Edward Island, except at Rustico Island, where damage was moderate.

Balsam Gall Midge, *Paradiplosis tumifex* Gagné—Infestations, attributed to *Dasineura balsamicola* (Lint.) in past years, were common throughout mainland Nova Scotia on balsam fir, but the expected increase did not materialize. Pockets of severely infested trees were found only at Fox River, Cumberland County, between Brookfield and Upper Stewiacke, Colchester County, and near Demsey Corner, Kings County; the infestation was moderate in the West Advocate–Parrsboro area of Cumberland County, but the population was low elsewhere in the Province. In

New Brunswick, 24% of the needles in natural regeneration were affected at Seal Cove on Grand Manan Island and in small numbers at several other locations in the southern part of the Province. Only a few affected needles were found at a few locations in Prince Edward Island.

Spruce Beetle, *Dendroctonus rufipennis* (Kby.)—The number of locations where spruce is infested by this beetle increased again in 1977 in Nova Scotia, as did the size of the areas affected.

At Glenholme, Colchester County, in an area of severe blowdown, the infestation has increased to about 50 ha; tree mortality is increasing at Amherst Point, Cumberland County, in a 17 ha stand; at Truro, in Victoria Park, the outbreak is still spreading, although many infested trees have been cut and removed; the infestation persists at the provincial wildlife park at Upper Clements, Annapolis County. Infestations were widespread throughout Cape Breton Island, affected stands being observed at a number of locations in all four counties.

A few scattered infested or dead trees were also found at several locations in Colchester, Lunenburg and Kings counties.

In Prince Edward Island, a few overmature white spruce trees were infested in the provincial park at Uigg, Queens County, and in a fire-damaged hedge at Strathgartney.

Saddled Prominent, *Heterocampa guttivitta* (Wlk.)—In New Brunswick, the infestations that caused pockets of moderate or severe defoliation in 1976 collapsed. Defoliation on sugar maple was light or very light in the sugar bush areas of Gloucester County, but moderate defoliation occurred on beech in one stand near Trudel. Elsewhere in the Region, no noticeable defoliation occurred and only a few larvae were collected at scattered locations in New Brunswick and Nova Scotia. However, defoliation in Gloucester County in 1976 and possibly in 1975 may have contributed to the reduction of maple sugar production in the spring. Pockets of dead and dying beech were common in the last year's infested areas, and in some, about 70% of the trees (more than 80% of merchantable beech volume) were dead. Most of the beech examined had cankers caused by the beech scale-nectria complex, and this may have reduced their ability to survive.

Forest Tent Caterpillar, *Malacosoma disstria* (Hbn.)—In Prince Edward Island, the outbreak continued for the fourth consecutive year over essentially the same areas between Springhill and Portage, near St. Louis and around Duvar, Prince County. Disease and parasites are both present in this population. In Nova Scotia, the 8 ha outbreak on trembling and largetooth aspen near Kentville continued in 1977. Apart from these, and a few red oak trees defoliated at Kentville, Kings County, only a few larvae were collected at scattered locations in the Region.

Maple Leafroller, *Cenopis acerivorana* MacK.—This insect was found at many locations in New Brunswick on sugar and red maple. Patches where moderate or severe leaf rolling occurred were common in Restigouche County and at a few scattered locations in the southern part of the Province. Repeated attacks by this insect may have contributed to branch and top mortality on numerous red maples in the southern part of Canadian Forces Base Gagetown in Queens County. In Nova Scotia, numbers of the insect decreased; moderate injury occurred in a small stand of sugar maple at Margaree Forks, Inverness County, and of red maple near Shulie

Lake, Cumberland County; elsewhere in the Province and in Prince Edward Island injury was usually very light at scattered locations.

Gypsy Moth, Lymantria dispar (L.)—Although, with the exception of 1936, no larvae of this voracious defoliator of hardwoods and conifers have been found in the Region, male moths have been captured every year since 1971 in some of the pheromone-baited traps placed at possible entry points and along tourist routes throughout the southern part of the Region. Most of the positive traps contained only single adult males. The number of positive traps increased sharply in 1976, but most contained only a single male moth. In 1977, there was another sharp increase in the number of positive traps and, in addition, the first multiple catches were recorded in Yarmouth County, N.S. More than half the 13 positive traps there contained at least two adults, and one trap in the town of Yarmouth had 10 male moths. Although a search again failed to find egg masses, the theory that the adults are being blown into the Region has to be reappraised and the possibility of the occurrence of an as yet undetected endemic population considered.

OTHER NOTEWORTHY INSECTS

Insect	Host(s)	Locality	Remarks
Alsophila pometaria (Harr.) Fall cankerworm	Elm Oak, red Maple, red Apple	Maritime Provinces	The 1976 outbreaks collapsed in Nova Scotia, but light defoliation in Cumberland and Pictou counties. In New Brunswick, severe defoliation in abandoned orchard at Burton; 2-year-old outbreak at Hardings Point decreased in intensity. In Prince Edward Island, populations decreased from 1976 levels.
Bucculatrix canadensisella Cham. Birch skeletonizer	Birch	Maritime Provinces	Moderate or severe infestations at scattered locations in central and eastern Nova Scotia, southeastern Prince Edward Island and near Wood Lake, St. John Co., N.B.
Coleophora fuscedinella (Zell.) Birch casebearer	Birch, white	Maritime Provinces	Moderate or severe loss of white birch foliage at widely scattered locations.
Coleophora innotabilis Braun Aspen casebearer	Aspen, trembling	Prince Edward Island	Small patches of defoliation ranging in size from a few trees to less than 1 ha throughout much of Province.
Coleophora laricella (Hbn.) Larch casebearer	Tamarack	Marinette, Halifax Co., and Whittenburg, Colchester Co., N.S.	Severe or moderate defoliation on scattered reproduction.
Croesia semipurpurana (Kft.) Oak leaf shredder	Oak, red	Maritime Provinces	Severe defoliation near Murray River, Kings Co., P.E.I.; light injury to about 30% of trees in stand near Lawrencetown, N.S., and varying degrees of defoliation in southern New Brunswick.

OTHER NOTEWORTHY INSECTS (Continued)

Insect	Host(s)	Locality	Remarks
Dioryctria reniculelloides (Mut. & Mun.) Spruce coneworm	Fir, balsam Spruce	Maritime Provinces	Marked increase in populations in eastern Nova Scotia and on Prince Edward Island; at several locations coneworm outnumbered spruce budworm in samples; population low in New Brunswick.
Dryocampa, rubicunda rubicunda (F.) Greenstriped mapleworm and *Anisota virginiensis* (Drury) Pinkstriped oakworm	Maple, red, sugar Birch, white, wire	Chignecto Game Sanctuary, Cumberland Co., N.S. and eastern Charlotte-southwestern Kings Co., N.B.	In Nova Scotia light or moderate defoliation of scattered red maples; in New Brunswick both insects caused patches of severe defoliation on maples and birches over approximately 38 km^2 of forest.
Ectropis crepuscularia (Schiff.) Saddleback looper	Coniferous, deciduous	Lindsay Lake, N.S.	Outbreak reported in 1976 has subsided.
Fenusa pusilla (Lep.) Birch leafminer	Birch, white, wire	Maritime Provinces	Moderate or severe browning patchy, especially on wire birch, in central and western Nova Scotia, in southeastern Prince Edward Island and at scattered locations throughout New Brunswick.
Fenusa ulmi Sund. Elm leafminer	Elm, English	Maritime Provinces	Foliar browning common; discoloration decreased in Nova Scotia but increased in Charlottetown, P.E.I.
Hydria prunivorata Ferg. Cherry scallopshell moth	Cherry, black	Nova Scotia	The 1976 severe infestation near Turf Lake, Halifax Co., collapsed.
Hylurgopinus rufipes (Eichh.) Native elm bark beetle	Elm, white	Maritime Provinces	See Dutch elm disease.
Itame pustularia (Guen.) Lesser maple spanworm	Maple, red	Priceville, N.B.	Percentage of dead and dying trees increased to 94% from about 50% in 1976.
Leucoma salicis (L.) Satin moth	Poplar, silver	Nova Scotia and New Brunswick	Severe defoliation on clumps of trees in eastern Nova Scotia and found at two locations in northwestern New Brunswick.
Messa populifoliella (Towns.) Poplar leafmining sawfly	Poplar, balsam, hybrid	New Brunswick	Leaf mining light or moderate at scattered areas in northwestern Madawaska Co., and light in hybrid poplar plantation at Bristol, Carleton Co.
Monochamus spp. Sawyer beetles	Fir, balsam	Burke Lake, Halifax Co., N.S.	Dead branch tips (3 to 10 per tree) on about 2% of trees in 40 ha Christmas tree stand resulted from adult feeding.

OTHER NOTEWORTHY INSECTS (Continued)

Insect	Host(s)	Locality	Remarks
Neodiprion nanulus nanulus Schedl Red pine sawfly	Pine, red	5 locations in Nova Scotia and 1 in Prince Edward Island	Common in plantations or Christmas tree stands; light and moderate defoliation occurred in small plantation at Georgetown, Kings Co., P.E.I.
Operophtera bruceata (Hulst) Bruce spanworm	Beech Maple, sugar	Lynn-East Mapleton-Simpson Lake area, Cumberland Co., N.S.	Outbreak reported in 1976 has collapsed. Populations low elsewhere.
Operophtera brumata (L.) Winter moth	Deciduous hosts	Nova Scotia and Prince Edward Island	Widely distributed but little defoliation; feeding usually occurred in conjunction with other insects.
Paleacrita vernata (Peck) Spring cankerworm and *Operophtera brumata* (L.) Winter moth	Deciduous trees	Southwestern Nova Scotia	Combined population of two insects caused severe defoliation to some hardwood trees at Kentville, and light defoliation of white elm at Brooklyn, Hants Co.
Physokermes piceae (Schr.) Spruce bud scale	Spruce	Black Brook, Victoria Co., N.B.	Common in spruce plantations, where levels of current shoot collar infections varied from 1 to 72%; populations low elsewhere.
Pineus similus (Gill.) Ragged spruce gall aphid	Spruce, Norway, red, white	Western Nova Scotia, Prince Edward Island and northwestern New Brunswick	Severe damage on red spruce at scattered locations in Nova Scotia; light on red, white and Norway spruce in Prince Edward Island; widespread in white spruce plantations in New Brunswick.
Pyrrhalta luteola Mull. Elm leaf beetle	Elm, white	Charlotte and York counties, N.B.	Moderate browning common throughout St. Stephen-Milltown area and light in Fredericton.
Rhyacionia buoliana (Schiff.) European pine shoot moth	Pine, red, Scots	Nova Scotia and New Brunswick	Infestations common in Nova Scotia; near Brookland, Pictou Co., about 90% of trees were infested in 1 ha plantation, and near Earltown, Colchester Co., severe current shoot damage occurred in two small plantations. In Prince Edward Island and New Brunswick insect was less common.
Sciaphila duplex Wlshm. Poplar leafroller	Aspen, trembling	Nova Scotia and Prince Edward Island	Severe leaf rolling at Lawrencetown and in scattered stands near Oxford, N.S., and around Alliston, Kings Co., P.E.I.; moderate at scattered locations in central and eastern Nova Scotia.

OTHER NOTEWORTHY INSECTS (Concluded)

Insect	Host(s)	Locality	Remarks
Scolytus multistriatus (Marsh.) Smaller European elm bark beetle	Elm, white	Upper Mills, Charlotte Co., N.B.	See Dutch elm disease

IMPORTANT FOREST DISEASES

Dutch Elm Disease, *Ceratocystis ulmi* (Buism.) C. Moreau—This disease continues to take its toll among the elm tree population in both New Brunswick and Nova Scotia. It has yet to be found in Prince Edward Island.

In Nova Scotia, the disease did not spread appreciably in 1977 but was identified for the first time at 16 new locations on the perimeters of, or within, the areas of previously known infection (see map, page 34).

In New Brunswick, the disease further intensified over much of the Province, depleting the dwindling shade-tree population in municipalities and rural areas alike. The area of known infection also increased as diseased trees were found for the first time near Rapids Depot, Restigouche County; the city of Saint John and St. George, Charlotte County; and Mortimer and Bass River, Kent County. This leaves Albert as the only county of New Brunswick where the disease has not yet been found.

At Fredericton, where a sanitation program has been in effect since the early 1950s, the number of new infections was about the same as in 1976. Within the sanitation control area, about 15% of the elms have become infected since 1969. However, outside this area within the city and especially on the north side of the St. John River, the incidence of the disease has reached epidemic proportions, and more than 600 dead or dying trees are designated for removal before spring.

The main carrier of Dutch elm disease in the Region, the native elm bark beetle, *Hylurgopinus rufipes* Eichh., was widespread and was collected at most locations where tanglefoot bands were placed on living elm trees in midsummer.

A single smaller European elm bark beetle, *Scolytus multistriatus* (Marsh.) was collected from a pheromone trap at Upper Mills, Charlotte County, N.B., in the same area where the insect was first found in the Region, in 1975.

Of 33 apparently healthy elm trees selected for observation in 1967 in areas of high tree mortality during a study of resistance to Dutch elm disease, 6 remain healthy, 4 are living and infected, 19 have died from the disease, and 4 have died from other causes. Of the 4 living infected trees, the first was confirmed as infected 7 years ago, the second 6 years ago and the third 5 years ago. The fourth tree became infected in 1976.

Scleroderris Canker, *Gremmeniella abietina* (Lagerb.) Morelet—Since its discovery in New Brunswick and Nova Scotia in 1971 and 1972 respectively, the disease has been found throughout much of the range of jack pine in eastern New Bruns-

wick and in scattered pine plantations elsewhere in the Province and in Nova Scotia (see map, page 33). Most species of pine occurring in the Maritimes are susceptible to the disease and have been found infected at one time or another.

In 1977, the fungus was found for the first time in several red pine and Scots pine Christmas tree plantations in Carleton, Restigouche, Northumberland and York counties, N.B., affecting the plantations to differing degrees. Jack pine plantations were infected in Kent County at Village St. Croix and near St. Pierre. Although no tree mortality is present, the disease is distributed throughout the plantations and many trees have infected branches up to 1.2 m above ground. The known distribution of the disease in Nova Scotia did not change in 1977.

Foliar Diseases of Deciduous Trees—Many species of fungi that cause leaf spots were collected or reported on a variety of hosts throughout the Region. Some of the most noteworthy follow:

Anthracnose caused by *Kabatiella apocrypta* (Ell. & Ev.) Arx discolored or defoliated maple trees at several locations in New Brunswick. The most noteworthy areas where moderate browning and leaf drop occurred were in the Fundy National Park and Riverside areas of Albert County, in eastern Kings County, and in the southern Victoria-northern Carleton County area, where conditions were compounded by wind damage; browning and defoliation were usually most noticeable on hilltops. Elsewhere in the Region discoloration was variable on maple shade trees.

Discula quercina (West.) Arx caused light or moderate foliar discoloration on beech in southwestern New Brunswick. Elsewhere, isolated patches of discoloration of varying degrees occurred on ash and oak.

Ash rust, *Puccinia sparganioides* Ell. & Barth., was severe on white ash over 8 ha at Pleasant Lake and on a few trees at Lake Trefry and moderate on scattered trees at Argyle in Yarmouth County, N.S.; light foliar discoloration occurred at Ellerslie, Prince County, P.E.I.

Ink spot of aspen, *Ciborinia whetzelii* (Seaver), Seaver was common at widespread locations in the Region but occurred most frequently in New Brunswick; infections were usually of light or moderate intensity and confined to small patches of trembling aspen except at Graham Corner, York County, and Speerville, Carleton County, where more than 90% of the leaves were infected on some trees.

Leaf and twig blight of aspen, *Venturia macularis* (Fr.) E. Muell. & Arx, infections were common on trembling aspen throughout the Region, but discoloration was generally light; infection was severe on a group of trees at New Horton, Albert County, and moderate at St. Luc, Kent County, Red Bank, Northumberland County, and Parker Ridge, York County, N.B.

Leaf blotch of horse-chestnut, *Guignardia aesculi* (Pk.) V. B. Stew., was common throughout the range of the host, and severe browning occurred at various locations in Inverness, Victoria, Antigonish, Queens and Yarmouth counties of Nova Scotia.

Melampsora medusae Thuem., the conifer-aspen rust, was severe on scattered hybrid poplar trees at the Beech Grove nursery near Charlottetown, P.E.I.

Drepanopeziza tremulae Rimpau caused appreciable foliar discoloration of aspen at Alcida, Gloucester County, Jeanne Mance, Northumberland County, and Parker Ridge, York County, N.B.

Cherry blight caused severe browning and wilting of pin cherry shoots at many isolated locations in eastern Nova Scotia and on Prince Edward Island.

Willow blight, *Venturia saliciperda* Nuesch, was present throughout the Region but less common than in 1976; leaf browning was severe on single ornamental willows at Lac Baker, Madawaska County, N.B., and moderate at widely scattered locations in central Nova Scotia and northwestern New Brunswick.

Moderate foliar browning was general on birch in southern New Brunswick between St. Martins and Lepreau, but the cause is unknown.

Chemical Injuries—Severe damage resembling that caused by *sulphur dioxide* occurred to all species of trees, shrubs and garden crops in an area 30–60 m wide and approximately 1.5 km long to the east of a pulp mill at Edmunston, N.B., on July 23, 1977; symptoms ranged from moderate leaf spotting to severe browning of entire leaves. Near South Little River, Gloucester County, N.B., potted alfalfa had slight discoloration within 1.6 km and southeast of the SO_2 source, but no visible injury was found on spruce in a 1977 New Brunswick Natural Resources plantation in the same general area.

Ocean salt spray blown inland by high winds caused moderate and severe foliar discoloration of conifers along Wallace Bay, Cumberland County, N.S., and red pine were similarly affected in a provincial park on Middle Island, Northumberland County, N.B.

Roadside salt spray and/or *winter drying* caused moderate or severe discoloration of roadside conifers, especially of pines along heavily travelled roads throughout the Region.

OTHER NOTEWORTHY DISEASES

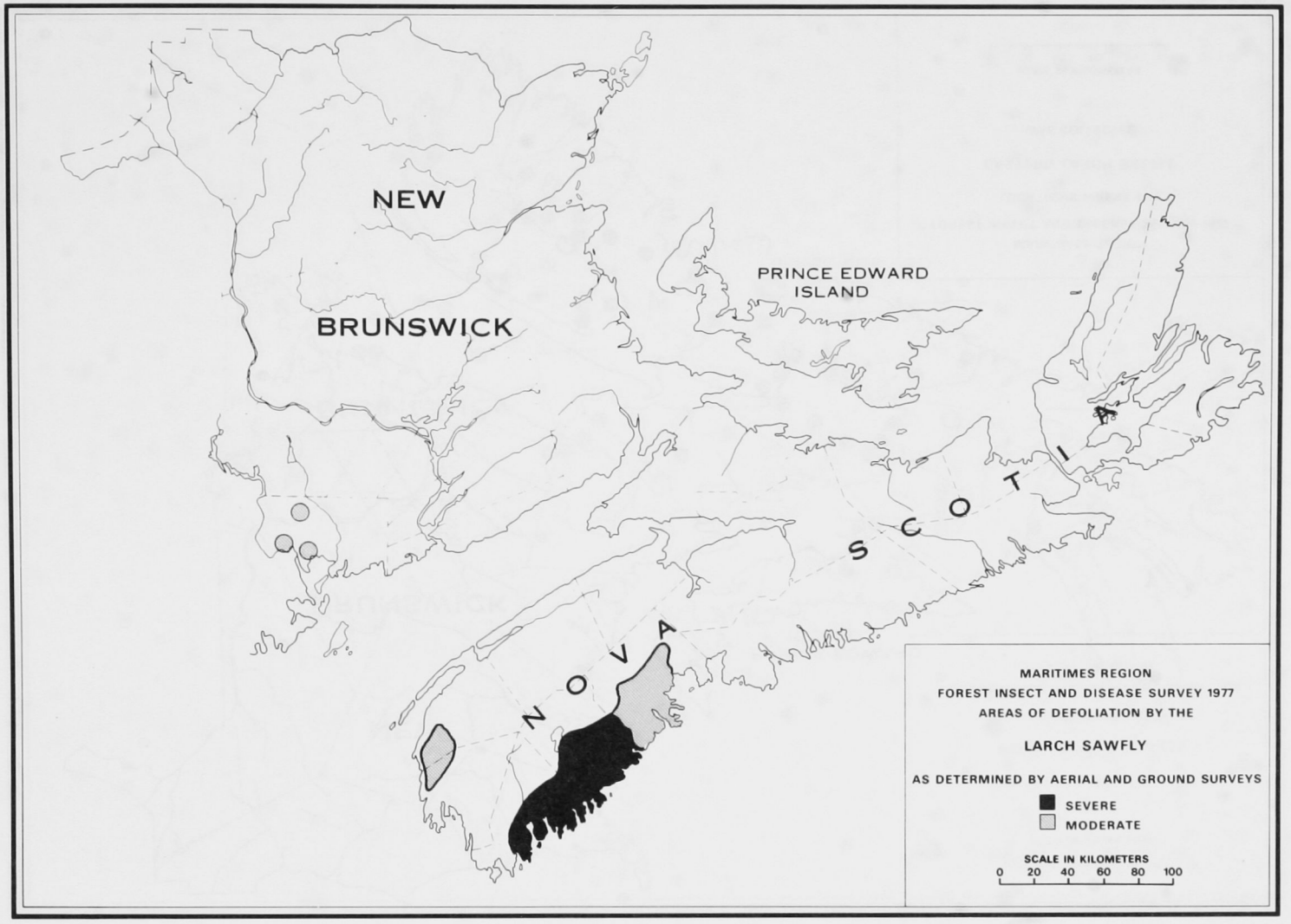
Organism and Disease	Host(s)	Locality	Remarks
Animal damage	Pine, red, Scots	Nova Scotia and New Brunswick	Porcupines caused moderate or severe girdling in one pine plantation in Cumberland Co. and several in Yarmouth Co., N.S., and one in Sunbury Co., N.B.
Armillaria mellea (Vahl ex Fr.) Kummer Armillaria root rot	Fir, balsam	Nova Scotia	Causing mortality of scattered trees in Christmas tree stands, plantations and cutover areas. Trees previously weakened by balsam woolly aphid were killed near Shortt Lake, Colchester Co.

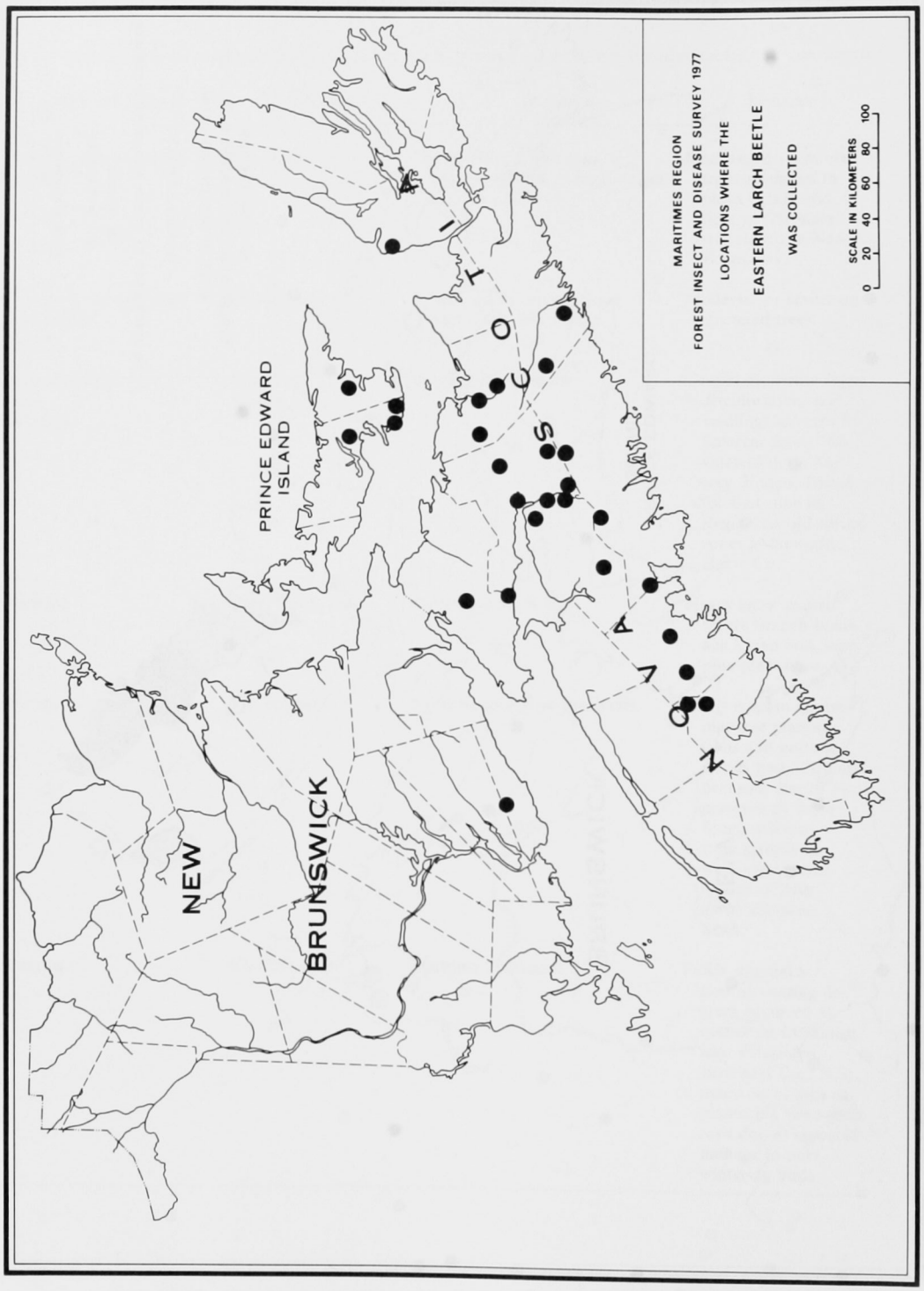
OTHER NOTEWORTHY DISEASES (Continued)

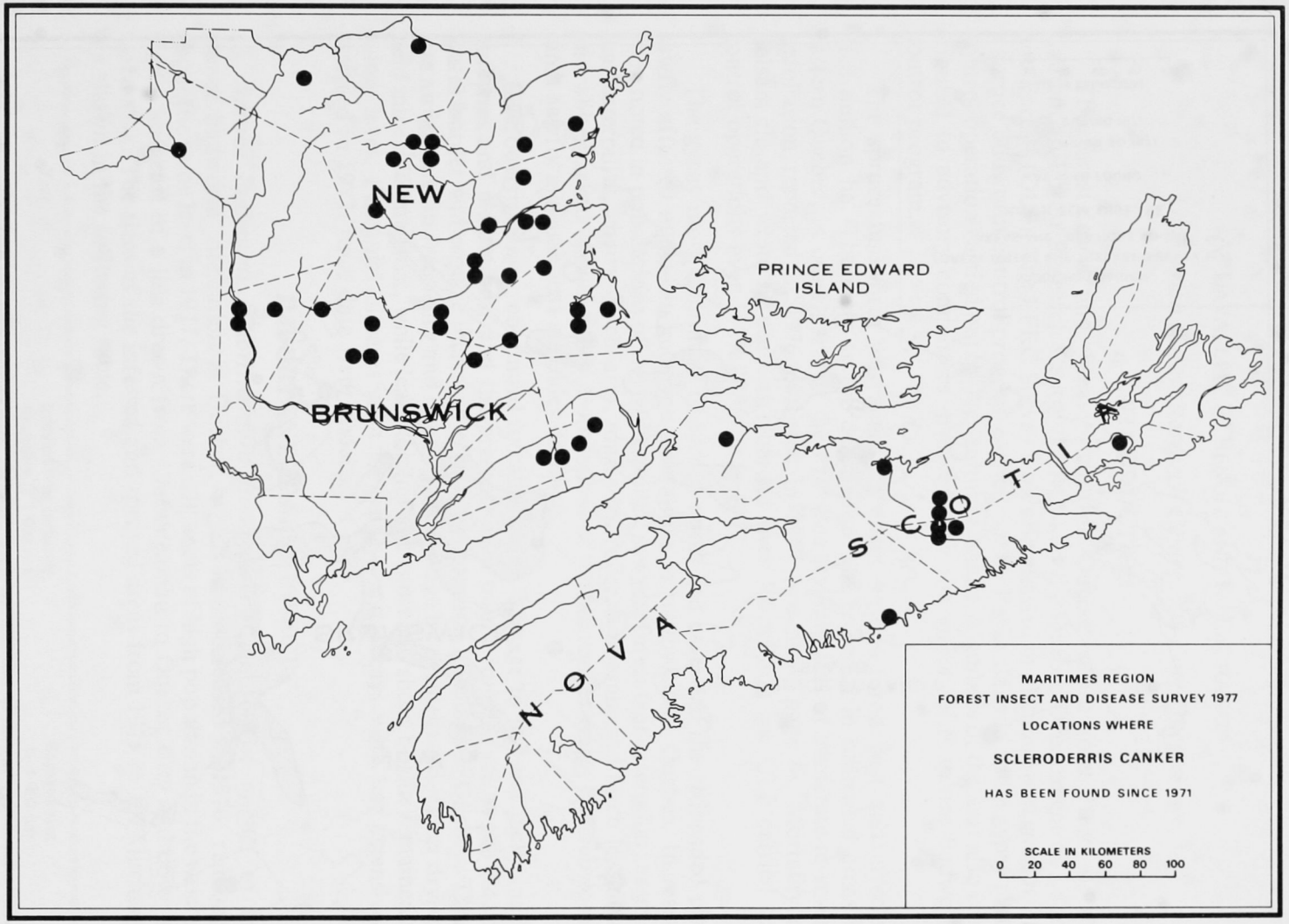
Organism and Disease	Host(s)	Locality	Remarks
Chrysomyxa spp. Needle rusts	Spruce, black	Lindsay Lake, N.S. and Geary, N.B.	Infection severe or moderate on small trees.
Coleosporium asterum (Diet.) Syd. Needle rust	Pine, jack	Dog Lake, Yarmouth Co., N.S.	Infections moderate or severe.
Cronartium comptoniae Arth. Sweetfern blister rust	Pine, lodgepole	Queens and Shelburne counties, N.S.	Less than 10% of trees infected in plantations.
Dieback	Alder	Eastern Westmorland Co. and Cornhill, Kings Co., N.B.	Numerous patches of alders dead and dying of unknown cause.
Endocronartium harknessii (J. P. Moore) Y. Hiratsuka Globose gall rust	Pine, Scots	3 locations in Cumberland Co., N.S., and 2 in Kent Co., N.B.	Not assessed regionally, but caused some tree mortality or was moderate on about 20% of trees.
Frost damage	Fir, balsam Spruce, black, white Oak, red	Lunenburg and Annapolis counties, N.S.; Kent and Victoria counties, N.B.	Moderate or severe injury in a few Christmas tree areas and in black spruce plantation near Black Brook. Young red oaks 3 m or less in height and lower crowns of larger trees suffered complete loss of foliage near West Clifford and between Dalhousie and Springfield in Nova Scotia.
Hypoxylon mammatum (Wahl.) Miller Hypoxylon canker	Aspen, trembling	Maritime Provinces	Common and widespread throughout Region (see 1976 Report).
Maple decline	Maple, red, sugar	Maritime Provinces	Twig and branch mortality and death of trees has been increasing in past 20 years. Affected trees are confined to cities, towns, villages and areas adjacent to well-travelled highways. Road-salting, traffic, construction etc. probable contributing factors.

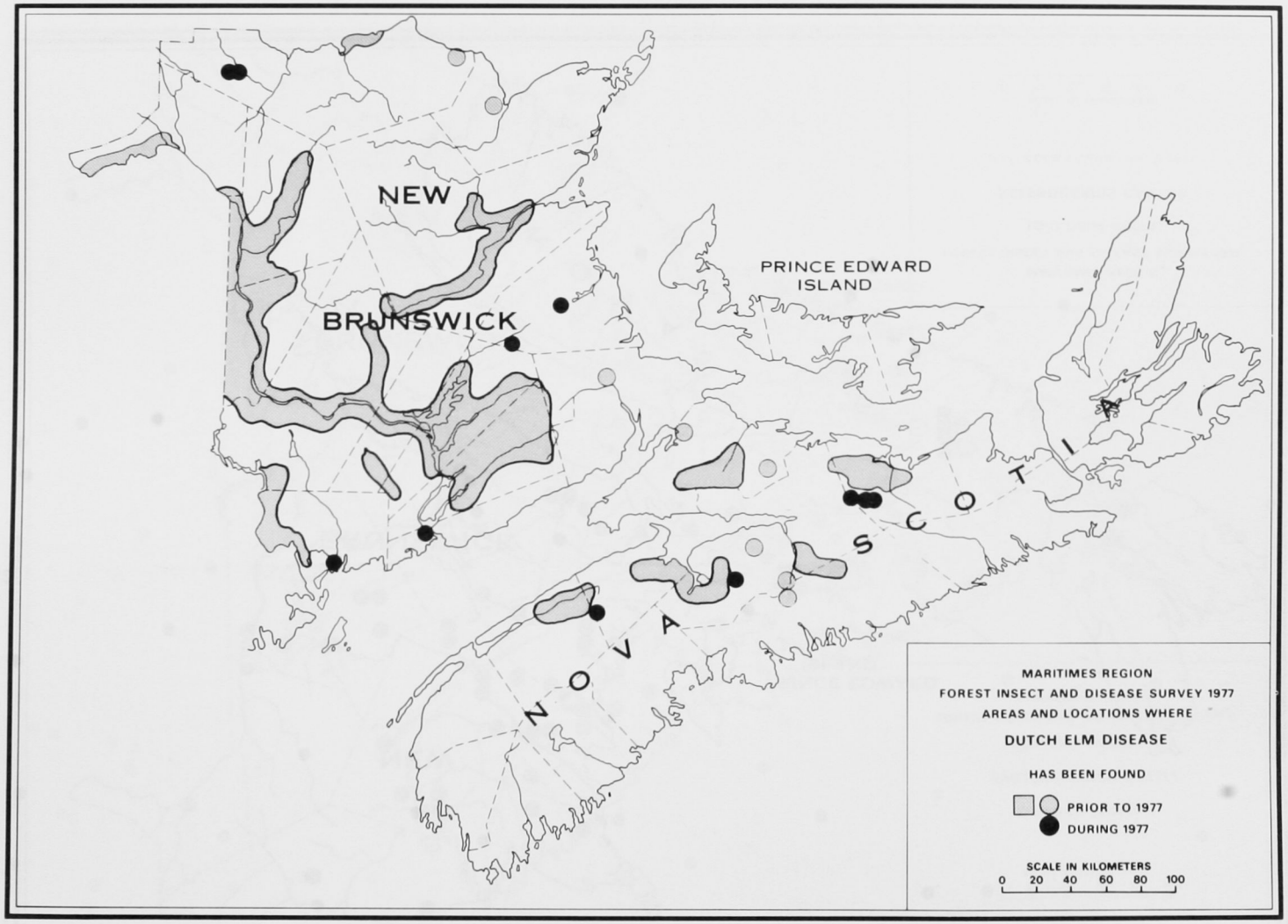
OTHER NOTEWORTHY DISEASES (Concluded)

Organism and Disease	Host(s)	Locality	Remarks
Pucciniastrum epilobii Otth Needle rust	Fir, balsam	Salem, N.S.; 2 locations in Gloucester and Northumberland counties, N.B.	Moderate on scattered trees examined in Nova Scotia and light in Christmas tree stands in New Brunswick.
Pucciniastrum geoppertianum (Kuehn) Kleb. Needle rust	Fir, balsam	3 locations in central Nova Scotia and 1 in Prince Edward Island	Moderate or severe on scattered trees.
Sirococcus strobilinus Preuss Shoot blight	Pine, red Spruce	Western Nova Scotia	Caused moderate foliar discoloration, and seedlings infected at Lawrencetown Provincial Forest Nursery. Fungus found for first time in Region on old spruce cones at Newport, Hants Co.
Snow damage	Pine, Scots, red	Carleton Co., N.B.	Heavy snow caused severe branch breakage in red and Scots pine plantation.
Sooty molds	Fir, balsam	Northwestern New Brunswick	Many trees in Christmas tree plantations and natural stands had black appearance due to presence of these fungi; affected trees associated with severe infestations of *Mindarus abietinus* Koch.
Winter drying	Conifers	Maritime Provinces	Foliar discoloration of varying degrees occurred at numerous locations; near Frizzleton, Inverness Co., N.S., many Scots pine in plantation have dead tops due to repeated damage to overwintering buds.


NEW
BRUNSWICK
PRINCE EDWARD
ISLAND
NOVA SCOTIA
MARITIMES REGION
FOREST INSECT AND DISEASE SURVEY 1977
AREAS OF DEFOLIATION BY THE
LARCH SAWFLY
AS DETERMINED BY AERIAL AND GROUND SURVEYS
SEVERE
MODERATE
SCALE IN KILOMETERS
0 20 40 60 80 100


MARITIMES REGION
FOREST INSECT AND DISEASE SURVEY 1977
LOCATIONS WHERE THE
EASTERN LARCH BEETLE
WAS COLLECTED
SCALE IN KILOMETERS
0 20 40 60 80 100
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA


NEW
BRUNSWICK
PRINCE EDWARD
ISLAND
NOVA SCOTIA
MARITIMES REGION
FOREST INSECT AND DISEASE SURVEY 1977
LOCATIONS WHERE
SCLERODERRIS CANKER
HAS BEEN FOUND SINCE 1971
SCALE IN KILOMETERS
0 20 40 60 80 100


NEW
BRUNSWICK
PRINCE EDWARD
ISLAND
NOVA SCOTIA
MARITIMES REGION
FOREST INSECT AND DISEASE SURVEY 1977
AREAS AND LOCATIONS WHERE
DUTCH ELM DISEASE
HAS BEEN FOUND
PRIOR TO 1977
DURING 1977
SCALE IN KILOMETERS
0 20 40 60 80 100

QUEBEC REGION

A. LAVALLEE, P. BENOIT AND D. LACHANCE

Laurentian Forest Research Centre, Ste-Foy, Quebec

INTRODUCTION

The forest insect and disease survey in Quebec was a joint effort of the Laurentian Forest Research Centre (LFRC) and the Quebec Department of Lands and Forests (QLF). The LFRC Survey Unit also assisted in planning and conducting a spruce budworm control program carried out by Parks Canada and a gypsy moth control operation carried out by Agriculture Canada. Members of the unit also contributed to advisory committees involved with the major QLF spruce budworm control program.

The spruce budworm was again the most serious forest pest and affected 32.8 million ha. The most severe defoliation was recorded in untreated areas in eastern Quebec; in other parts of the Province several areas of moderate-to-severe defoliation reported in 1976 persisted in 1977 (see map, page 6). Mortality of balsam fir and white spruce was recorded over 5.6 million ha. QLF carried out control operations over 1.4 million ha in 1977.

The gypsy moth continued to spread north and east, and the redheaded pine sawfly affected numerous red pine plantations in southwestern Quebec. Increases were noted in populations of the whitespotted sawyer, forest tent caterpillar, eastern tent caterpillar, cherry casebearer, maple leafroller, ambermarked birch leafminer and whitemarked tussock moth. Populations of the fall cankerworm, fall webworm, larch sawfly and oak leaf shredder declined.

Scleroderris canker continued to cause major damage to red and jack pine in nurseries and plantations, and the presence of a more virulent race at the United States border will require increased efforts at detection in southern Quebec. There was an increase in frequency and intensity of damage by needle rusts, winter drying, field mice and late frost, while leaf blotches and spots and shoot blights remained at a low level. Perennial diseases such as cankers and decays were not extensively sampled in 1977, since data were updated in 1976.

IMPORTANT FOREST INSECTS

Spruce Budworm, Choristoneura fumiferana (Clem.)—The impact of the spruce budworm infestation in Quebec, which had decreased in 1976, remained about the same level in 1977. There were still areas of high population in the western region and east of a line drawn from Chibougamau to Quebec City and down to Coaticook. The sizes of the infested and sprayed areas from 1975 to 1977 inclusive are shown in the following table.

Year	Infested area including mortality (x 1 000 ha)	Sprayed area (x 1 000 ha)
1975	35 400	2 887
1976	33 150	3 656
1977	32 800	1 396

According to the QLF, the average egg-mass number decreased again in 1977; it was 46% lower than in 1976 and 67% lower than in 1975.

Western Region

A large part of the area between the Ontario border and La Vérendrye Park was heavily defoliated and, from egg-mass counts, the 1978 situation should be the same. The second and largest defoliated area was between Lebel-sur-Quévillon and the Rupert River, where defoliation was moderate to severe in the south, decreasing to light toward the north.

Central Region

Most of the western half of this region did not suffer damage in 1977. The exceptions were several small dispersed infestations and a large heavily defoliated area between Lake Saint-Jean and Lake Mistassini.

The eastern half of the central region was also defoliated severely from Parc des Laurentides north to Lake Plétipi, Chicoutimi County.

Southern Region

In this predominantly agricultural region, heavy defoliation occurred in woodlands within a band 60 km wide, along the United States border as far west as a line drawn from Montmagny to Coaticook.

Eastern Region

The area of severe infestation that prevailed in Saguenay County just north of the St. Lawrence River, was contiguous to the one in the eastern part of the central region. As in 1976, it extended east with less intensity in a band 50 to 60 km wide, along the shore as far as the Musquaro River. Egg-sampling in this region does not indicate any change for 1978.

The Lower St. Lawrence River area and Gaspé Peninsula were severely attacked by the budworm. Only those areas sprayed with insecticides retained a fair amount of new foliage. Although the egg-mass counts in this region showed a reduction of 60% from 1976, severe defoliation is still predicted for 1978.

Redheaded Pine Sawfly, Neodiprion lecontei (Fitch)—Attacks in red pine and sometimes in jack pine plantations of southwestern Quebec, between the Ottawa and Quyon rivers, increased in 1977. Moderate-to-severe damage prevailed in many plantations between Labelle and Mont-Laurier. In contrast, many high populations of the redheaded pine sawfly collapsed in plantations between Papineau and Montebello, and in southern Quebec between the Richelieu and Saint-François rivers, where only one severe, one moderate and four light pockets of defoliation were observed among the 26 surveyed plantations.

White Pine Weevil, Pissodes strobi (Peck)—There were three main infestation areas in 1977: one, between Fort-Coulonge and Messine in the west, with a number of light infestations; a second, between Montebello and the Laurentians, north of Montreal, with light-to-moderate infestations; and a third along both sides of the Saint-Maurice River from Saint-Louis-de-Champlain up to Beaumont Dam, north of La Tuque, where numerous light-to-severe infestations were recorded. A few other scattered plantations were found infested in Woburn, Frontenac County, and in East Angus and Pont-Rouge and near Armagh, Bellechasse County. Mostly eastern white pine, white spruce, Norway spruce and Scots pine were attacked.

Whitespotted Sawyer, Monochamus scutellatus (Say)—High populations of this sawyer beetle were reported by forest workers, especially at Matagami, and at Lebel-sur-Quévillon, Abitibi-Est County, where adult beetles had killed black spruce near cutover areas by chewing the bark off the branches. In the same region, adult beetles migrated in large numbers to the cities of Val-d'Or and Amos. The beetle was found in higher numbers than usual in many localities of Temiscamingue, Pontiac and Gatineau counties; they also caused some damage near Girardville, Lac-Saint-Jean-Ouest County, and Lake Témiscouata and Lake Mistigougèche, Rimouski County.

The incidence of the whitespotted sawyer beetle may increase in many localities in the near future as balsam fir and white spruce die after very severe attacks by the spruce budworm.

Larch Sawfly, Pristiphora erichsonii (Htg.)—The increase in population levels of the larch sawfly recorded in 1976 did not continue in 1977. Populations were low throughout most of the Province except in a triangle limited by Ile des Allumettes - Baskatong Reservoir - Montreal, where they varied from low to high. Two small plantations of Japanese larch (0.2 ha) and European larch (0.5 ha) owned by the Canadian International Paper Company near Harrington and Avoca respectively had to be sprayed with Sevin because of the threatening high populations. Small light infestations were found near Villemontel, Lake Cadillac, Barraute and Rapide-Sept in Abitibi County, and moderate infestations from the Mattawin River north to Lake Albanel in central Quebec. Also, small light infestations were found in the vicinity of Quebec City and in Laurentides Park. The most easterly collections were from the Magpie River on the North Shore and from 27 km east of Murdochville in the Gaspé Peninsula.

Gypsy Moth, Lymantria dispar (L.)—Gypsy moth infestations have increased in size and intensity since 1976, and new infestation centers should develop inside and outside the known infested areas in the near future. The 1977 situation can be described as follows: All degrees of defoliation were observed in many localities within an agricultural area of about 5 180 km^2 roughly delimited by Saint-Régis (west corner of Huntingdon County), Beloeil, Granby, Pigeon-Hill and the United States border. This area was made up of five contiguous zones: three totalling 2 850 km^2, with small and local light infestations, and two totalling 2 330 km^2, dotted with numerous moderate-to-severe infestations (Beauharnois - Châteauguay - Huntingdon counties and Rouville - Iberville - Missisquoi counties). Westerly from these areas was a very small area of light defoliation on each side of Lake Deux-Montagnes, around Oka and Hudson. However, the infestation in Paul Sauvé Provincial Park near Oka was severe and the egg count was high.

Wire birch and red oak were the species most commonly attacked, and some individual coniferous trees, such as pine and hemlock, were often almost completely defoliated when they were within infested deciduous stands.

The pheromone traps set out by the Plant Quarantine Division, Agriculture Canada, and LFRC gave positive captures between Quyon and Fasset, along the Ottawa River; at Saint-Donat, Sainte-Agathe and Piedmont north of Montreal; between Saint-Esprit and Berthierville and between Maskinongé and Deschambault, on the north shore of the St. Lawrence River; at Cap-de-la-Madeleine, Quebec City and Château-Richer; and in the southern region of Quebec, where catches were frequent between Deschaillons and the United States border.

Outside the known infested areas, a larva was found at Lambton, a pupa at North Hatley and some eggs at Fasset, Papineau County, Saint-Placide, Deux-Montagnes County, Saint-Thérèse, Terrebonne County, Saint-Jacques-Nord, Montcalm County, Pointe-du-Lac, Saint-Maurice County, Cap-de-la-Madeleine, Champlain County, Beaulac, Wolfe County, and Sawyerville, Compton County.

Maple Leafroller, *Cenopis acerivorana* MacK.—In 1977, an unusual situation with this maple leafroller caused severe defoliation of sugar maple and red maple in many localities of the Matapédia Valley. Amqui was the center of a severely defoliated sector of 200 km^2. Another sector of 900 km^2 with moderate-to-severe defoliation, closer to the St. Lawrence River, was localized between Sainte-Jeanne-d'Arc and Saint-Léandre. Scattered light defoliation occurred in a third sector of 2 000 km^2 in Rimouski and Matapédia counties, contiguous to the other two areas. South of these areas another 700 km^2 showed light-to-moderate defoliation.

Elsewhere in the Province, some moderate-to-severe defoliation was observed on sugar maple at Lake de la Tête d'Original, Temiscamingue County, Rougemont, Rouville County, Saint-Antoine-de-Pontbriand, Mégantic County, Saint-Jean-Chrysostome, Lévis County, and Armagh, Bellechasse County. Numerous elms were also moderately defoliated at La Conception, Labelle Country.

Birch Casebearer, *Coleophora fuscedinella* (Zell.)—As in 1976 the main zone of numerous infestations varying from light to severe was located east of a line drawn from Trois-Rivières to Lake Mégantic, Frontenac County, with extensions running as far as the tip of the Gaspé Peninsula on the south shore of the St. Lawrence and as far as Sept-Iles on the north shore. Defoliation of white and wire birch varied from 30 to 80% near Rimouski and amounted to 20% near Saint-Damase, Matapédia County. At Grande-Cascapédia, 1.2 ha of alder were 50% defoliated. Some dispersed populations could be found on each side of the Saguenay River as far north as Lake Saint-Jean.

Oak Leaf Shredder, *Croesia semipurpurana* (Kft.)—The percentage of the total number of collections of this oak leaf shredder reporting moderate and severe defoliation decreased from 81 in 1975 to 52 in 1976 and to 36 in 1977. The 1976 infestation in the triangle Fort-Coulonge - Maniwaki - Montebello almost collapsed in 1977. A small medium population remained at Fort-Coulonge and a high population remained at Montebello. However, at Grandes-Piles and Cap-de-la-Madeleine and in the vicinity of Quebec City, defoliation of red oak was between 40 and 70% as in 1976. At Pointe-à-la-Garde, Bonaventure County, the population went from trace in 1976 to high in 1977.

A Casebearer, *Coleophora* sp.—This unidentified casebearer is usually uncommon, but in 1977 many local populations were moderate or high. These are the first recorded infestations in Quebec. Many trembling aspen stands around Amqui and Saint-Léon-le-Grand, Matapédia County, and Sainte-Angèle, Rimouski County, were infested. If hibernating populations survive the winter, the same situation should prevail in 1978.

Fall Cankerworm, *Alsophila pometaria* (Harr.)—The infestation around Hull and the one from Namur to Labelle between the Rouge River and the Petite Rouge River, reported in 1976, collapsed in 1977 and populations elsewhere were generally lower. However, some severe defoliation was present in Caughnawaga and moderate defoliation was seen in Quyon and Saint-Thomas-de-Joliette. Low popu-

lations persisted in Hull and light defoliation was observed in Saint-Henri, Lévis County, Berthier, Montmagny County, and Sainte-Hélène, Kamouraska County.

Severe defoliation is predicted for 1978 at Varennes, Verchères County, Caughnawaga, Laprairie County, Saint-Thomas-de-Joliette, Joliette County, and Saint-Henri, Lévis County. The tree species mostly affected in 1977 were Manitoba and sugar maples and basswood.

Ambermarked Birch Leafminer, *Profenusa thomsoni* (Konow)—Numerous centers of infestations of all sizes and from light to severe were present throughout the Province where white birch grows predominantly. In Abitibi County, many infestations occurred in the area between Lake Faillon, Lebel-sur-Quévillon and the Castagnier River. In north-central Quebec, some light infestations and more numerous moderate-to-severe infestations were scattered within a triangle of about 14 000 km^2 delimited by Gouin Reservoir, Lake Rhéaume, Champlain County, and Lake de la Perdrix Blanche, Lac-Saint-Jean-Ouest County. Two light infestations were present near Causapscal, and there was one severe infestation south of Lake Mitis, in the eastern region. On the North Shore, there was a moderate infestation near Lake Sainte-Anne, Saguenay County, and a severe infestation at Port-Cartier, Saguenay County.

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)—This sawfly had little importance in most instances in 1977, but moderate-to-severe defoliation was encountered in the following localities: in the western region — Rouyn, Maniwaki, Decelles Reservoir, Lake Chicobi and Desmaraisville; in the central and southern regions — Saint-Donat, Berthierville, Gouin Reservoir, Chibougamau, Lake Saint-Jean, Warwick, Granby, Saint-Fabien-de-Panet, Lake à l'Epaule, Baie-Saint-Paul and Saint-Fidèle; in the eastern region — Godbout, Sept-Iles, Manche-d'Epée and Gaspé.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—Light and moderate defoliation of trembling aspen occurred again in 1977 around Temiscaming and Ville-Marie in western Quebec. As in 1976, trembling aspen was severely infested with 90 to 100% defoliation at Notre-Dame-de-la-Doré (36 km^2) and also at Sainte-Jeanne-d'Arc in the Lac-Saint-Jean area (10 km^2). However, egg counts show a 50% decrease from 1976, and this indicates a probable population reduction for 1978.

In southern Quebec, the forest tent caterpillar was present in low numbers, except in Saint-Jude, Saint-Hyacinthe County, and Deauville, Sherbrooke County, where trembling aspen was about 60% defoliated on an area of 130 ha and 3 ha respectively. Also, in Franklin Centre, Huntingdon County, two sugar maple bushes of 60 ha each were defoliated, one by 30% and the other by 100%. Both partially refoliated during the summer. According to egg counts in these areas, the infestation should be more intense and more widespread in 1978.

Rusty Tussock Moth, *Orgyia antiqua* (L.)—The large 1976 infestation in the Gaspé Peninsula collapsed in 1977 and there remained in that region only a few scattered localized and small defoliated areas. The tussock moth was collected from Labelle, north of Montreal, to Port-Cartier on the North Shore, and near Gaspé; 31% of collections were from coniferous trees and 54% from birches, mostly from white birch.

Whitemarked Tussock Moth, *Orgyia leucostigma* (J. E. Smith)—The whitemarked tussock moth was collected more often than usual in 1977. Half of the

collections were from maples and birches, very few from conifers. Low populations were detected in many areas of the Gaspé Peninsula. Populations in that region were high along the road north of Le Gîte in Parc de la Gaspésie and also around L'Anse-à-Valleau. North of L'Ascension-de-Patapédia, Bonaventure County, white birch was defoliated by 15% on an area of 3.8 km^2 and by 40% on another area of 0.6 km^2.

Fall Webworm, Hyphantria cunea (Drury)—In 1977, populations of the fall webworm decreased for the second consecutive year. Defoliation was light and sometimes moderate along the Ottawa River between Papineau and Fort-Coulonge. West of this area, at Ile des Allumettes, it was moderate and severe. Around Kipawa Lake and Cabonga and Baskatong reservoirs, defoliation was light; it was moderate near Decelles Reservoir and severe near Beattyville, Abitibi County. Moderate-to-severe defoliation was observed on cherry trees and willows in Parc Matane. The average number of tents per kilometer of road in areas of light-to-severe defoliation was 33; a maximum of 272 was obtained at Demers Centre, Pontiac County.

OTHER NOTEWORTHY INSECTS

Insect	Host(s)*	Locality	Remarks
Adelges piceae (Ratz.) Balsam woolly aphid	Fir, balsam	Saint-Majorique, Gaspé-Est Co.	High populations on trunks.
		L'Anse-à-Valleau, Gaspé-Est Co.	Active infestations.
Anisota virginiensis (Drury) Pinkstriped oakworm	Birch, white	St-Thomas-Didyme, Lac-St-Jean-Ouest Co.	Moderate defoliation on large number of trees.
Aphrophora parallela Say Pine spittlebug	Fir, balsam Pine, eastern white, jack, mugho, Scots Spruce, black Tamarack	Papineauville, St-Jovite; Taureau Reservoir, Lake Potherie Inférieur, St-Maurice Co.; Davelluyville, Arthabaska Co.; St-Vallier, Cap-Tourmente, St-Urbain	Medium-to-high populations.
		Ste-Foy	High populations on mugho pine and moderate on tamarack.
Archips argyrospilus (Wlk.) Fruit-tree leafroller	Aspen, trembling Birch, white Maple, red Willows	Province-wide, but more common in Témiscamingue Co.	Frequent.
		Mont-Laurier, Des Jardins River, Témiscamingue Co.	Light defoliation.
		St-Hilarion, Charlevoix-Ouest Co.; Lake Kénogami, Chicoutimi Co.	Moderate-to-severe defoliation.
Chionaspis lintneri Comst. Lintner's scale	Alder Birch, white	Gilardo Dam, St-Maurice Co.; Lake Morialice, Maskinongé Co.; 40 km northeast of Windigo, Champlain Co.	Severe attacks, mostly on birch.
Contarinia baeri (Prell) European pine needle midge	Pine, red, Scots	Island Brook, Compton Co.	Severe defoliation on Scots pine.

OTHER NOTEWORTHY INSECTS (Continued)

Insect	Host(s)	Locality	Remarks
		Ste-Marguerite, Dorchester Co.	Light defoliation on red pine.
Cryptococcus fagisuga Lind. Beech scale	Beech	Cap-Tourmente; Ile d'Orléans; Lake Trois-Saumons, L'Islet Co.	Moderate-to-severe attacks on trunks. Stable situation in Province.
Diprion similis (Htg.) Introduced pine sawfly	Pine, eastern white, jack, red, Scots	L'Epiphanie, Ste-Apollinaire	Light-to-moderate defoliation on a few tall eastern white pines.
Gilpinia hercyniae (Htg.) European spruce sawfly	Spruce, Norway white	St-Hilarion, Charlevoix-Ouest Co.; Val Racine, Compton Co.	Populations more abundant than usual in two 4 ha plantations of white spruce. To observe again in 1978.
Heterocampa guttivitta (Wlk.) Saddled prominent	Beech, Birch, wire	Mont-Carmel, Champlain Co.	Low populations.
	Maple, red, sugar	St-Raphaël, Bellechasse Co.	Light defoliation.
		St-Eugène, L'Islet Co.	Moderate defoliation on sugar maple in area adjacent to 1976 infestation. Numerous evening grosbeaks eating caterpillars.
Leucoma salicis (L.) Satin moth	Cottonwood, eastern Poplar, Lombardy, silver	Many localities in southern Quebec from Huntingdon to Victoriaville and East Angus	Mostly severe defoliation up to 95%, on areas from 1/2 to 4 ha.
	Willows	Ile du Havre aux Maisons, Iles-de-la-Madeleine Co.	Moderate defoliation.
Lithocolletis aceriella Clem. Maple leafminer	Maple, red sugar	Low, Gatineau Co.; Park Papineau-Labelle (northeast gate); Stanbridge and Eccles Hill, Missisquoi Co.	Medium populations.
Messa nana (Klug) Early birch leaf edgeminer	Birch, white, wire, yellow	Forestville	New extension on North Shore.
		Masson, Papineau Co.; Lake Memphrémagog	Medium populations.
		St-François-de-Masham and St-Pierre-de-Wakefield, Gatineau Co.; Entrelacs, Terrebonne Co.	Low populations.
Mindarus abietinus Koch Balsam twig aphid	Fir, balsam Spruce, Norway, white	L'Ascension, Labelle Co.; Chandler, Gaspé-Est Co.	Medium populations on a few trees.
		St-Julien, Wolfe Co.	High populations.

OTHER NOTEWORTHY INSECTS (Continued)

Insect	Host(s)*	Locality	Remarks
Neodiprion swainei (Midd.) Swaine jack pine sawfly	Pine, jack	Vicinity of St-Ambroise and St-Honoré, Chicoutimi Co.	Numerous moderate-to-severe infestations.
Paleacrita vernata (Peck) Spring cankerworm	Elm, white	St-Jovite	High populations on about 20 trees.
Paradiplosis tumifex Gagné Balsam gall midge	Fir, balsam	Louiseville, Warwick	High populations. Damage previously attributed to *Dasineura balsamicola* Lint.
		Baie-St-Paul	Medium populations.
		St-Damase, Ste-Paula, Matapédia Co.	Medium-to-high populations.
		Rivière-au-Tonnerre, Saguenay Co.	Medium populations.
Pikonema alaskensis (Roh.) Yellowheaded spruce sawfly	Spruce, black, Colorado, red, white	Mont-St-Michel, L'Annonciation, Labelle Co.; Maskinongé; Bernierville, Mégantic Co.	Moderate-to-severe defoliation.
		Rouyn; Magpie River, Saguenay Co.	Most westerly and easterly collection points respectively.
		St-Adelme, Matane Co.	13% white spruce mortality on 2 ha area following previous infestation.
Plagiodera versicolora (Laich) Imported willow leaf beetle	Willows	Ste-Clothilde, Châteauguay Co.	Numerous trees with 90 to 95% of foliage affected.
Rhyncaenus rufipes Lec. Willow flea beetle	Willows	Lake Brome, Brome Co.	90% of foliage affected. About 10% defoliation.
Saperda concolor Lec. Poplar-gall saperda	Aspen, trembling	Senneterre; north of Lake aux Rats, Lac-St-Jean-Ouest Co.; south of Pipmuacan Reservoir, Chicoutimi Co.; La Malbaie and 30 km north near La Malbaie River; 40 km north of Les Escoumins near river of same name, Saguenay Co.; vicinity of St-Hyacinthe, St-Joseph-de-Beauce; St-Damien, Berthier Co.	Numerous moderate attacks on branches and trunks.
		Vicinity of St-Zénon, Berthier Co., and St-François-Xavier, Rivière-du-Loup Co.; in triangular area of Roberval-Chambord-Lac-Bouchette, Lac-St-Jean-Ouest Co.	Numerous severe attacks.

OTHER NOTEWORTHY INSECTS (Concluded)

Insect	Host(s)	Locality	Remarks
Scolytus multistriatus (Marsh.) Smaller European elm bark beetle	Elm, white	Mostly in southern Quebec. North of St-Lawrence River; Shawbridge, St-Alexis-des-Monts, Grand'Mère and Cap-Tourmente	A few hundred individuals collected with baited traps.
		Botanical Garden of Montreal	More than 17,000 individuals captured in baited traps.
Sthenopis quadriguttatus Grote "Hepialid moth borer"	Poplars	Matane	30% of trees attacked in small 6-year-old plantations.
Thecodiplosis piniresinosae Kearby Red pine needle midge	Pine, red	St-Michel-des-Saints	Severe damage for second consecutive year.
		L'Ascension, Labelle Co.; Ste-Emélie-de-L'Energie, Joliette Co.	Light damage.
Toumeyella numismaticum (P. & M.) Pine tortoise scale	Pine, jack	Bristol and Ladysmith, Pontiac Co.; St-Gabriel-de-Brandon, Berthier Co.	Medium populations.
		La Croche, Champlain Co.	High populations on many trees.
Zeiraphera improbana (Wlk.) Larch budmoth	Tamarack	Ste-Blandine, Rimouski Co.; St-Moïse, Matapédia Co.	Low populations.
		St-Hilarion, Charlevoix Co.; St-Moïse, Matapédia Co.	Medium populations.
		St-Majorique, Gaspé-Est Co.	High populations.
Zelleria haimbachi Busck Pine needle sheathminer	Pine, jack	Pont-Rouge, Portneuf Co.	Light-to-moderate damage.

*Only those that were attacked often in 1977. Within each group, the names of the hosts are arranged alphabetically.

IMPORTANT FOREST DISEASES

Scleroderris Canker, Gremmeniella abietina (Lagerb.) Morelet—Scleroderris canker continued to be the most serious forest disease problem in Quebec. In addition to damage reported in natural forests and plantations, this disease caused significant losses in at least one provincial nursery. At Trecesson, Abitibi County, 95,000 red pine seedlings and several jack pine seedlings were destroyed after the identification of *G. abietina* infections.

Few new infection centers were detected in 1977 among the 100 plantations of either red or jack pine reported to have the disease. However, the severity of the infections continued to increase, since more than half of the reports mention moderate-to-severe damage. For example, at Capucin, Matane County, a 2 ha, 6-year-old red pine plantation showed 92% of the living saplings infected and 44%

mortality, compared with 36 and 5% mortality in 1976 and 1975 respectively. High mortality was also reported on red pine at Pointe-Lebel, Saguenay County.

In natural forests, the disease was found almost throughout the natural range of jack pine, where the damage, observed mainly on natural regeneration, is much less serious than in plantations. Generally, enough saplings survive to regenerate a stand even though the growth rate of these surviving trees is noticeably reduced. *G. abietina* was found on black spruce at Onatchiway Lake, Dubuc County, and at Subercase River, Abitibi County.

During the field season, the LFRC Survey Unit was informed of the presence of a new virulent race of *G. abietina* in New York State and later of such a race in Vermont. Hence, pine plantations near the Quebec-United States border were examined carefully for this disease. No infections were found. A special survey for this strain of the fungus is planned for 1978 in southern Quebec.

Armillaria Root Rot, *Armillaria mellea* (Vahl ex Fr.) Kummer—As mentioned in the Annual Report for 1975, heavy and repeated defoliation by insects as well as other factors predisposes trees to fatal attack by this fungus. Armillaria root rot, present in natural stands throughout the Province, finds excellent conditions for development in stands severely infested by the spruce budworm. The majority of the 100 collections of the causal fungus on balsam fir came from the Gatineau River valley, where generally more than 25% of the trees were infected in the sampling area, and from the Saint-Maurice River valley, where the severity of the infections varied from light to severe. These two regions have been exposed to repeated budworm defoliation for the last 5 or 6 years, the Gatineau area being the first and most severely infested.

A study made by the QFL of the biological deterioration of balsam fir wood after spruce budworm infestation confirms the relationship between attack and incidence of armillaria root rot as already shown in this and previous reports. In 30 sample plots in the Ottawa Valley, the causal fungus severely affected 26 to 100% of the trees. Comparable data were obtained from 12 other sample plots in the lower St. Lawrence River area, at Temiscouata and Squatec lakes, Temiscouata County.

Armillaria root rot was also reported 12 to 15 times in scattered locations throughout the Province in white spruce and jack pine, both having light to moderate infections. The fungus was found in 2 to 5% of the trees in 10 plantations of jack pine, Norway spruce or red pine. A 2 ha area of a jack pine plantation about 9 years old near Montcerf, Gatineau County, showed 10% of the trees infected with *A. mellea*.

Globose Gall Rust, *Endocronartium harknessii* (J. P. Moore) Y. Hiratsuka—In natural jack pine stands, the number of collections of this disease made in 1977 was comparable to that of 1976. The severity reported in the infection centers was generally light: in only 15% of the collections is it mentioned that more than 5% of the trees had trunk cankers or that more than 25% of the branches showed galls. The few moderate-to-severe-infection centers mentioned were mainly in Gatineau and Saguenay counties.

A detailed survey made for two successive years by the QLF survey teams in the jack pine natural stands surrounding the Normandin provincial nursery, Roberval County, showed a change in the number of infected trees from 3% in 1976 to 7% in 1977.

Globose gall rust was noted in 59 jack pine plantations, of which 85% showed trace-to-light-infection levels. The few moderate-to-severe-infection centers were in Gatineau and Charlevoix counties. A new infection center was reported in a 10-year-old jack pine plantation near Tadoussac, Saguenay County, where 5% of the trees were infected. Of the 20 Scots pine plantations affected, half showed infection of more than 5% of the trees. Severely infected Scots pine plantations were mainly in Beauce, Frontenac and Drummond counties.

Sweetfern Blister Rust, *Cronartium comptoniae* Arth.—Basal stem cankers caused by this rust were found in 29 natural jack pine stands. Damage was generally light, an average of 4.6% (1 to 15%) of the trees having cankers in the infection centers. These trees were mainly in the Saguenay–Lac-Saint-Jean and Outaouais regions. A stand near Normandin provincial nursery, Roberval County, contained 12% of infected trees in 1976 and 15% in 1977. The disease was reported in seven jack pine plantations in the same two regions. Only two plantations, located in Roberval County, had more than 5% of the trees infected.

Dutch Elm Disease, *Ceratocystis ulmi* (Buism.) C. Moreau—This year, leaf wilting appeared suddenly and leaf discoloration was pronounced.

Although the number of new infections did increase from last year in many regions of the Province, it decreased elsewhere. For example, examination of permanent sample plots (for a total of 338 elm trees) at Berthierville, Berthier County, Sainte-Théodésie, Verchères County, La Présentation, Saint-Hyacinthe County, and Saint-Grégoire, Nicolet County, revealed an average of 15% new infections in 1977 compared with 4.3% in 1976. On the other hand, in the Ottawa Valley, examination of 686 elm trees in 10 sample plots revealed new infections to be 8% compared with 12% in 1976. The trees in all the plots already mentioned were in fields and farms and were sometimes scattered over relatively large areas. A QLF survey of elm trees around provincial government buildings in Quebec City revealed that 7% of 238 elm trees had symptoms of Dutch elm disease.

Needle Rusts of Conifers—The rather cool and humid weather of the 1976 summer resulted, as expected, in an overall increase of conifer needle rusts in 1977. Infections by *Chrysomyxa ledi* d By. and *C. ledicola* Lagh. on black spruce in natural forests increased in frequency and severity over last year. Fifty-four collections were made of *C. ledi* compared with 35 last year, 30% of these showing light-to-moderate damage compared with 20% in 1976. Similar data for *C. ledicola* showed 107 collections for 1977 against 58 for 1976 and 49% with light and moderate damage against 22% for 1976. The main infection centers for these two rusts were in the Abitibi region and from Lac-Saint-Jean eastward. Severe-infection centers (where more than 75% of the foliage was infected) were found for *C. ledi* at Lake Daveau, Roberval County, and for *C. ledicola* at Lake Ventadour, Abitibi County.

On balsam fir, the needle rust caused by *Pucciniastrum epilobii* Otth was collected 26 times in 1977 but not at all in 1976. Light infection centers were scattered throughout the range of fir. Another needle rust of balsam fir, *Milesina fructuosa* (Faull) Hirat. f. (*Milesia fructuosa* Faull) was reported occasionally as trace.

In plantations, the needle rust caused by *Coleosporium asterum* (Diet.) Syd. was also much more common than in 1976, with more than 50 collections each for jack and red pine. Infection centers were localized mainly between the Red and

Coulonge rivers in the Outaouais region and on both sides of the St. Lawrence River from Trois-Rivières to Quebec City. Disease incidence was generally low, except in the following cases where its incidence was rated as moderate or high: red pine plantations at Saint-Ludger, Beauce County, Marsboro, Frontenac County, Sainte-Justine-de-Newton, Vaudreuil County, and Canton Goyer, Labelle County, and jack pine at Saint-Ignace-du-Lac, Berthier County, Namur, Argenteuil County, and Saguay Lake, Labelle County.

Snow Blight—A serious infection resulting from a snow blight fungus, *Lophophacidium hyperboreum* Lagerb., occurred at Normandin provincial nursery, Roberval County, where more than 180,000 black spruce and 200,000 white spruce seedlings, all 3-2 stock, were killed in the spring of 1977. Moderate levels of infection by a *Phacidium* sp. were noted in four white spruce plantations in Portneuf, Charlevoix and Lotbinière counties. Light and moderate infection of *Phacidium abietis* (Dearn.) Reid & Cain were noted on balsam fir growing in natural stands on 12 sites mainly in the Quebec and Saguenay–Lac-Saint-Jean regions.

Needle Casts—The needle cast of pine caused by *Lophodermium pinastri* (Shrad. ex Hook.) Chev. was reported in 78 plantations. It affected red and jack pine plantations, principally in the Quebec region and in Labelle and Gatineau counties. About one-third of the reports mention areas where more than 50% of the needles were infected. Light-infection centers in natural stands of jack pine were reported in 98 locations in Quebec, mainly in the Abitibi region and northwest of Lake Saint-Jean. Light-infection centers of *L. pinastri* were also noted on white pine along Grand-Capsa line road, Portneuf County, and Rosemond Lake, Pontiac County, and on red pine at Duchesnay, Portneuf County, and Sainte-Marguerite, Beauce County.

Light-infection centers of *Isthmiella crepidiformis* (Darker) Darker on black spruce were noted in 33 natural stands mainly in the Saguenay–Lac-Saint-Jean and Abitibi regions. *Davisomycella ampla* (Davis) Darker caused light infections in 13 jack pine stands in Labelle, Pontiac, Abitibi, Temiscamingue and Maskinongé counties.

Foliar Diseases of Hardwoods—The frequency and intensity of foliar diseases of hardwoods were generally low in 1977. Ink spot of trembling aspen, caused by *Ciborinia whetzelii* (Seaver) Seaver, appeared earlier than usual in the season, but the overall number of collections (177) and the general severity of infections were comparable to what they were in 1976. About 82% of the reports received mentioned that fewer than 25% of the leaves were infected on trees in infected stands. The more severe infection centers were located in the Outaouais region, especially in the Gatineau and Red River valleys. The disease was infrequent in the extreme western part of the Province and particularly at Lake Simard, Temiscamingue County, where disease severity was high in 1976. The Gaspé Peninsula was again relatively free of the disease.

Other leaf diseases of hardwoods, such as leaf spots, blisters and rusts, were infrequent. There were 16 collections of *Kabatiella apocrypta* (Ell. & Ev.) Arx from sugar maple and 20 collections of *Phyllosticta minima* (Berk. & Curt.) Ell. & Ev. from red maple, mainly in southern Quebec. Only a few reports of tar spot of maple, *Rhytisma acerinum* Pers. ex Fr., and of willow, *R. salicinum* (Pers.) Fr., were received. The aspen leaf rust, *Melampsora medusae* Thuem., was collected 13 times in the Gaspé Peninsula and the Saint-Maurice River valley.

Leaf and Twig Blights of Hardwoods—This type of disease is directly affected by weather conditions occurring in spring, and its occurrence varies from year to year. This is the case with *Venturia macularis* (Fr.) E. Muell. & Arx., the cause of a leaf and twig blight of aspen, which was virtually absent in the Eastern Townships in 1976 but was reported several times in 1977. The following table gives the general distribution of the disease in Quebec in 1977. The highest frequency of reports came from the Abitibi-Outaouais and Saguenay-Lac-Saint-Jean-North Shore regions. Also, mention of light-to-trace disease severity in connection with 89% of the collections means that on the average less than 25% of the crown of diseased trees was affected.

Region	Number of collections				
	Trace (1-5%)*	Light (6-25%)	Moderate (26-75%)	Severe (76%+)	Total
Abitibi-Outaouais	122	35	11	5	173
North of Montreal-St-Maurice River valley	39	18	1	2	60
Portneuf-Quebec-Charlevoix counties	24	9	5	2	40
Saguenay-Lac-St-Jean-North Shore	82	27	13	4	126
Eastern Townships-Beauce County	5	7	4	0	16
Lower St. Lawrence-Gaspé Peninsula	13	8	0	0	21
TOTAL	285	104	34	13	436
%	65	24	8	3	100

*Mean percentage of crown affected.

Infections of *Venturia saliciperda* Nuesch on willows were as frequent as last year throughout Quebec except in the Gaspé Peninsula, where none were recorded. Again, infections were light everywhere. A leaf blight on balsam poplar, caused by *Linospora tetraspora* G. E. Thompson, was reported 12 times, mainly in Argenteuil, Labelle and Montcalm counties. Six of these collections showed more than 75% of the leaves affected on diseased trees in centers of localized infection.

Nursery Diseases—In addition to other nursery problems mentioned in this report, a smothering disease caused by *Thelephora terrestris* Ehrh. ex Fr. and damping-off caused by several fungi are noteworthy. Because of its ability to form mycorrhizae, *T. terrestris* is generally considered beneficial to trees and particularly to seedlings. However, for the last few years isolated cases of severe seedling dieback were observed, and this dieback has been attributed to *T. terrestris*. This year, at the Trecesson provincial nursery, Abitibi County, it affected about 10% of the seedling stocks of white and red spruce and killed 33% of the black spruce seedlings on half a seedbed. At Grandes-Piles, Laviolette County, 135,000 seedlings (75%) of a Scots pine seedling block were severely affected. In most of these cases, seedlings were 3-0

or 4-0 stock and were too crowded for their size. Fructifications of *T. terrestris* were common on these seedlings.

Several cases of damping-off were found at different nurseries in the Province. At Trecesson, Abitibi County, a *Rhizoctonia* sp. caused the damping-off of 10 to 20% of the seedlings on two large seedbeds, one of black spruce and one of white spruce. A *Fusarium* sp. caused heavy damage on part of a white spruce seedbed at Grandes-Piles, Laviolette County, and caused moderate damage on part of a black spruce seedbed at Normandin, Roberval County. A *Pythium* sp. caused localized damping-off on white spruce at Duchesnay Forest Station nursery, Portneuf County.

Abiotic Damage—In March 1977, most of central and southern Quebec experienced two periods of above-average temperatures that stimulated early bud activity. From March 9 to 16, daily maximum and minimum temperatures exceeded the previous 10 years' averages by 9 to 10°C. From March 25 to April 1, temperatures stayed about 5°C above average. However, in early April a week of temperatures that were 3 to 5°C lower than average, including 3 days below freezing, brought an abrupt end to the warm weather and was probably the cause of the extensive late frost damage that occurred over almost the whole Province. Around Quebec City and south of the St. Lawrence River, between Montmagny and Sherbrooke, numerous ornamental deciduous trees failed to leaf out properly in May. On sugar, red and Norway maples and on white birch, trembling aspen and hybrid poplar trees, terminal as well as lateral buds up to half a meter within the crown were killed by frost. Leafing was delayed about 2 weeks and then originated from lateral or adventitious buds farther within the crown, leaving unsightly dead twigs that were apparent for about a month. Many young birch trees did not recover from such damage. Isolated specimens of several other tree species, such as red oak, yellow birch, white elm, basswood, cherry, ash and beech, were also severely affected. It was noted that damage was more severe on trees exposed to westerly winds and on those exposed to road salt.

About 40 cases of similar damage to deciduous trees in natural stands were reported, mainly from the south shore of the St. Lawrence River and from an area extending to the eastern end of the Gaspé Peninsula. Again, red and sugar maple, birch and trembling aspen were most affected. In these natural stands, about 10 to 25% of the crown usually showed late frost damage. In Gaspé-Ouest County, in a more or less circular area of about 1,000 km^2 southeast of Murdochville, from 10 to 80% of aspen buds failed to open owing to frost kill. Late frost damage was noted on conifers, mainly in plantations and, in most cases, on white and Norway spruce. Damage was light and occurred in central Quebec, south of the St. Lawrence River.

More than 100 reports of winter drying on conifers in natural stands, mainly on balsam fir and white and black spruce, were received. Generally fewer than 25% of the needles were affected. The regions most frequently cited were Saguenay-Lac-Saint-Jean, Outaouais and Abitibi. Winter drying was also noted in 159 plantations, mainly in the foregoing regions plus Quebec, one-third of these plantations having between 26 and 75% of the tree crown affected. Species most affected were red, jack and Scots pine and white and Norway spruce.

Snow damage was reported in 61 red pine plantations and 30 jack pine plantations, mainly in Portneuf, Charlevoix, Brome-Missisquoi, Wolfe, Frontenac, Matane and Bonaventure counties. The damaged area was generally less than 2 ha in

each case, but in one-third of all reports between 10 and 50% of the tree crowns were broken.

Wind damage in natural stands was reported at 25 localities. The most frequently affected species were balsam fir (11 cases), jack pine and black spruce. At Notre-Dame-des-Pins, Beauce County, 80% of balsam fir over a 2 ha area were wind-thrown. At two locations in Gaspé Park, Gaspé-Ouest County, between 50 and 70% of the balsam fir were also wind-thrown in areas of about 10 and 300 ha respectively. In four aspen stands in Abitibi, Temiscamingue and Pontiac counties, from 20 to 30% of the trees were wind-thrown over an area of approximately 30 ha. In southern Chibougamau Park, for about 20 km along route 167, about 10% of the tops of black spruce and jack pine were broken by winter wind. Snow or ice may also have been involved. A few kilometers to the northeast, about 3% of jack pine trees were similarly affected. Several isolated cases of broken tops were also noted on black spruce, jack pine, balsam fir and tamarack in natural stands over a strip some 135 km long by 40 km wide, beginning around Gouin Dam and the upper Saint-Maurice River and extending toward route 167.

Animal Damage—Field mice caused damage to ornamental trees and windbreaks within an area 75 km east and west of Quebec City, mostly on the south shore of the St. Lawrence River. The mice showed a preference for sugar and red maples, trembling aspen and cherry and apple trees. However, white ash, white birch, Lombardy poplar, Scots pine and eastern white cedar were also damaged. Six small woodlots containing mainly sugar maple were severely damaged with 50 to 95% of the trees showing signs of feeding.

Squirrel damage, principally on jack pine but also on eastern white pine, was reported from the Saguenay–Lac-Saint-Jean, Abitibi and Saint-Maurice regions. In damaged stands, the mortality of branch tips caused the loss of 1 to 6% of the tree foliage.

Some reports of porcupine damage in natural stands were received. Eastern white and jack pine were principally affected. At Saint-Modeste provincial nursery, Rivière-du-Loup County, 5% of Scots pine seedlings were severely damaged over half a hectare.

OTHER NOTEWORTHY DISEASES

Organism and Disease	Host(s)	Locality	Remarks
Apiosporina morbosa (Schw.) Arx Black knot	Cherry, pin, choke	Throughout host range	One-third of the 140 collections showed 2–5% of trees infected.
Botrytis sp. Gray-mold blight	Pine, jack	Grandes-Piles nursery, Laviolette Co.	Loss of 40% of 130,000 container-grown seedlings.
	Spruce, black	Trecesson provincial nursery Abitibi Co.	15% of seedlings affected; localized spots on seedbeds.
Ceratocystis fimbriata Ell. & Halst. Ceratocystis canker	Aspen, trembling	East of Gouin Dam, Champlain Co., and in Matapédia River valley, Bonaventure Co.	14 collections localized mostly around these 2 places.

OTHER NOTEWORTHY DISEASES (Continued)

Organism and Disease	Host(s)	Locality	Remarks
		Authier, Abitibi Co.	First report this far west in Province.
Coccomyces hiemalis Higgins Shot hole	Cherry, pin	Throughout host range	Half as many collections as in last 2 years. 58% of collections show trace infections.
Cronartium ribicola J. C. Fischer ex Rabh. White pine blister rust	Pine, eastern white	Pontiac, Temiscamingue, Gatineau, Maskinongé and Champlain counties	6–12% of trees infected in diseased stands. General situation unchanged from last year.
Erwinia amylovora (Burr.) Winsl. et al. Fire blight	Cotoneaster	Charlesbourg, Québec Co., and Montreal Island	Four reports showing 8–30% of plants in hedges infected.
	Mountain-ash American	Throughout host range	Several reports, mainly from urban centers.
Eutypella parasitica Davidson & Lorenz Eutypella canker	Maple, sugar	Throughout host range	Status unchanged.
Gnomoniella coryli var. *spiralis* Pk. Leaf spot	Hazelnut, beaked	10 km north of La Tuque, Champlain Co.	Uncommon fungus, affecting 5% of foliage on a few trees.
Hail	Pine, jack Spruce, white, Norway	Charlevoix Co.	15–50% of tree crowns affected in 4 plantations.
Hypoxylon mammatum (Wahl.) Miller Hypoxylon canker	Aspen, trembling	Throughout host range	Status unchanged.
Melampsora abieti-capraearum Tub. Needle rust	Fir, balsam	Saguenay, Lac-Saint-Jean and North Shore regions	Between 1 and 5% of trees affected in diseased stands.
Nectria coccinea (Pers. ex Fr.) var. *faginata* Lohm., Wats. & Ayers Beech bark disease	Beech	Southern and central Québec	Status unchanged.
Nectria galligena Bres. Nectria canker	Maple, sugar, red Birches	Central Quebec	About 20 reports showing 2 to 8% of trees affected in these stands.
Nectria cinnabarina (Tode ex Fr.) Fr. Nectria dieback	Noted on 15 species of trees and shrubs	Southern Quebec	47 collections received mainly from ornamentals.
Pestalotiopsis funerea (Desm.) Stey. Needle blight	Pine, jack	Saint-Félix, Abitibi Co.	About 15% of trees affected over 1 ha in plantation. Average of 50% foliage affected on these trees.

OTHER NOTEWORTHY DISEASES (Concluded)

Organism and Disease	Host(s)	Locality	Remarks
		Victoriaville, Arthabaska Co.	Scattered spots of heavy infection in 3-2 seedbeds.
Phomopsis juniperovora Hahn Phomopsis blight	Cedar, eastern white	Around Quebec City and Sherbrooke	Light damage on ornamental trees in 7 reports received.
Potebniamyces coniferarum (Hahn) Smerlis Needle blight	Larch, Japanese	Trecesson provincial nursery, Abitibi Co.	50% of foliage affected on 90% of seedlings in one seedbed.
Sulphur dioxide	Maple, mountain, red, sugar Aspen, trembling	Temiscaming, Temiscamingue Co.	Mixedwood stand located southeast of paper mill; 13-50% of trees showed 30-80% of foliage with pollution symptoms.
Valsa abietis Fr. Cytospora canker	Fir, balsam	Saguenay, Gaspé-Ouest, Montmorency, Portneuf and Champlain counties and Outaouais region	Light damage, 2-5% of trees diseased in affected stands.
Verticillium dahliae Kleb. Verticillium wilt	Maple, sugar	Saint-Antoine-des-Laurentides, Terrebonne Co.	Disease relatively rare in Quebec.

ONTARIO REGION

G. M. HOWSE, H. L. GROSS AND A. H. ROSE

Great Lakes Forest Research Centre, Sault Ste. Marie, Ontario

INTRODUCTION

Weather conditions in spring and early summer were unusual in that May was warmer than normal and was followed by a cool, wet period (including frosts) during most of June. However, there was little noticeable effect on the extensive infestations of two forest insects, the spruce budworm and the forest tent caterpillar, which continued to dominate the forest pest scene in Ontario in 1977. The spruce budworm situation eased somewhat, slightly less forested area being infested in 1977 than 1976, but the extent of balsam fir tree mortality increased greatly, particularly in northeastern Ontario, where small pockets of significant white spruce tree mortality were recorded for the first time in the current outbreak. Forest tent caterpillar infestations continued to intensify and expand and caused extensive defoliation of aspen, maple and oak. In Owen Sound District sugar maple stands that had been defoliated for several consecutive years by the caterpillar showed evidence of deterioration and tree mortality. Other forest insects that created major problems included the oak leaf shredder, the Bruce spanworm, a variety of sawflies, and adult sawyer beetles. Among the more chronic problem insects, the white pine weevil, larch sawfly, yellowheaded spruce sawfly and birch leafminers showed no letup or increased, whereas the large aspen tortrix, cedar leafminers and the linden looper declined considerably. A pill beetle caused severe damage to young spruce seedlings at the Dryden Forest Station. Considerable effort of the Ontario Survey Unit went into budworm and forest tent caterpillar surveys, including detecting and mapping defoliation and tree mortality, and egg-mass surveys to forecast damage potential. In addition, the Unit cooperated with the Ontario Ministry of Natural Resources (OMNR) by providing biological information on the timing and effectiveness of aerial spraying operations carried out to protect high-value forests against spruce budworm on 4 260 ha, forest tent caterpillar on 1 787 ha and oak leaf shredder on 611 ha.

A special survey was carried out to determine the incidence and impact of diseases of aspen sapling stands. In young aspen stands, leaf and twig blight and stem and root defects caused most of the damage found. Foliar diseases of conifers and hardwoods, with a few exceptions, were generally at low damage levels in 1977. Dutch elm disease was detected in the city of Fort Frances in 1977, more infected trees were found near Thunder Bay, where the disease was detected in 1976, and high mortality of remaining elms continued elsewhere in Ontario. A condition termed *maple decline*, characterized by the occurrence of pockets of dead and dying sugar maple, became evident in Owen Sound District. Affected stands were in an area where several consecutive years of forest tent caterpillar defoliation had occurred. Armillaria root rot continued to be a major mortality factor in jack pine plantings, and a condition known as multileadering remained a significant problem with nursery stock at many provincial forest stations. Damage caused by drought in previous years was prevalent throughout Ontario, and June frosts caused severe damage to current foliage of many species of host trees, particularly in northeastern Ontario.

IMPORTANT FOREST INSECTS

Spruce Budworm, Choristoneura fumiferana (Clem.)—Ontario has experienced 11 consecutive years of spruce budworm infestation. The overall situation eased somewhat in 1977 in that infestations mapped by aerial and ground surveys declined considerably in southern and northeastern Ontario. They worsened, however, in northwestern Ontario. The net change in area of moderate-to-severe defoliation was a decrease of 660 000 ha from the area covered in 1976, for a total of 14.09 million ha (see map, page 6).

Very warm, sunny weather in May speeded larval growth, with the result that development was a week or more ahead of normal by the end of May. This was followed by a cool, wet period through most of June that slowed development. In fact, frosts occurred on several nights during the period 3–10 June and caused moderate-to-severe damage to new growth of balsam fir and white spruce trees. This type of damage was common throughout Wawa, Sault Ste. Marie, Blind River and Chapleau districts. Impact on budworm populations was variable.

In southern Ontario, that part of the outbreak termed *the Algonquin segment* declined further from the 647 511 ha of 1976 to 407 932 ha for 1977. Approximately 50 pockets of moderate-to-severe defoliation occurred. These were confined for the most part to the Algonquin Region and consisted of the remnants of previous larger infestations. Several pockets of new defoliation and infestations that increased in size were found in the Bracebridge and Parry Sound districts in the western part of the Algonquin Region. Small pockets of infestation remained in the Eastern Region in Tweed, Lanark, Cornwall, Ottawa and Brockville districts; in the Central Region in Huronia, Maple, Cambridge and Lindsay districts; and in the Southwestern Region in Owen Sound District. Contemplated spraying operations in Algonquin Provincial Park proved to be unnecessary because of low populations. However, the provincial forest nursery at Midhurst and the nearby Springwater Park were sprayed by mist blower.

Aerial mapping of spruce-budworm-associated tree mortality, which was supplemented by ground observations and 100-tree mortality checks, showed that tree mortality was present in 1.315 million ha. This large increase from 0.647 million ha in 1976 is the result of a real increase in the area with tree mortality and especially the result of a more generalized depiction of the information on a small-scale map. Mortality levels of dominant and codominant balsam fir are quite variable from stand to stand but, overall, averaged 45–50%. With the exception of two or three locations, significant amounts of white spruce mortality could not be found.

Egg-mass counts increased on an overall basis by about 32% compared with those of 1976. The increase is due largely to a buildup on white spruce in Pembroke District. On the other hand, populations have continued to decline on balsam fir. Forecasts for 1978 are for diminished infestations.

The *northeastern Ontario segment* of the outbreak declined from a high of 14.04 million ha in 1976 to 13.47 million ha in 1977, largely as a result of reductions of infestation boundaries from Sault Ste. Marie to North Bay. However, these reductions were offset by a general expansion northward from the 1976 boundary in the northern districts of Hearst, Kapuskasing and Cochrane. There did not appear to be any significant spread in a westerly direction from the Wawa and Hearst districts, although infestations increased and new infestations were found in White

River, Terrace Bay and Geraldton districts. A new infestation, covering about 20 000 ha, was detected in the eastern part of Geraldton District in mature white spruce stands along the Pagwachuan River in the vicinity of Clavet and Downer townships. Moderate-to-high numbers of ground beetles, *Calosoma frigidum* Kby., were observed feeding on budworm larvae in Gaudette and LaVerendrye townships, Sault Ste. Marie District, and in the Mashagama Lake area of Blind River District. For the second consecutive year there were fairly high numbers of spruce coneworm larvae, *Dioryctria reniculelloides* Mut. & Mun., feeding with spruce budworm on white spruce. A total of 4 260 ha was aerially sprayed, primarily with Matacil, by OMNR in Wawa, Chapleau and Kirkland Lake districts in 1977 to minimize damage in high-value forest areas.

The area of spruce-budworm-associated tree mortality, as mapped from the air with 108 ground checks, totalled some 4.168 million ha, 1.54 million ha more than that recorded in 1976. The overall average of balsam fir mortality was 48%, for an increase of 10% over 1976. Four locations with white spruce mortality averaging 15% were detected and ground-checked. These are the first recorded instances of significant white spruce tree mortality in northeastern Ontario in the present outbreak and probably represent isolated pockets of white spruce mortality. The spruce mortality is in areas of severe balsam fir mortality in Chapleau District and may indicate that white spruce mortality occurs 3–4 years after the onset of balsam fir mortality. The incidence of the balsam fir beetle, *Pityokteines sparsus* Lec., increased somewhat in 1977, but numbers overall remain very low. The only secondary insect consistently encountered in dead and dying trees is the whitespotted sawyer beetle, *Monochamus scutellatus* Say, and it appears that balsam deteriorates quickly when it is present.

Egg-mass densities in 1977 increased 40% over those of 1976. Furthermore, from these it is forecast that there will be further infestation expansions, along the northern and northwestern boundaries of the outbreak and that infestation levels will likely be reduced considerably in Sault Ste. Marie District and adjacent parts of Wawa and Blind River districts.

In the *northwestern segment*, the total amount of moderate-to-severe defoliation increased considerably, from the 61 512 ha mapped in 1976 to 211 974 ha in 1977. There are two major areas of infestation: the first, which covers 146 000 ha in Fort Frances District, extends from Bennett Lake some 72 km to the west and north; the second, totalling some 65 400 ha, extends eastward from Kawnipi Lake in Atikokan District to Lower Shebandowan Lake in Thunder Bay District. Forecasts indicate moderate expansion of infestations in this part of Ontario in 1978.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—An increase in populations of this pest and in area infested were reported for most regions in 1977. A total of 122 200 km^2 was moderately to severely defoliated in 1977 (see map, page 69) compared with 82 000 km^2 in 1976.

In northwestern Ontario infestations expanded, and severe defoliation of aspen extended over approximately 59 570 km^2 compared with 24 000 km^2 in 1976, and now include the infestation centered around Dryden. The infestation extended along the Ontario–Manitoba border from Bigsby Island on Lake of the Woods on the south to the 13th base line and beyond on the north with defoliation that extended farther eastward than in 1976. Populations increased and caused moderate-to-heavy

defoliation in and around the town of Atikokan and southwest of the city of Thunder Bay.

Infestations in the Northern Region continued to expand and moderate-to-severe defoliation was reported over approximately 28 490 km^2 compared with 20 000 km^2 in 1976.

In the Northeastern Region infestations continued around Sudbury and North Bay, although there was a reduction in the amount of damage around Sudbury. The area infested increased sharply east of Espanola and on Manitoulin Island.

The area infested in southern Ontario increased slightly from 32 500 km^2 in 1976 to 33 800 km^2. The extent of damage to hardwoods increased in the Algonquin Region with heavy defoliation in a broad band paralleling Georgian Bay. In the Eastern Region moderate-to-severe defoliation extended from Marmora to Perth, over a larger area than in 1976, and new small pockets of infestation to the east were reported.

Infestations intensified in the Central and Southwestern regions with heavy defoliation of maple, aspen and various other hardwoods east and west of Lake Simcoe and in a wedge-shaped area extending from Thornbury–Wiarton on the north to Wingham on the south. Within the latter area, where infestations have been reported each year since 1974, pockets of severe maple mortality were mapped (see map, page 69). Additional information on maple mortality in that area is given on page 65. The possible relationship between forest tent caterpillar defoliation and mortality is being investigated.

Pockets of light and moderate defoliation were recorded outside these main infestation boundaries elsewhere in the Province. Using *Bacillus thuringiensis*, OMNR sprayed a total of 1 787 ha in six provincial parks in Parry Sound and Bracebridge districts to prevent nuisance to park users and to minimize foliage loss.

Defoliating Insects of Aspen—In addition to the forest tent caterpillar, there are three other defoliators of aspen that can cause extensive damage, and in some instances defoliation may be caused by a combination of them.

For the past 3 years the aspen leafroller, *Pseudexentera oregonana* Wlshm., has caused extensive defoliation of aspen in parts of northern Ontario. Population levels declined in the Kapuskasing, Cochrane, Timmins and Kirkland Lake areas to moderate, but high populations were reported in aspen pockets north of Blind River and Elliot Lake. On the other hand, the total area in two infestations in northwestern Ontario west of Thunder Bay and east of Fort Frances increased. Light-to-moderate defoliation was reported elsewhere in northern Ontario, especially around the more heavily infested areas already mentioned.

Infestations of the large aspen tortrix, *Choristoneura conflictana* (Wlk.), in the Northeastern and Algonquin regions have been declining since 1975. In 1977 only light defoliation was reported anywhere in those regions.

The unusual damage to aspen caused by the Bruce spanworm, *Operophtera bruceata* (Hulst), in northwestern Ontario and reported in 1976 recurred in 1977. The infestation, mostly east and south of Lake Nipigon, expanded and intensified, and aspen trees were stripped of their foliage earlier than other trees nearby were defoliated by the forest tent caterpillar.

Oak Leaf Shredder, Croesia semipurpurana (Kft.)—Populations of this early spring defoliator of red oak fluctuate at relatively high levels in some areas of southern Ontario and along the North Channel of Lake Huron. Although the widespread infestations of 1975 declined somewhat in 1976, heavy defoliation recurred and new heavy infestations were reported at a number of southern Ontario locations in 1977. Red oak stands near Penetanguishene and on a number of nearby islands, in the Uxbridge-Ballantrae area, in Dufferin County Forest, between Barrie and Orillia and south of St. Catharines were heavily infested. Elsewhere in southern Ontario and along the North Channel only low population levels were reported.

Because further heavy defoliation of mature oak trees in Awenda Provincial Park near Penetanguishene was probable, OMNR carried out control measures covering some 611 ha using Sevin-4-oil and Orthene. Good foliage protection was achieved.

Webspinning Sawfly, Cephalcia sp. prob. *frontalis* Westw.—This unusual defoliator normally feeds on foliage produced in the previous year, in nests of severed needles and excrement fastened along the branch or stem. The high populations of this sawfly on red, jack, Scots and white pine reported in 1976 in the Algonquin, Eastern and Central regions increased in 1977. In some instances complete defoliation of small trees was reported; new heavy infestations were found; and severely defoliated plantations were common. Chemical control measures were applied by OMNR to heavily infested red pine near Kemptville.

Redheaded Pine Sawfly, Neodiprion lecontei (Fitch)—Population levels of this pest of red pine generally declined along the northern edge of its distribution which extends from Sault Ste. Marie to Pembroke. On the other hand, population levels remained high or increased in red pine plantations near Bracebridge, Fenelon Falls, Minden and Sharbot Lake, and medium infestations were common elsewhere. Plantations treated with virus in 1976 by the Forest Pest Management Institute were relatively free of this sawfly in 1977. However, chemical control measures applied by OMNR and private owners and involving the use of malathion were required in numerous instances to reduce defoliation of other planted trees.

European Pine Sawfly, Neodiprion sertifer (Geoff.)—Populations of this sawfly continued at low levels throughout its distribution area in the Province. At only two of 22 locations sampled were more than 50% of the trees infested, with an average of three colonies per tree. At all other locations fewer than 20% of the trees were infested, usually with one colony per tree. Minor extensions in the range of this introduced sawfly were recorded north of Brockville and Bancroft and near Port Carling.

Yellowheaded Spruce Sawfly, Pikonema alaskensis (Roh.)—Population levels of this white and black spruce pest remained high for the seventh consecutive year, or increased from 1976 through much of Ontario. Open-grown and windbreak trees at many locations along Highway 11 between the Manitoba and Quebec borders and along other northern Ontario highways were frequently infested. In addition, ornamental and plantation trees at widely separated locations were severely defoliated in both northern and southern Ontario. There was some mortality of young white spruce west of Cochrane following 3 years of defoliation. Heavily infested ornamental spruce in Balsam Lake Provincial Park were treated with an aerial application of malathion in June to reduce populations after a resurgence that followed a 1975 control operation.

Jack Pine Sawflies—This classification includes swaine jack pine sawfly, *Neodiprion swainei* Midd.; jack pine sawflies, *N. pratti banksianae* Roh. and *N. pratti paradoxicus* Ross; and the redheaded jack pine sawfly, *N. virginianus* complex. With the exception of 160 ha of heavy defoliation by Swaine jack pine sawfly south of Elk Lake, no appreciable defoliation by any jack pine sawfly was reported in 1977. Although fluctuations in the population levels of most jack pine sawflies have been at relatively low levels for a number of years, colonies of *N.p. paradoxicus* are common each year wherever jack pine occurs in southeastern Ontario.

Balsam Fir Sawfly, Neodiprion abietis complex—Pockets of moderate-to-severe defoliation of balsam fir were reported north, east and south of Lake Nipissing and between Lake Simcoe and Nottawasaga Bay on Georgian Bay. Light-to-moderate defoliation occurred in southern Ontario. In northern Ontario low populations were general.

Larch Sawfly, Pristiphora erichsonii (Htg.)—Except in northwestern Ontario, defoliation of tamarack was more noticeable than in 1976. Moderate-to-severe infestations recurred at numerous locations, and light populations were common elsewhere. In southern Ontario, where exotic larch plantations are particularly prone to defoliation, it was necessary in a number of instances to apply control measures, and malathion was used.

Eastern Pine Shoot Borer, Eucosma gloriola Heinr.—In contrast to red and white pine, where shoots, mostly on lateral branches, are attacked, in jack pine it is the leading shoot that is usually attacked. Because of the loss of the leader, the form of the tree is affected and damage is of much greater consequence. Counts of damaged jack pine leaders in parts of the North Central and Northern regions revealed substantial damage involving in a few instances from 20 to 67% of the leaders. Generally, low populations of this shoot borer may be found in jack pine stands across all of northern Ontario, and damage to white and red pine is not uncommon in southern Ontario.

Sawyer Beetles, Monochamus spp.—Only in rare instances is the damage caused by adult sawyer beetle feeding sufficient to cause appreciable twig and branch mortality. However, tree mortality was reported in 1977 because of the severity of the damage, and twig and branch mortality was extensive across much of northern Ontario. In a number of instances high adult populations occurred in the vicinity of strip-cutting operations, and the damage was most noticeable on trees along the edge of the operation. The damage became evident in late July and early August and *Monochamus scutellatus* (Say) was probably the cause of most of it. Sawyer beetle populations are usually high where tree mortality is extensive, for example in budworm outbreaks. In this instance, however, most damage was in areas unaffected by the spruce budworm, and the hot, dry weather of the preceding 2 years may have contributed to the population buildup.

White Pine Weevil, Pissodes strobi Peck—In spite of the occurrence of some high counts of leader weevilling on a variety of conifers, most counts were little changed from 1976. In a Norway spruce plantation near Thunder Bay 48% of the leaders were damaged, but weevilled leader counts elsewhere on other spruce species were low. Although high counts of weevil damage to white and jack pines ranging from 35 to 90% were reported at a number of locations in the Northeastern and

Algonquin regions, generally only small amounts of damage could be found wherever young trees were examined.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.—An increase in the population level of this pest was reported in the Central Region and light infestations occurred on jack and Scots pine trees at a number of widely scattered locations. Elsewhere in the Province only endemic levels were reported.

Red Pine Needle Midge, *Thecodiplosis piniresinosae* Kearby—Periodically high populations of this midge cause considerable needle drop in red pine. The larvae feed inside the needle sheath at the base of the needle. Damaged needles turn brown in late summer and this is usually the first indication of the midge's presence. After a brief outbreak in 1967 and 1968, populations declined to endemic levels. Damaged shoots found in 1977 provided evidence of injury that had occurred in 1976. It was ascertained, however, from counts of lost needles, that the damage to shoots was more severe in 1977 than in 1976, defoliation being 87% and 53%, respectively. Most severe damage occurred in plantations of large red pine north of Thessalon, with light damage in the surrounding area.

Pine Spittlebug, *Aphrophora parallela* (Say)—This spittlebug, which feeds on a wide variety of conifers, is especially damaging to pine, where heavy feeding can cause needle and twig mortality. This loss poses a problem to the Christmas tree industry. Small pockets of heavy infestation were widely scattered through much of southern Ontario and north of Thessalon in northern Ontario. Damage on Scots pine was more prevalent than that on other pines.

Pill Beetle, *Cytilus alternatus* Say—An infestation of this beetle indirectly resulted in a loss of approximately three quarters of a million rising 2-0 black spruce seedlings at the Dryden Forest Station. The beetle larvae feed on the roots of seedlings and during July caused a small percentage of the loss. However, the major loss occurred as a result of ravens (*Corvus corax* L.) feeding on the larvae and pupae of the beetle. The ravens pulled small clumps of seedlings from the ground to expose the larvae and pupae entangled in the root systems, thereby killing the seedlings.

Damage to nursery seedlings caused directly by the pill beetle has been reported only once previously and that was in 1967 at the OMNR Forest Station at Gogama.

Larch Casebearer, *Coleophora laricella* Hbn.—Noticeable defoliation by this casebearer was confined to southern Ontario. Except for 500 ha in the Minesing swamp area near Barrie, where defoliation of native larch was visible from the air, most other damage occurred in widely scattered exotic larch plantings.

Cedar Leafminers, *Argyresthia aureoargentella* Brower, *A. canadensis* Free., *A. thuiella* Pack. and *Pulicalvaria thujaella* (Kft.)—With some exceptions, low population levels were general through much of southern Ontario after the widespread collapse of the infestation in 1976. The only substantial area of moderate-to-severe defoliation occurred in a broad band east of Fenelon Falls to Marmora. Small pockets of noticeable defoliation were found near Orangeville and Creemore in southern Ontario and near Providence Bay on Manitoulin Island. Most eastern white cedar has recovered from the effects of the earlier infestation.

Fruit Tree Leafroller, *Archips argyrospilus* (Wlk.)—This leafroller caused extensive defoliation of white birch and many other deciduous trees and shrubs in a broad band extending from Chapleau to the Quebec border. The fruit tree leafroller

is better known, as its name implies, as a defoliator of fruit trees, and such extensive defoliation of forest trees is most unusual. Other insects found associated in the infestation included the obliquebanded leafroller, *Choristoneura rosaceana* (Harr.), and the birch tubemaker, *Acrobasis betulella* Hulst.

Elsewhere in Ontario light-to-moderate defoliation was common near Temagami, and light defoliation of oak occurred near Thunder Bay.

Birch Leafminer, Fenusa pusilla (Lep.)—Although damage by this introduced leafminer is reported each year, severe leaf browning appeared to be more extensive and severe in 1977 than in previous years, especially in a broad band extending south from the Kirkland Lake–Timmins area to the Bracebridge–Parry Sound area. First-generation miners often caused complete defoliation of white birch in urban, rural and forested areas. Persistent heavy infestations on white and wire birch were common in much of southeastern Ontario. Leaf browning of white birch was conspicuous in recently invaded areas of northwestern Ontario, especially in and around Thunder Bay and near Lake Nipigon.

Mountain-ash Sawfly, Pristiphora geniculata (Htg.)—Defoliation was reported at numerous locations across northern Ontario, severe defoliation being common in recently invaded areas. A further spread to the west was recorded when this sawfly was found on mountain-ash at Burchell Lake south of Kashabowie.

Aspen Leafblotch Miner, Lithocolletis ontario Free.—Damage caused by this miner of trembling aspen occurred mainly in pockets and was widely scattered across all of northern Ontario. Moderate-to-severe mining was reported at several locations, but generally the damage was light. In addition, young trees at a few locations in Algonquin Park suffered severe leaf mining.

Linden Looper, Erannis tiliaria Harr.—The outbreak that began in the Northeastern Region in 1974 continued to dissipate with only small pockets of moderate-to-severe damage near Blind River. To the west, scattered light defoliation was reported near Thunder Bay and Nipigon, often in association with the Bruce spanworm. In southern Ontario, moderate-to-severe defoliation of oak and maple recurred north of Simcoe, and moderate defoliation was reported in the surrounding area.

Fall Cankerworm, Alsophila pometaria Harr.—Populations of the pest were relatively high for the second consecutive year in some parts of southern Ontario, especially in the Ottawa area, where moderate-to-severe defoliation of red oak, white elm and sugar maple was reported. Pockets of heavy defoliation also occurred near Simcoe, but elsewhere in southern Ontario populations were lower than in 1976. Small numbers of the linden looper, *Erannis tiliaria* Harr., and the spring cankerworm, *Paleacrita vernata* (Peck), were often associated with the fall cankerworm.

Fall Webworm, Hyphantria cunea (Drury)—Population levels of this webworm remained high in some areas and showed declines in other areas, such as west of North Bay, south of Parry Sound and in the vicinity of Orillia–Port Severn–Honey Harbour. High numbers were reported near Paris, Brantford, Peterborough, Fort Erie, Niagara-on-the-Lake, Point Pelee National Park and Pembroke, where a wide variety of deciduous trees were defoliated. Elsewhere in southern Ontario the tents of this late season defoliator were quite common. In northern Ontario tent colonies were widely scattered.

OTHER NOTEWORTHY INSECTS

Insect	Host(s)	Locality	Remarks
Actias luna L. Luna moth	Birch, white, yellow	Near Thessalon	High numbers persisted.
Anisota senatoria J. E. Smith Orangestriped oakworm	Oak, white	Southwestern Ontario	Small pockets of defoliation.
Aphrophora saratogensis (Fitch) Saratoga spittlebug	Pine, red	Pembroke area	Only small numbers found.
Archips negundanus Dyar Boxelder leafroller	Maple, Manitoba	Sault Ste. Marie	High populations persist.
Caliroa sp. Slug sawfly	Oak, red	Uxbridge	Pocket of heavy infestation.
Callirhytis cornigera (O.S.) Horned oak gall wasp	Oak, bur, pin, red, white	Municipality of Niagara	Heavy infestations with tree mortality.
Calosoma frigidum Kby. Ground beetle	Various hosts	Northeastern Ontario	Feeding on a number of defoliating insects, especially spruce budworm.
Cenopis acerivorana Mack. formerly *C. pettitana* (Rob.) Maple leafroller	Maple, red, sugar	Near Sault Ste. Marie, Temagami and Chapleau	Low populations.
Conophthorus banksianae McP. Jack pine tip beetle	Pine, jack	Northeastern Ontario	Common in young trees.
Corthylus punctatissimus (Zimm.) Pitted ambrosia beetle	Maple, sugar	Near Midland	Causing mortality in reproduction.
Corythucha arcuata (Say) Oak lace bug	Hackberry	Point Pelee National Park	Pocket of severe foliar damage.
Dasineura gleditschiae O.S. Honey locust pod gall midge	Honey-locust	Central Region	Heavy leaf damage on ornamentals.
Datana integerrima G. & R. Walnut caterpillar	Walnut, black	Southern Ontario	Widely scattered tree defoliation.
Dioryctria reniculelloides Mut. & Mun. Spruce coneworm	Spruce, white	Northern Ontario	Common, with pockets of heavy damage to cone crops.
Diprion frutetorum (F.) Nursery pine sawfly	Pine, Scots	Sault Ste. Marie	New distribution record.
Diprion similis (Htg.) Introduced pine sawfly	Pine, jack, white	Fort Frances, Balsam Lake Park and Orono	High populations.
Dryocampa rubicunda rubicunda F. Greenstriped mapleworm	Maple, red	Province-wide	Low numbers.
Ecdytolopha insiticiana Zell. Locust twig borer	Honey-locust	Turkey Point	High numbers.
Eriophyes sp. Mite	Aspen, trembling	Northeastern Ontario	Population levels declined.

OTHER NOTEWORTHY INSECTS (Concluded)

Insect	Host(s)	Locality	Remarks
Gonioctena americana (Schaef.) American aspen beetle	Aspen, trembling	Northeastern Ontario	Pockets of heavy defoliation.
Heterocampa guttivitta Wlk. Saddled prominent	Maple, sugar	Cockburn and St. Joseph Islands	Infestation collapsed
Malacosoma americanum (F.) Eastern tent caterpillar	Cherry Apple	From Sault Ste. Marie southward	Heavy infestations, widespread.
Malacosoma californicum pluviale (Dyar) Western tent caterpillar	Deciduous trees	Northern Ontario	Low populations.
Mindarus abietinus Koch Balsam twig aphid	Spruce	Chapleau nursery	High numbers on seedlings.
Orgyia leucostigma J. E. Smith Whitemarked tussock moth	Deciduous trees	Sault Ste. Marie and Sudbury and near Tilbury	Low population levels.
Pissodes approximatus Hopk. Northern pine weevil	Pine, red Spruce, blue	Near Powassan and Barrie respectively	Severe damage in plantations.
Prodiplosis morrisi Gagne Leaf curl midge	Poplar, hybrids	Kemptville nursery	High populations.
Profenusa lucifex Ross Oak leafmining sawfly	Oak, red, white	Southern Ontario	Widely scattered high populations.
Proteoteras aesculana Riley Maple twig borer	Maple, silver	Orono Forest Station	Leaders heavily infested.
Proteoteras willingana (Kft.) Boxelder twig borer	Maple, Manitoba	Near St. Williams	High numbers.
Rhyacionia buoliana Schiff. European pine shoot moth	Pine, red, Scots	Southern Ontario	Low populations.
Sthenopis sp. Root borer	Aspen, trembling	Northern Ontario	Low numbers in roots.
Toumeyella liriodendri (Gmel.) Tulip scale	Magnolia Tulip-tree	Niagara Peninsula	High populations with branch mortality.
Toumeyella numismaticum (P. & M.) Pine tortoise scale	Pine, jack, Scots	Near Simcoe, Chapleau and Timmins	High populations on individual trees.
Zeiraphera canadensis Mut. & Free. and *Z. destitutana* (Wlk.) Spruce shootworms	Spruce, white	North and west of Lake Superior	Commonly associated with spruce budworm.

IMPORTANT FOREST DISEASES

Diseases of Aspen Saplings—Trembling aspen stands usually regenerate vegetatively by suckers that grow from the root systems of the previous stand. Each survey field technician in the four northern regions sampled five randomly selected young

sucker stands. All diseases observed were evaluated and internal defect was assessed by dissecting the stem and root system of 10 randomly selected trees.

Hypoxylon canker, *Hypoxylon mammatun* (Wahl.) Miller, was detected in only 15% of the stands. One stand had 3% of the trees affected. All other stands had less than 1% cankered. Thus, for Ontario, the disease appears to be of minor significance in sapling-sized aspen. This is in contrast to its major importance in larger-sized stands.

Cytospora canker, *Cytospora chrysosperma* (Pers.) Fr., was common on recently dead branches and stems. However, the canker is usually considered secondary, affecting only weakened tree parts.

Leaf and twig blight of aspen, *Venturia macularis* (Fr.) Müll. & Arx, was detected in 96% of the stands sampled. Damage was greatest in the North Central and Northwestern regions, where disease incidence averaged 46%. Foliar damage averaged 2.5%, which seems unimportant. However, 82% of the affected trees had the terminal shoot killed, and thus height growth and tree form were affected. In the Northern and Northeastern regions incidence averaged 11% except for one stand in Jocelyn Township of the Northeastern Region, where 73% of the trees were affected. Again, terminal damage was the principal form of injury, and foliar loss was negligible.

Ink spot of aspen, *Ciborinia whetzelii* (Seaver) Seaver, occurred in 31% of the stands sampled. Most of the affected stands had light foliar damage. A stand in Melgund Township in the Northwestern Region had 80% foliar damage, and this stand was also one of the most severely affected by leaf and twig blight.

Stem and root defects were common. Sixty-one percent of the suckers sampled had internal defect, most of which (81%) was classed as stain. Stain was apparent in 39% of the stems and 49% of the roots sampled. Considerable rot was also present in both stems (8%) and roots (25%). Most of the defects yielded bacteria or various imperfect fungi that were not specifically identified. Fungi associated with root rots were *Armillaria mellea* (Vahl ex Fr.) Kummer and *Coprinus micaceus* Fr. Both of these were also isolated from root stain along with *Collybia velutipes* (Curt. ex Fr.) Kummer, *Peniophora cinerea* (Pers. ex Fr.) Cke., *Peniophora polygonia* (Pers. ex Fr.) Bourd. & Galzin and *Scytinostroma galactinum* (Fr.) Donk. Rot organisms associated with stems were *A. mellea, Fomes ignarius* (L. ex Fr.) Kickx, and *Gloeocystidiellum karstenii* (Bourd. & Galzin) Donk. These were also associated with stem stain as were *P. polygonia* and *Poria subacida* (Pk.) Sacc.

Foliar Diseases of Conifers—Damage caused by spruce needle rusts, *Chrysomyxa ledi* d By. and *Chrysomyxa ledicola* Lagh., remained at the low level reported for 1976. Occurrence and incidence remained high on small trees and the lower branches of large trees, but foliar damage levels were usually rated trace. Light foliar damage was occasionally observed in the Northern and Northeastern regions and in the eastern part of the North Central Region. Light damage was also present in windbreaks at the Dryden forest nursery.

For most of Ontario, pine needle rust, *Coleosporium asterum* (Diet.) Syd., remained at the low level of occurrence reported for recent years. In the Eastern Region, however, light and moderate damage levels were common on red and jack pine.

As in recent years, incidence and damage by jack pine needle cast, *Davisomycella ampla* (Davis) Darker, remained low. In fact, a general decline occurred in most regions. The damage level was trace in the few stands that had moderate foliar damage in 1976, and generally the disease was rated as trace or absent for the remainder of Ontario.

Foliar damage levels of diplodia tip blight, *Diplodia pinea* (Desm.) Kickx, were high in a pole-sized plantation of Austrian pine in the Southwestern Region and a similar plantation of Scots pine in the Central Region. Elsewhere in both regions low foliar damage was common in young Austrian pine plantations.

Pine needle cast, *Lophodermium nitens* Darker and *Lophodermium pinastri* (Schrad. ex Hook) Chev., were associated with extensive mortality of red pine seedlings at the G. Howard Ferguson Forest Nursery, Kemptville. Elsewhere, *L. pinastri* was detected at low foliar damage levels on young red pine plantations scattered throughout southern Ontario.

Foliar Diseases of Hardwoods—The status of ink spot of aspen, *Ciborinia whetzelii*, reported under "Diseases of Aspen Saplings" is reflective of conditions observed generally for aspen saplings. Occasional instances of moderate foliar damage and a few stands with high damage levels were reported for most of the range of aspen. Usually the disease was present only at trace or light damage levels.

Maple anthracnose, *Kabatiella apocrypta* (Ell. & Ev.) Arx, was common on maples growing in urban locations throughout the Algonquin, Central and Southwestern regions. In most municipalities, foliar damage to about half the maples was moderate, but instances of trees with 100% damage were common.

Armillaria Root Rot, Armillaria mellea (Vahl ex Fr.) Kummer, continued to be one of the major causes of immature pine mortality throughout the Province. In the North Central Region mortality increased to as high as 10% in several jack pine plantings. Also in that region, *A. mellea* has been recognized in association with a condition known as spruce chlorosis, which seems to affect both black and white spruce. Other influences could be contributing to that condition. In an investigation of spruce chlorosis, staff members of the Great Lakes Forest Research Centre detected considerable mortality of small feeder roots, and it is felt that this could be the result of the drought conditions that have prevailed for several years. A survey to determine the extent of spruce chlorosis is planned for 1978.

Dutch Elm Disease, Ceratocystis ulmi (Buism.) C. Moreau—Detection of this disease in Blake Township near the city of Thunder Bay in 1976 stimulated intensive surveys for detection of the disease in the North Central and Northwestern regions. A diseased elm was detected in the city of Fort Frances, and the range of the disease now extends through all major concentrations of elm in Ontario. The Blake Township occurrence intensified. Otherwise the disease in these regions appears to be confined to these localized situations.

Elsewhere in Ontario the disease continued to cause a high mortality rate in the remaining elm population.

Scleroderris Canker, Gremmeniella abietina (Lagerb.) Morelet—Several races of the causal fungus are now recognized. Only the North American race is known to exist in Ontario. The status of this destructive disease of pine regeneration remains essentially unchanged. Mortality of recently planted red pines was reported near

Sioux Lookout in the Northwestern Region and in Stisted and Bethune townships of the Algonquin Region. These represent minor range extensions for *G. abietina.*

Maple Decline—Maple crown deterioration results from a variety of causes, some of which are not well defined. This year two situations are reported.

Pockets of dead and dying sugar maple have developed in the Owen Sound District of the Southwestern Region. The stands affected occur in areas that have experienced recent forest tent caterpillar defoliation (see infestation description under Forest Tent Caterpillar), but other influences are possible. Trees of all size classes are affected, usually in patches that are more prevalent in stand interiors. Other species, including red maple, appear to be unaffected. Crowns appear to have deteriorated rapidly. Dead trees frequently have premature separation of bark, and wood deterioration seems to be especially fast. While *Armillaria mellea* is present on many of the recently dead maples, the role of *A. mellea* appears to be secondary. Patches of dead trees vary in size from a few trees to 12 ha of almost complete sugar maple mortality. A survey to determine the impact of this maple decline is planned for the 1978 season.

Maple crown deterioration has been common throughout the range of sugar maple for many years in Ontario. This year the maple dieback condition was estimated throughout southern Ontario for trees in rural woodlots, along roadsides and in urban situations. Trees with 5% or less of the branches dead were considered healthy. Those with more than 20% of the branches dead were rated as severely affected. Maples in woodlots appeared least affected, with 68% healthy and only 5% severely affected. Trees along roadsides and in urban situations had 56 and 46% healthy, respectively. Both situations had 15% of the maples with severe dieback. Only 10% of the stands had better than 80% of the maples rated as healthy, and these were mostly woodlots.

Oak Decline—This year 12 oak plots consisting of 100 oaks each were established to determine if red oaks were deteriorating in southern Ontario. Ownership and access problems prevented complete randomness of plot location, but the areas selected were considered typical oak woodlots. It is planned to follow the crown character of the trees in each stand for 5 years. Healthy trees having $\leqslant$5% branch mortality averaged 45% (28-70%). Averages for classes 2, 3 and 4, which had 20, 40 and 60% of the branches dead respectively, were as follows: Class 2, 27% (7-60%); Class 3, 21% (11-32%); and Class 4, 7% (0-19%). A dead-tree class was not included at the time the plots were established. From these initial data it is very apparent that dieback is common in the red oak population of southern Ontario.

Multileadered Nursery Stock—Seedlings with more than one prominent leader are currently unacceptable for planting. In recent years a large portion of the spruce produced at many of the provincial nurseries is culled as multileadered. This year the proportion culled ranged from 24 to 45%. Other conifer species usually do not suffer as much multileadering. This year, however, 60% of the larch seedlings at the G. Howard Ferguson forest nursery, Kemptville, and 49% of the 2-0 red pine at the Dryden forest nursery were multileadered.

Single Tree Mortality of Balsam Fir—Possibly caused by the extensive drought conditions that prevailed in recent years, the incidence of balsam fir mortality seemed to more than double across Ontario this year. Stands with up to 5% mortality for this species were common, and dead fir were noticeable in most stands.

Globose Gall Rust of Pine, Endocronartium harknessii (J. P. Moore) Y. Hiratsuka—High tree mortality, up to 5%, was detected in stands of seedling-sized jack pine in the Geraldton District of the North Central Region. It is apparent that this disease is an important problem in pine regeneration programs. The disease can also be a problem in nursery management. This year the incidence of galls on harvested seedlings at the Dryden forest nursery was low. However, incidences of 10 to 15% have occurred.

Abiotic Damage—Drought conditions that have prevailed in many parts of northern Ontario ended in 1977, most stations recording normal amounts of precipitation. Evidence of drought damage, however, increased probably because of tree reaction to the stress conditions of previous years. Damage was greatest in the southern parts of the Northwestern and North Central regions west of Lake Nipigon. Surveys indicate that pine mortality and deterioration are now present in an area of approximately 1 965 km^2. Trees growing on dry sites outside this area across northern Ontario also show drought reaction. Balsam fir, white birch and aspens, as well as pines, appear stressed in many areas.

Parts of southern Ontario experienced a drought in 1977. The Algonquin and Eastern regions seemed to be most affected. Elsewhere, dry conditions were not as widespread, but parts of other southern regions also experienced the drought. Premature leaf drop was common throughout the affected areas, particularly for white birch and largetooth aspen.

Frost damage was severe in many areas of Ontario after the freezing temperatures that occurred in mid-June. Numerous stands throughout northern Ontario east of Lake Nipigon suffered severe foliar damage, balsam fir and white and black spruce being the most affected species. Many stands that previously seemed to be resistant to frost damage were affected, including stands of jack pine and tamarack. Hardwood species also suffered severe frost damage, white birch, alder and trembling aspen being most affected. The situation was similar in southern Ontario, Norway and white spruce suffering extensive foliar damage in many areas. Hybrid poplar in the Eastern Region was also heavily damaged.

Winter drying was negligible throughout most of Ontario. Damage to jack pine plantations in the Chapleau and Gogama districts of the Northern Region was common. However, it was difficult to separate this damage from damage by the drought conditions of 1976. Symptoms of both winter drying and drought reaction were apparent in many of the plantations.

OTHER NOTEWORTHY DISEASES

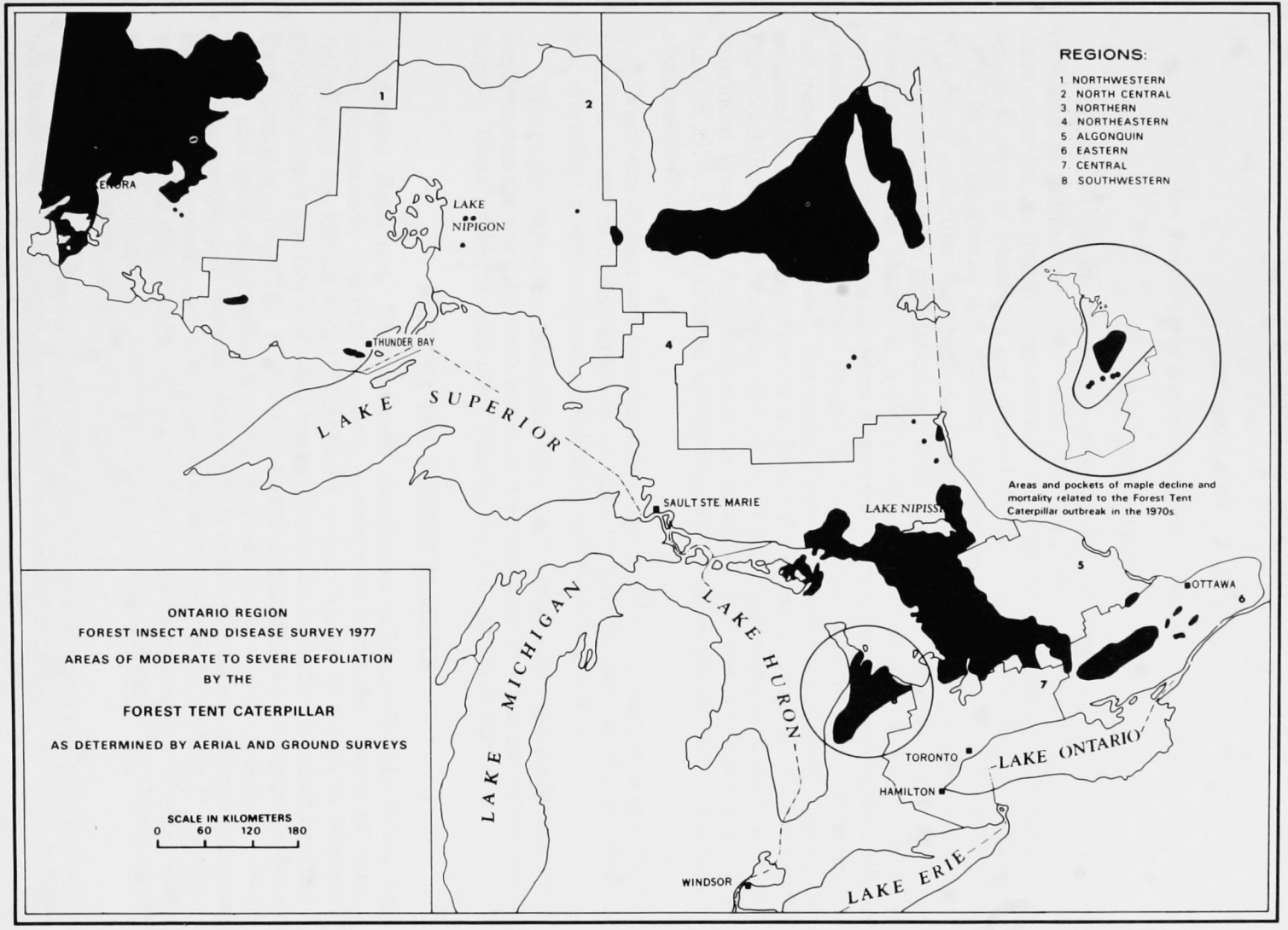
Organism and Disease	Host(s)	Locality	Remarks
Arceuthobium pusillum Pk. Eastern dwarf mistletoe	Spruce, black	Province-wide	Caused extensive witches' brooms at many locations.
Chrysomyxa arctostaphyli Diet. Spruce broom rust	Spruce, black	Province-wide	Status unchanged.
Cronartium coleosporioides Arth. Stalactiform rust	Pine, jack	Throughout host range	Common at trace damage level. Moderate damage in only a few stands.

OTHER NOTEWORTHY DISEASES (Continued)

Organism and Disease	Host(s)	Locality	Remarks
Cronartium comandrae Pk. Comandra blister rust	Pine, jack	Throughout host range	Common at light and trace damage levels.
Cronartium comptoniae Arth. Sweetfern blister rust	Pine, jack	Throughout host range	Status unchanged.
Cronartium ribicola J. C. Fischer ex Rabh. White pine blister rust	Pine, white	Throughout host range	Status unchanged.
Cryptosporium neesii var. *betulinum* Sacc. Canker	Birch, yellow	Sault Ste. Marie District, Northeastern Region	Associated with mortality and cankering of regeneration.
Cylindrocladium floridanum Sob. & Seymour Cylindrocladium root rot	Conifer seedlings	Tree nurseries	Root disease problem.
Cylindrosporella caryae (Pk.) Petr. Anthracnose	Hickory	Cambridge District, Central Region	High foliar damage in several woodlots.
Discula plantani (Pk.) Sacc. Anthracnose	Sycamore	Southwestern Region	Common foliar problem.
Eutypella parasitica Davidson & Lorenz Maple canker	Maple, sugar	Throughout host range	Common cause of cankers.
Fomes annosus (Fr.) Karst. Fomes annosus root rot	Conifers	Southern Ontario	No distributional change.
Gloeosporium sp. Leaf spot	Birch, yellow	Wawa District of Northeastern Region	Moderate foliar damage common.
Hendersonia pinicola Wehm. Needle cast	Pine, jack	Pembroke District, Algonquin Region	High foliar damage on scattered trees.
Leucostoma kunzei (Fr.) Munk Canker	Spruce	Province-wide	Important canker.
Lophodermella concolor (Dear.) Darker Needle cast	Pine, jack	Pembroke District, Algonquin Region	Associated with *Hendersonia pinicola* on scattered trees.
Melampsora medusae Thuem. Conifer-aspen rust	Aspen, trembling tamarack Poplar, hybrids	Algonquin, Eastern and Northeastern regions	Trace foliar damage common on native hosts. High foliar damage on certain hybrid poplar clones.
Marssonina populi (Lib.) Magn. Leaf blight	Poplar hybrid	Algonquin and Eastern regions	Moderate foliar damage common.
Melampsorella caryophyllacearum Schroet. Fir broom rust	Fir, balsam	Throughout host range	Common at low and trace damage levels.
Melanconium bicolor Nees Canker	Birch, yellow	Sault Ste. Marie District, Northeastern Region	Associated with mortality and cankering of regeneration.

OTHER NOTEWORTHY DISEASES (Concluded)

Organism and Disease	Host(s)	Locality	Remarks
Phyllosticta paviae Desm. Leaf blotch	Horse-chestnut	Central and Southwestern regions	Foliar damage prevalent on ornamentals.
Polyporus tomentosus Fr. Root and butt rot	Conifers	Province-wide	A common root rot.
Rhizosphaera kalkhoffii Bub. Needle cast	Spruce, Colorado blue	Southwestern Region	High foliar damage in one plantation.
Rhytisma acerinum (Pers.) Fr. Tar spot	Maple, red	Algonquin Region	Trace foliar damage common.
Septoria populicola Pk. Leaf spot	Poplar, balsam	Central, North Central and Northwestern regions	Light foliar damage at scattered locations.
Sirococcus strobilinus Preuss Tip blight	Spruce, Colorado blue	Southwestern Region	High foliar damage in one plantation.
Therrya fuckelii (Rehm) Kujala Canker	Pine, red	Eastern Region	Associated with crown dieback in Limerick Forest.
Venturia populina (Vuill.) Fabric. Leaf and twig blight	Poplar, balsam	Northern Region	Low foliar damage common.


REGIONS:
1. NORTHWESTERN
2. NORTH CENTRAL
3. NORTHERN
4. NORTHEASTERN
5. ALGONQUIN
6. EASTERN
7. CENTRAL
8. SOUTHWESTERN
KENORA
LAKE NIPIGON
THUNDER BAY
LAKE SUPERIOR
SAULT STE MARIE
LAKE NIPISSING
OTTAWA
LAKE MICHIGAN
LAKE HURON
TORONTO
HAMILTON
LAKE ONTARIO
WINDSOR
LAKE ERIE
Areas and pockets of maple decline and mortality related to the Forest Tent Caterpillar outbreak in the 1970s.
ONTARIO REGION
FOREST INSECT AND DISEASE SURVEY 1977
AREAS OF MODERATE TO SEVERE DEFOLIATION
BY THE
FOREST TENT CATERPILLAR
AS DETERMINED BY AERIAL AND GROUND SURVEYS
SCALE IN KILOMETERS
0 60 120 180

PRAIRIES REGION

Y. HIRATSUKA AND J. PETTY

Northern Forest Research Centre, Edmonton, Alberta

INTRODUCTION

The status of most major forest insect and disease pests in the Prairies Region remained much the same in 1977 as in 1976. The forest tent caterpillar caused severe defoliation for the fourth consecutive year to trembling aspen stands throughout the southern parts of Manitoba but showed definite signs of decline and collapse in 1978. In Saskatchewan and Alberta, the area and severity of defoliation by the forest tent caterpillar increased somewhat, with no sign of a population decrease. The spruce budworm population and area of infestation increased markedly in the Interlake region of Manitoba in 1977, and continued defoliation was observed at several other locations in southern Manitoba. Infestations in north-central Alberta remained static. A significant decline in the population of the jack pine budworm was reported in Sandilands Provincial Forest in Manitoba, but high populations persisted in localized infestations in Belair Provincial Forest and Spruce Woods Provincial Forest. The intensity and extent of jack pine budworm damage in Nisbet Provincial Forest, in Saskatchewan, increased in 1977 and is predicted to be the same in 1978. Several isolated infestations of mountain pine beetle were found in southwestern Alberta.

Dutch elm disease was found in a few new locations in Manitoba in 1977, but none was reported in Saskatchewan or Alberta. Several unusual circular areas of tree mortality, possibly caused by lightning strikes, were reported.

Fire blight, forest tent caterpillar, silver leaf, winter injury and herbicide or soil-sterilant damage were the main causes of tree problems in urban centers across the Region. These problems were dealt with by the pest extension service.

IMPORTANT FOREST INSECTS

Spruce Budworm, *Choristoneura fumiferana* (Clem.)—In Manitoba, high larval populations continue to cause moderate-to-severe defoliation of current foliage and top-kill on about 2 000 ha of spruce–balsam fir stands in Whiteshell Provincial Park and 60 ha of white spruce plantation in Turtle Mountain Provincial Park (see map, page 78). Light-to-moderate defoliation was reported in Spruce Woods and Birds Hill provincial parks. In the Interlake region moderate-to-severe defoliation occurred in scattered white spruce stands throughout agricultural areas, increasing in incidence and extent from about 111 000 ha in 1976 to 311 000 ha in 1977. During the fall of 1977, egg-mass counts conducted in Spruce Woods, Whiteshell and Turtle Mountain provincial parks led to predictions of moderate, severe and light defoliation, respectively, for 1978.

In Alberta, aerial surveys conducted over previously reported outbreak areas in northwest Alberta revealed no evidence of population buildup. In the Athabasca Forest, about 6 400 ha of spruce forests in areas around Fort McMurray showed light-to-moderate defoliation with patches of severe defoliation. Damage was somewhat less intense than in 1976. No egg surveys were made to predict infestation levels in 1978.

Forest Tent Caterpillar, Malacosoma disstria Hbn.—In Manitoba, this insect continued to cause severe defoliation to trembling aspen and other broad-leaved trees and shrubs throughout the southern section of the Province (see map, page 79). The present outbreak covers about 119 000 km^2 compared with 103 000 km^2 in 1976. Although the area of infestation increased somewhat, the present epidemic appears to be waning. From egg-mass surveys conducted at 147 sample plots distributed throughout the infested areas it was predicted that 63% of the plots would have less defoliation in 1978 than in 1977 and that only 12% of the plots would have more.

In Saskatchewan, populations of the forest tent caterpillar increased in 1977. Surveys north and west of Prince Albert to Lac Isle-à-la Crosse and Pinehouse Lake located seven areas of moderate-to-severe defoliation. In the Emma and Christopher lakes area, moderate-to-severe defoliation occurred over approximately 6 000 ha, thus increasing over 1976. The outbreak now reaches into Prince Albert National Park, extending 1.6 km west of the park gate. In the Big River–Delaronde Lake–Sled Lake area the infestation increased to 19 000 ha. Previously unreported outbreaks were near Green Lake and surrounded Pinehouse and Bar lakes.

Patchy light-to-severe defoliation was present along the Saskatchewan–Manitoba border between Duck Mountain Provincial Park and the Trans-Canada Highway and west to Canora, Bankend and Lestock.

In Cypress Hills Provincial Park, defoliation was moderate to severe in the "core area" and light to moderate northwest to Bald Butte.

Egg-band sampling in the Emma and Christopher lakes area and Cypress Hills indicated a continuation of high populations in 1978.

In Alberta, the size and severity of forest tent caterpillar infestations increased from those reported in 1976. There were two main areas where moderate-to-severe defoliation was observed: west of Edmonton and northwest of Lesser Slave Lake.

The infestation west and southwest of Edmonton was encompassed by a line from Edmonton to Pigeon Lake, Crimson Lake, Shiningbank Lake, Mayerthorpe, Lac Ste. Anne and Thorsby and back to Edmonton. Defoliation was moderate-to-severe along the western side of the infested area, where stands of trembling aspen were more or less continuous, and became patchy, light, moderate or severe eastwards into agricultural areas where the aspen occurs in bluffs. Within this area of the outbreak, varying degrees of defoliation have persisted since 1964 and have centered around Wabamun Lake, Chip Lake and Lac Ste. Anne. Moderate-to-severe defoliation was general here in 1977.

The other area surrounded Lesser Slave Lake and extended northwest to Peace River, then north and east to within a few miles of Bison Lake. On the south side of Lesser Slave Lake, defoliation was patchy and moderate to severe, extending south of the lake a short distance except along the valleys of West Prairie Creek, Prairie River and Swan River, where it extended about 25 km south of Highway 2. Along the north side of Lesser Slave Lake and northwest to Peace River, defoliation was caused by the forest tent caterpillar in association with the large aspen tortrix, *Choristoneura conflictana* (Wlk.). In some areas the tent caterpillar was predominant, while in others the large aspen tortrix was the major species. Defoliation was generally moderate to severe.

Low populations were reported in central Alberta between Stettler and Camrose and east to Wainwright. Tent caterpillar populations in Lethbridge were moderate, and chemical controls were applied in several instances.

Jack Pine Budworm, Choristoneura pinus pinus Free.—In Manitoba, a significant decline in epidemic populations of this species occurred in planted and naturally growing jack pine and other host stands in Sandilands Provincial Forest with the exception of two localized areas in the northern section. The conspicuous redness of jack pine foliage, characteristic of moderate-to-severe defoliation, was generally absent in 1977. Field examinations of infested stands during early larval development confirmed the presence of budworm larvae in staminate flowers in sufficient numbers to cause extensive feeding damage. A significant decline in larval populations resulted, however, in generally light, with occasionally moderate, defoliation of individual trees. The causes of this larval decline in the Sandilands is not known, but similar observations have been made in Minnesota.

High populations of the jack pine budworm continued to persist in two localized infestations in Belair Provincial Forest and caused moderate-to-severe defoliation of current needles and shoots.

In 1976, a combination of severe drought and moderate-to-severe defoliation had placed stands under heavy stress. Predictions for 1977 indicated a continuing increase in populations and a continuation of drought conditions in affected stands. As a result, provincial officials decided to spray budworm-infested stands by aerial application of the insecticide fenitrothion. The infested area treated was north of Stead and covered an estimated 720 ha.

Aerial sprays were applied in early June, and the results, based on prespray and postspray assessments, indicated that populations were reduced only 26% but that defoliation was noticeably reduced compared with that of untreated stands.

In Spruce Woods Provincial Forest, most of the pine plantations were also treated with fenitrothion in early June; prespray and postspray assessments indicated that the insecticide reduced larval populations by 68%.

Results of egg-mass sampling in jack pine budworm infestations indicate a general decline of populations in 1978.

In Saskatchewan, moderate-to-severe defoliation by this insect occurred over approximately 18 700 ha in Nisbet Provincial Forest in 1977. Approximately 1 500 ha of this total was south of the North Saskatchewan River, south of Crutwell. Many open-grown trees, particularly in reforestation plots established in 1962, had little green foliage remaining. The high larval populations in 1976 and 1977 destroyed foliage of these years and also pre-1976 foliage. Egg-mass surveys indicate that populations are likely to be high again in 1978 in most of the infested locations.

Mountain Pine Beetle, Dendroctonus ponderosae Hopk.—Several small infestations of the mountain pine beetle were detected in Crowsnest Forest and Waterton Lakes National Park of southwestern Alberta in 1977. The only previously recorded outbreak of this beetle in Alberta occurred along the Bow River Valley in Banff National Park between 1940 and 1943.

Climatic records of the area of the present infestation indicate that the potential outbreak hazard of the mountain pine beetle is low. Two successive mild winters and

the presence of stands of lodgepole pine that are nearing maturation are likely the most important factors that contributed to the present infestations. Cutting and burning of infested trees was started in the Syncline Campground in late 1977 to combat this insect.

OTHER NOTEWORTHY INSECTS

Insect	Host(s)	Locality	Remarks
Aceria parapopuli (Keifer) Poplar bud-gall mite	Poplar, balsam, hybrid Aspen, trembling	Southern parts of Alberta, Saskatchewan and Manitoba	A serious pest of planted trees.
Aceria negundi Hodg. Leaf gall	Maple, Manitoba	Saskatoon, Prince Albert, Nipawin, Tisdale, Watson, Moose Jaw and Outlook, Sask.	Caused light damage.
Adelges cooleyi (Gill.) Spruce gall aphid	Spruce, white	Saskatchewan and Manitoba	Reported at many locations throughout agricultural areas.
Agrilus anxius Gory Bronze birch borer	Birch, cutleaf	Winnipeg and some rural areas of Manitoba	Serious damage reported.
Alsophila pometaria (Harr.) Fall cankerworm	Elm, white	Along Red River between Selkirk and Winnipeg, south of Emerson, and at Winkler, Morden, Brandon, Portage la Prairie, Prince Albert, Moosomin, and Saskatoon	Moderate-to-severe defoliation on scattered trees along Red River between Selkirk and Winnipeg and at Moosomin; light to moderate elsewhere.
Caliroa cerasi (L.) Pear slug	Apple Cotoneaster Hawthorn Mountain-ash	Winnipeg, many urban areas of Alberta	Light-to-moderate injury reported. Slight decrease in population level from 1976 in Alberta.
Cephalcia fascipennis (Cress.) Webspinning sawfly	Spruce, Colorado blue, white	Shellbrook and Maidstone	Light damage reported.
Eriosoma americanun (Riley) Woolly elm aphid	Elm	Saskatchewan and Alberta	Light-to-moderate damage reported on boulevard and ornamental elms in Edmonton, Red Deer, Lethbridge, Calgary and other urban and rural areas.
Gracillaria syringella (F.) Lilac leafminer	Lilac	Urban areas of northern Saskatchewan and Alberta	Perennial problem in many areas.
Mayetiola piceae (Felt) Spruce gall midge	Spruce, white	Shellbrook area, Saskatoon and northern Alberta	Moderate damage to shelterbelts near Shellbrook and a few ornamentals in Saskatoon. Moderate on regeneration in spruce stands in northwestern Alberta.

OTHER NOTEWORTHY INSECTS (Concluded)

Insect	Host(s)	Locality	Remarks
Mordwilkoja vagabunda (Walsh) Poplar vagabond aphid	Poplar	Central Saskatchewan	Light damage reported from a few areas.
Neodiprion abietis (Harr.) Balsam fir sawfly	Fir, balsam	Manitoba	Light defoliation noted in Hecla Island and Whiteshell provincial parks and along Pelican Narrows Road.
Nymphalis antiopa (L.) Mourning cloak butterfly	Aspen, trembling Poplar, balsam Willow	Prince Albert National Park and Nipawin, Hudson Bay and Prince Albert areas	Light feeding damage reported.
Oligonychus ununguis (Jac.) Spruce spider mite	Spruce, Colorado, blue, Norway, white	Saskatchewan and Alberta	Light-to-moderate damage in many urban centers.
Orgyia antiqua (L.) Rusty tussock moth	Miscellaneous	Alberta	Decrease in population from 1976.
Petrova spp. Pitch twig moths	Pine	Alberta	Commonly found on pines transplanted from forested area to urban centers.
Pikonema alaskensis (Roh.) Yellowheaded spruce sawfly	Spruce, Colorado, blue, white	Manitoba, Saskatchewan and Alberta	Many reports of light-to-moderate defoliation throughout Prairie Provinces on open-grown planted spruce. Considered to be persistent pest problem.
Pissodes strobi (Peck) White pine weevil	Spruce, Colorado, blue, white	Parkside and Glaslyn areas, Sask.; Edmonton, Red Deer, Calgary and High River, Alta.	Light-to-moderate terminal injury reported.
Saperda calcarata Say Poplar borer	Aspen, trembling	Manitoba, Saskatchewan and Alberta	Common and causing light damage throughout aspen parkland zone of Prairie Provinces.

IMPORTANT FOREST DISEASES

Dutch Elm Disease, Ceratocystis ulmi (Buism.) C. Moreau—Dutch elm disease is the most important and serious tree problem in Manitoba and is currently causing extensive damage to native and planted white elm stands. In 1975, outbreaks of the disease were diagnosed for the first time in the Province at Brandon, Selkirk and Winnipeg.

In 1976, increased incidence of diseased trees occurred in the Brandon and Selkirk areas, where high populations of the native elm bark beetle, *Hylurgopinus rufipes* (Eichh.), the primary vector, were also present. In addition, new light-to-severe outbreaks were recorded at Winnipeg Beach, Teulon, Matlock, Scanterbury,

Beaconia, Grand Beach, Pine Falls, Lockport, Beausejour and scattered locations along the Brokenhead River and in Beaudry and Highland provincial parks.

In 1977, the most significant extension of Dutch elm disease was in and around the town of Sprague. Native elm stands in this area are fairly isolated. Thus the pathogen may have been introduced accidentally by tourists travelling through infected areas of Ontario or Minnesota. Although a slight decrease in the total number of confirmed trees (948) occurred, new infections were recorded at Gimli, Lac du Bonnet and Belair. In addition, previously infected areas expanded and disease incidence increased along the Brokenhead River. In Winnipeg and Brandon the number of confirmed diseased trees decreased slightly to 69 and 71, but in Selkirk it increased to 570.

Surveys conducted with the staff of Saskatchewan Agriculture and the PFRA Tree Nursery revealed no sign of Dutch elm disease in Saskatchewan. The native elm bark beetle, however, was found in several locations.

Neither the disease nor the vector beetles were reported from Alberta.

Scleroderris Canker, Gremmeniella abietina (Lagerb.) Morelet—No new records of distribution were reported outside of the general area in Jasper National Park, where this disease was first reported in 1974.

Tree Group Mortality—An unusual circular disturbance of forest about 25 km north of Hinton, Alta., was reported. The area of dead and dying trees is circular, covering about 0.1 ha, and is located within a naturally stocked, even-aged lodgepole pine stand about 85 years old. All lodgepole pine (about 110) within the circular area appeared dead, and about 30 trees around the periphery were still dying or partially killed. From on-site examinations and soil analysis, possible causes such as fire, insects, diseases, chemicals and climatic conditions have been ruled out as the primary cause of the disturbance. The most plausible explanation at this time is that it is the "tree group mortality" caused by lightning that has been frequently reported from Europe and Australia. However, reexamination of the site will be necessary to confirm this possibility. The exact mechanism of the tree group mortality is not known, but under certain conditions the lightning strike kills trees without causing fire.

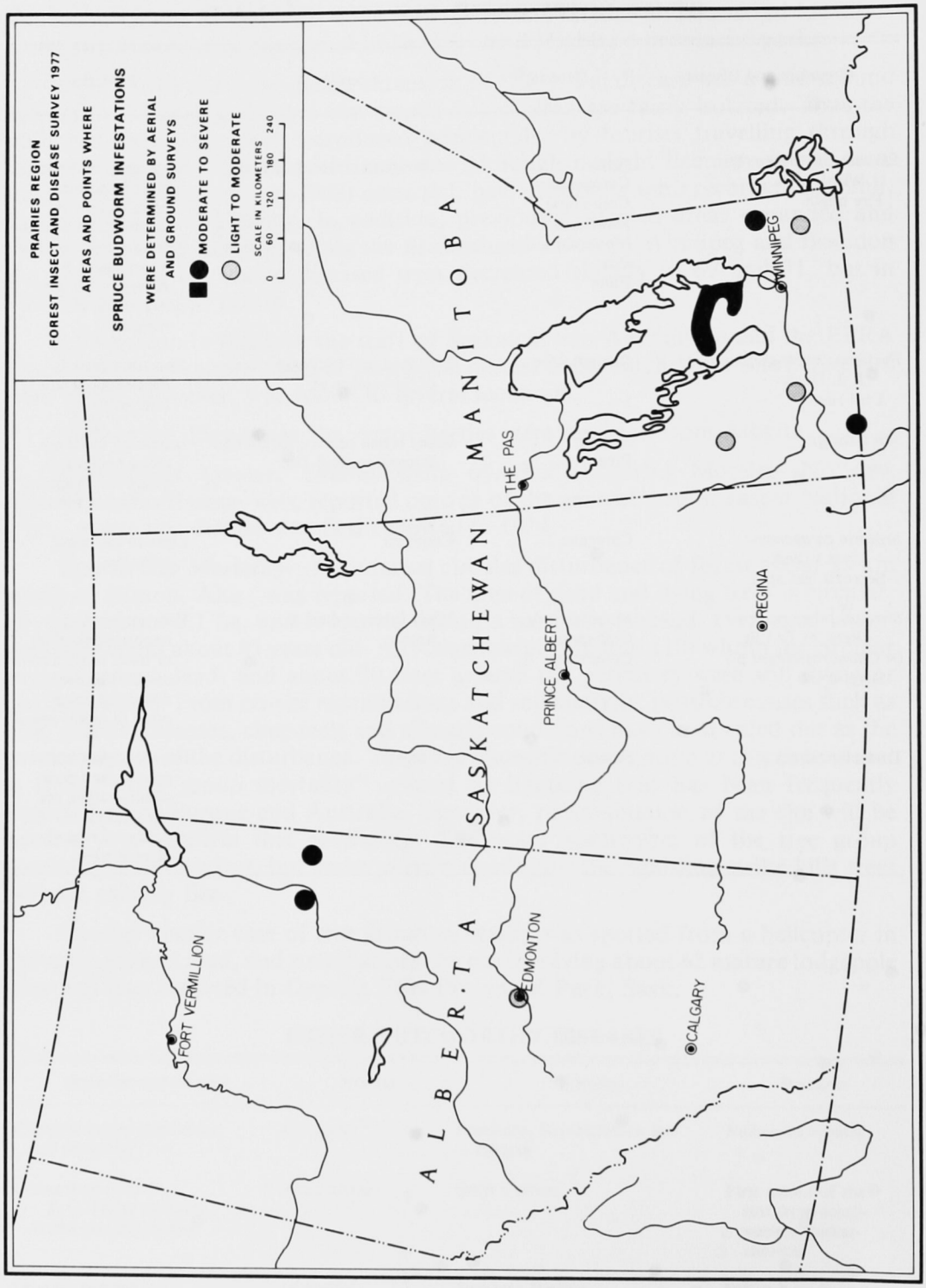
Another similar case of tree group mortality was spotted from a helicopter in the same general area, and a similar occurrence involving about 62 mature lodgepole pine was also reported in Cypress Hills Provincial Park, Sask.

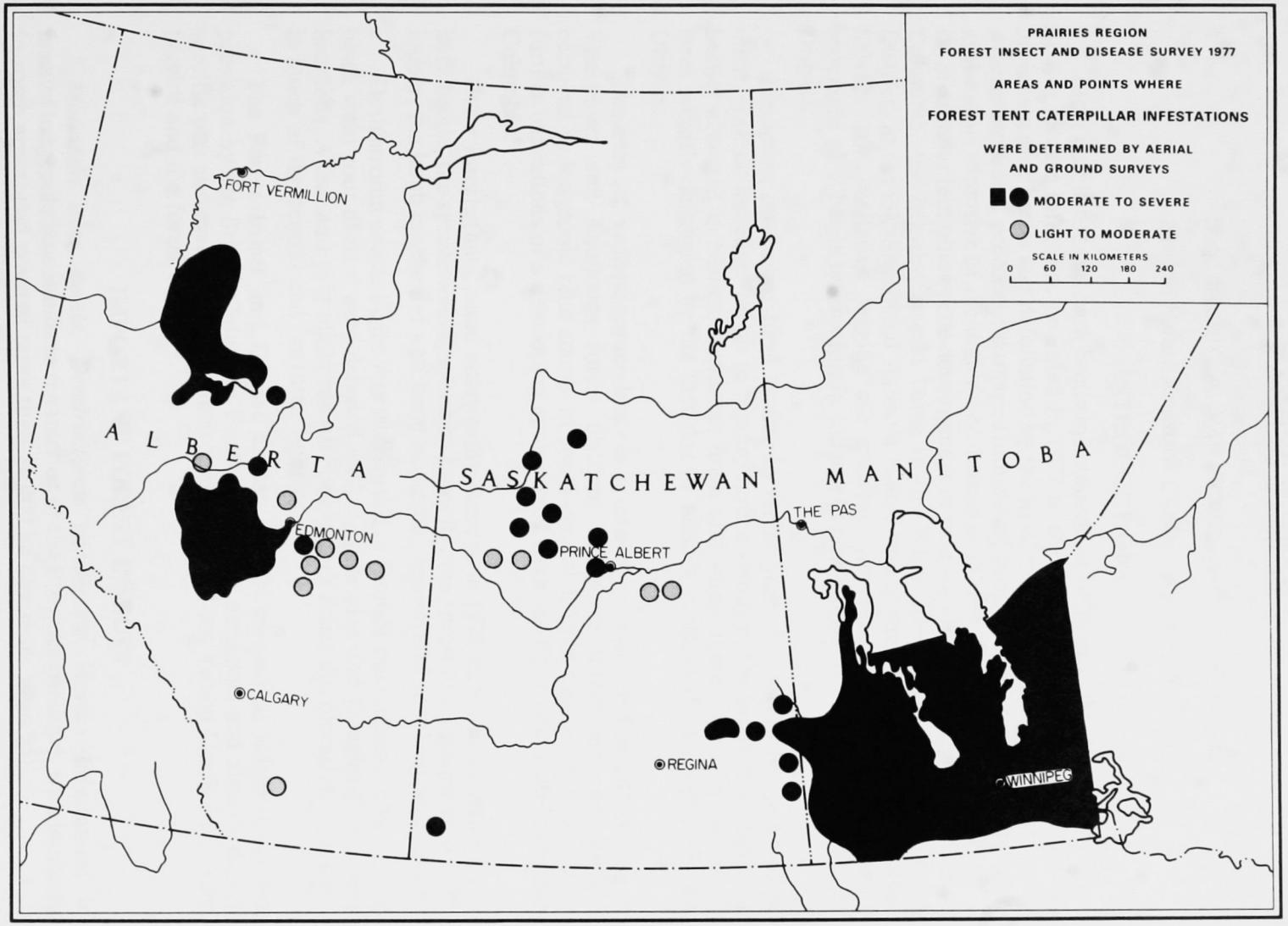
OTHER NOTEWORTHY DISEASES

Organism and Disease	Host(s)	Locality	Remarks
Chemical injury (herbicides, soil sterilants)	All species	Manitoba, Saskatchewan and Alberta	Numerous reports.
Cronartium ribicola J. C. Fisher ex Rabh. White pine blister rust	Black currant	Swift Current	First record of the rust from south-western Saskatchewan.
Drought damage	All species	Southern Prairies	Difficult to diagnose positively but appears common in southern Prairies, especially in Alberta and Saskatchewan.

OTHER NOTEWORTHY DISEASES (Concluded)

Organism and Disease	Host(s)	Locality	Remarks
Erwinia amylovora (Burr.) Winsl. et al. Fire blight	Apple Cotoneaster Crab apple Hawthorn Mountain-ash Pear Plum	Most urban centers in Region	Very common and most important ornamental-tree disease. This disease is now designated as a pest under the Agriculture Pests Act, 1974, in Alberta.
Puccinia caricis-shepherdiae J. J. Davis Leaf rust	Russian-olive	Davidson and McTaggart areas of Saskatchewan	Common, causing light-to-moderate infection.
Salt damage	Spruce Pine	Many urban centers, including Edmonton, Red Deer	Increasing incidence along boulevards where salt is applied to roads in winter.
Septoria caraganae (Jacz.) Died. Septoria leaf spot	Caragana	Conquest	Light-to-moderate infection.
Stereum purpureum (Pers. ex Fr.) Fr. (≡ *Chondrostereum* p.) Silver leaf	Mountain-ash Crabapple Cotoneaster	Many urban centers in Region	Very common and important problem of older trees. This disease has been diagnosed more often in recent years.
Transplant shock	Several	All areas	Improper planting practice and poor planting stock are main causes of deaths of recently planted trees.


PRAIRIES REGION
FOREST INSECT AND DISEASE SURVEY 1977
AREAS AND POINTS WHERE
SPRUCE BUDWORM INFESTATIONS
WERE DETERMINED BY AERIAL
AND GROUND SURVEYS
MODERATE TO SEVERE
LIGHT TO MODERATE
SCALE IN KILOMETERS
0 60 120 180 240
ALBERTA
SASKATCHEWAN
MANITOBA
FORT VERMILLION
EDMONTON
CALGARY
PRINCE ALBERT
THE PAS
REGINA
WINNIPEG


PRAIRIES REGION
FOREST INSECT AND DISEASE SURVEY 1977
AREAS AND POINTS WHERE
FOREST TENT CATERPILLAR INFESTATIONS
WERE DETERMINED BY AERIAL
AND GROUND SURVEYS
MODERATE TO SEVERE
LIGHT TO MODERATE
SCALE IN KILOMETERS
0 60 120 180 240
FORT VERMILLION
ALBERTA
SASKATCHEWAN
MANITOBA
EDMONTON
PRINCE ALBERT
THE PAS
CALGARY
REGINA
WINNIPEG

PACIFIC REGION

D.A. ROSS, G.A. VAN SICKLE AND C.S. WOOD

Pacific Forest Research Centre, Victoria, B.C.

INTRODUCTION

Most defoliator and bark beetle infestations of 1976, as well as that year's areas of tree disease infection, persisted in 1977 in the Pacific Region. Tree-kill by the mountain pine beetle and defoliation by the western spruce budworm were the most widespread insect problems; damage from dwarf mistletoe and root rots continued as the most extensive of the major tree disease problems. The weather of early 1977 favored mountain pine beetle development in pine stands in most regions of British Columbia, the heaviest attacks being in the White River area of Nelson Forest District, in the Okanagan and Ashnola valleys and in the Chilcotin-Cariboo area. Salvage and sanitation logging are credited with the reduction of the major mountain pine beetle infestation in lodgepole pine stands in Prince Rupert Forest District.

Favorable conditions have existed in recent years for spruce beetle development, with an increased threat to mature spruce stands in the Interior. Douglas-fir beetles occurred in numerous chronic areas and where there were beetle-attacked trees recently defoliated by the Douglas-fir tussock moth in the Kamloops Forest District.

The area of western spruce budworm infestation expanded to 246 000 ha in Vancouver and Kamloops forest districts. Extensive infestations of sawflies occurred in lodgepole pine stands in south-central British Columbia. There were further indications of a developing epidemic of larch sawfly in southeastern British Columbia.

Other insects that caused noteworthy damage in 1977 were the western balsam bark beetle, the spruce weevil, a hemlock sawfly, the forest tent caterpillar, a larch looper, the larch casebearer and larch budmoth, and several cone and seed insects.

Dothistroma needle blight was widespread in Interior pine stands. Infections of black stain root disease were detected on lodgepole pine and Douglas-fir at many locations. A leaf and twig blight caused conspicuous foliar discoloration of poplars in much of the central and northern Interior.

The Forest Insect and Disease Survey staff is pleased to acknowledge the provision by the British Columbia Forest Service of personnel and aircraft during specific pest surveys, and the excellent cooperation of the Yukon Lands and Forest Service and the forest industry.

IMPORTANT FOREST INSECTS

Mountain Pine Beetle, *Dendroctonus ponderosae* Hopk.—Infestations in mature lodgepole pine stands in the interior of the Province persisted, with increases in some areas, and covered more than 52 000 ha (see map, page 95).

The mild winter of 1976-77, early warm spring and extended hot summer contributed to high brood survival and adult development. Infestations could intensify and expand in 1978, unless overwintering mortality is high.

In Nelson Forest District, the numbers of beetle-killed trees increased substantially, the most severe outbreak being in the White River drainage, where 117,000 red-topped lodgepole pine trees were recorded on 9 300 ha compared with 39,000 on 4 900 ha in 1976. Near the Canada–United States border, in the Flathead River valley, 4,500 red-tops were recorded on 500 ha, a tenfold increase since 1976. Green-infested lodgepole pine trees were numerous in the White River and Flathead River drainages. In the West Kootenay region and the Golden area, the numbers of beetle-killed pine trees declined because of salvage control logging. In the Columbia River valley, 7,000 western white pine trees were killed on 1 300 ha.

In Kamloops Forest District, infestations were recorded on 10 000 ha of lodgepole and ponderosa pine, the largest infestations being in the Ashnola River drainage, 4 100 ha; at Carpenter Lake, 2 100 ha; at Whiteman Creek, 1 700 ha; and in the Tulameen area, 1 200 ha. Smaller infestations of 40 to 900 ha were recorded at Bonaparte Lake, Yalakom River and Whiteman Creek. Beetles continued to kill western white pine trees in the following areas: Blue River, 870 ha; Adams Lake, 390 ha; and Sugar Lake, 180 ha. Current levels of attack are expected to continue in 1978, although salvage control operations are in progress in some parts of the Okanagan and Lillooet regions.

An extensive infestation in the Klinaklini Valley in Cariboo Forest District declined; there more than 18,000 trees were killed in 1977, and a total of 250,000 since 1975 over 7 500 ha. Other infestations in lodgepole pine stands increased to cover more than 16 000 ha. Significant numbers of red-topped trees occurred at Tatla Lake–Mosley Creek, 1,600 trees; Dog Creek–Canoe Creek, 4,300; Mount Graham–Gang Ranch, 4,100; Cariboo River–Cariboo Lake, 1,000; and Konni Lake–Nemaia Creek, 860. Infestations will probably continue in 1978 where susceptible stands occur.

More than 11,000 red-topped lodgepole pines were recorded in the interior of Prince Rupert Forest District, a decline from the 18,000 trees recorded in 1976. The highest numbers of dead trees were recorded near Ritchie, 1,500; Woodcock, 1,000; Carnaby, 1,000; Harold Price, 2,500; and the Dean and Takia rivers, 1,100 trees, for an increase of 700 trees since 1976. Salvage logging substantially reduced the numbers of red-tops in the Kispiox Valley.

In Prince George Forest District, mortality of lodgepole and western white pine trees increased in the northern end of McNaughton Lake, with 2,200 trees killed; Swift River, 500; and Stuart–Trembleur lakes, 300. Small groups of red-tops were observed north of Inzana Lake and along the Middle River.

The infestation in 2 500 ha of mature lodgepole pine stands in the Klinaklini region of Vancouver Forest District declined to 4,000 dead trees from 18,000 trees in 1976. Red-topped lodgepole and western white pine were scattered over 375 ha in Mowhokam and Ainslie creeks in the Fraser Canyon. At Spruce Creek near Anderson Lake, 300 lodgepole pine trees were killed, and groups of 25–30 dead western white pine were recorded near Birkenhead Lake, Skagit River, and Nahatlatch Lake and River.

Spruce Beetle, Dendroctonus rufipennis (Kirby)—Spruce beetle populations and beetle-killed trees increased in white and Engelmann spruce stands in the interior of British Columbia, particularly near recently logged areas (see map, page 96). An early warm spring and hot summer temperatures accelerated subsequent

beetle development in many areas from the usual 2-year cycle to a 1-year, which greatly increased attack potential in 1978.

In Kamloops Forest District, populations continued to increase, particularly in wind-thrown trees in and around recently logged areas. A new infestation was recorded in standing timber over 300 ha near Lambly Creek. Near Cayoosh Creek, logging and a trap-tree program contributed to containment of the beetle population.

The number of beetle-killed white spruce trees in Prince Rupert Forest District increased dramatically. Near Smithers Landing, approximately 2 000 ha of spruce stands were infested; up to 83% of the trees were attacked in the center of the infestation. Near Pork Chop Lake, infestations increased to 120 ha from 40 ha in 1976 and threaten surrounding spruce stands. Smaller infestations from 3 to 30 ha occurred in mature stands on the Babine and Morice rivers, and at Haul, Morrison, Holland, Torkelsen, McBride, Bill Nye and Coffin lakes.

Sizable pockets of recently killed white spruce were recorded in Prince George Forest District around Carp, Merton and Weedon lakes and Weedon Creek, and in the Tezzeron-Inzana lakes area. Scattered groups of 2 to 15 infested trees were observed on 8 000 ha southeast of Inzana Lake and on 600 ha south of Chuius Mountain.

In Mowhokam Creek, Vancouver Forest District, 9% of Engelmann spruce trees in a mixed spruce-alpine fir stand were attacked; 150 trees were attacked before 1976 in an adjacent stand.

Spruce beetle populations increased slightly in windthrow in the Marshall Creek area, Yukon Territory. White and black spruce trees weakened by flooding of 80 ha in the Aishihik power project canal were attacked, and a population increase is forecast for 1978.

Douglas-fir Beetle, *Dendroctonus pseudotsugae* Hopk.—The numbers of beetle-killed Douglas-fir trees increased in Kamloops Forest District in 1977, noticeably in the Kamloops area, where Douglas-fir stands had been previously defoliated by the Douglas-fir tussock moth. Scattered groups of red-topped trees occurred over 2 100 ha along Tranquille and Monte creeks, in Highland and Pass valleys and near Paul, Tunkwa and Kamloops lakes. Small groups of 2 to 10 trees were scattered through the area from Merritt to Penticton and from Vernon to Shuswap Lake.

Trap trees successfully attracted beetles at Jamieson and Dairy creeks and south of Savona, where stands were threatened by high numbers of bark beetles.

In Vancouver Forest District, bark beetles were present in small numbers of trees previously defoliated by the western spruce budworm at Railroad, Rutherford and North creeks, in McKenzie Basin, along the Birkenhead Lake road in the Pemberton region, and at Siwash, Snass and Trafalgar creeks near Hope. Douglas-fir beetle brood production in attacked trees was low, and populations posed no significant threat to surrounding stands.

Western Balsam Bark Beetle, *Dryocoetes confusus* Sw. (*Dryocoetes-Ceratocystis* complex)—In Kamloops Forest District, areas of alpine fir trees killed by this insect-disease complex increased to 11 000 ha, the largest areas being in the Fly Hills, 3 400 ha; at Hunters Range, 1 900 ha; and at Stoyoma Lake, 900 ha. Tree

mortality was also widespread in higher-elevation stands west of Little Fort and McClure and Nicoamen creeks.

In Prince Rupert Forest District, an estimated 25% of the alpine fir have been killed over 3 900 ha in the McKendrick Pass area. In the eastern part of the District, 2,700 trees were killed in scattered patches near Smithers, and groups of up to 500 dead trees occurred at Dome Mountain and at Howson, Cumming and Winfield creeks.

Dead alpine fir trees were scattered through 450 ha along Mowhokam and Ainslie creeks in the Fraser Canyon region, Vancouver Forest District.

The number of recorded beetle-killed high-elevation alpine fir totalled 8,000 in Nelson Forest District, fewer than in previous years.

Western Spruce Budworm, Choristoneura occidentalis Free.—The total area of defoliation of Douglas-fir stands by the western spruce budworm in Vancouver Forest District increased to more than 90 000 ha from 71 000 ha in 1976 (see map, page 96). Areas of severe defoliation increased to 33 000 ha, mainly in the Fraser Canyon area from Yale to the Nahatlatch River valley, in the Skagit River drainage south of Hope, and in the Owl Creek and Birkenhead River areas near Pemberton. Light defoliation appeared to be less widespread and was recorded mainly in the Lillooet River valley north of Pemberton. Approximately 80% of the mature Douglas-fir trees were killed over 250 ha at Tsileuh Creek near Hells Gate in the Fraser Canyon, and at Trafalgar Creek 70% of the trees were killed on 40 ha. Severe defoliation in these stands occurred early in the epidemic and persisted for several years. Mortality of mature trees is not common and is usually confined to understory and intermediate trees in small areas of continuous defoliation. Trees top-stripped for 1–10 m were common in areas of severe defoliation. Refoliation may occur in many severely defoliated trees, but top-stripping has resulted in dead tops and in increment and height-growth loss. Egg-mass density was much reduced from the 1976 level but was sufficiently high in many areas to fall into a predicted severe defoliation category for 1978.

Defoliation of Douglas-fir stands continued in Kamloops Forest District, covering 124 000 ha. Moderate-to-severe defoliation was widespread in the Fraser Canyon region and expanded in the Carpenter Lake, Yalakom River and Ashcroft areas. In the Adams–Shuswap region, 10 500 ha were lightly defoliated, as were 700 ha in the Princeton–Merritt area. New areas of light defoliation were recorded at East Barriere and White lakes in the Shuswap–Adams lakes region, at Walhachin and at Barnes Lake near Ashcroft and at Maiden and Big Bar creeks near Clinton. Continuing defoliation of Douglas-fir stands is predicted for most areas for 1978.

Two-year-cycle Spruce Budworm, Choristoneura biennis Free.—Engelmann spruce and alpine fir on 1 200 ha in the White River valley and at Silverton Creek, Nelson Forest District, were lightly defoliated. Populations in spruce stands near McMurdo Creek declined, and no defoliation was observed.

Defoliation of spruce-alpine fir stands continued in the Horsefly River–Hendrix Lake area in Cariboo Forest District.

In Prince George Forest District, bud damage to alpine fir and white spruce exceeded 90% for 5 km along the Holmes River access road. Lighter damage extended back from the road for several kilometers.

Larch Casebearer, *Coleophora laricella* (Hbn.)—Larch casebearer defoliated western larch trees throughout much of the host range in Nelson Forest District. The total area of defoliation increased slightly, most noticeably from Creston to Castlegar. Moderate-to-heavy defoliation occurred in the Salmo, Fruitvale, Castlegar, Nelson and Creston areas, along the Pend-d'Oreille River and from Crawford Bay south along Kootenay Lake to Rykerts. Larch stands were lightly defoliated in the Slocan Valley from Crescent Valley to New Denver, and from Cranbrook to Elko in the East Kootenay. Overwintering larval populations of the larch casebearer indicate continuing moderate defoliation in most areas.

Additional parasites, *Agathis pumila* (Ratz.), from Europe were released in the Rossland area in July 1977 under the continuing biological control program.

In Kamloops Forest District, the distribution of the casebearer expanded farther west, from Heckman Creek to Lavington. High-elevation stands on 600 ha near Anarchist Mountain were lightly defoliated in the first recorded defoliation of western larch above 900 m elevation in British Columbia. Severe defoliation is predicted for 1978 in stands near Anarchist Mountain, and larval populations are expected to increase and expand in the Lumby–Cherryville area.

European Pine Shoot Moth, *Rhyacionia buoliana* (Schiff.)—A survey initiated in 1975 to determine the occurrence of shoot moth continued as a cooperative survey by the Canadian Forestry Service, the British Columbia ministries of Agriculture and Forests, and Agriculture Canada.

In 1977, pine trees in residential areas and commercial nurseries were surveyed in most communities in the Okanagan Valley from Osoyoos to Vernon and within the Kamloops city boundaries. Shoot moth larvae were collected from 40 sites in Kelowna and 18 in Kamloops from mugho, Scots, ponderosa and lodgepole pine trees. Infested shoots or severely infested trees were removed, and dimethoate was applied to infested trees.

In Nelson Forest District, larvae continued to infest mugho pine in the viewpoint area of Hugh Keenleyside Dam at Robson. In Trail, young exotic pine trees, recently transported from the Vancouver area, were infested with larvae. Pruning and insecticide applications were done at both locations. No infested native pines were recorded and baited pheromone traps to monitor adult populations were negative.

The pest is well established in the lower mainland region of Vancouver Forest District. In Victoria, 20% of the shoots were infested in young exotic pines on the University of Victoria campus. These were treated with dimethoate.

Western Hemlock Looper, *Lambdina fiscellaria lugubrosa* (Hulst)—The infestation of hemlock loopers, which defoliated more than 10 500 ha of western hemlock stands in Wells Gray Park in 1976, collapsed, and this is attributed to parasitism of the overwintering looper eggs.

Larch Sawfly, *Pristiphora erichsonii* (Htg.)—Infestations in Nelson Forest District increased in mature western larch stands in the Sparwood area; defoliation was moderate on 600 ha and light on 200 ha (see map, page 97). Larval populations extended southwest to Hosmer and were recorded at Dutch Creek at the north end of Columbia Lake, and near Rossland. Infestations are expected to increase in area and intensity in 1978, as large numbers of overwintering larvae in cocoons were

evident. Past outbreaks developed initially in the Sparwood area and later expanded westward throughout the host range.

In Prince George Forest District, up to 95% defoliation of tamarack trees occurred over 1 600 ha in the Bednesti-Tatuk lakes region. Light defoliation was common in stands throughout the Peace River, Monkman and Liard River areas. Continuing defoliation is expected in 1978.

Larch Budmoth, *Zeiraphera improbana* (Wlk.)—Defoliation of tamarack continued for the third consecutive year in the Hyland River valley, Yukon Territory. Moderate-to-severe defoliation extended for 50 km along Highway 10 from Km 80; light defoliation extended for 70 km from Km 10. Between Watson and Frances lakes, along Highway 9, defoliation was light where severe defoliation had occurred in 1976.

In Nelson Forest District, the budmoth severely defoliated 2 000 ha of western larch at 1 200 to 1 500 m elevation in the Granby River valley between Pass Creek and Almond Creek, for a substantial increase over 1976.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.—Infestations increased to more than 30 000 ha in trembling aspen stands in the McBride area of Prince George Forest District. Defoliation extended for 70 km between McKale and Kiwa creeks along the Fraser River and occurred on smaller areas from Tête Jaune Cache south to Valemount and east into Mount Robson Provincial Park.

In Kamloops Forest District, patches of trembling aspen were defoliated over 2 000 ha near Gosnell, Barriere, Little Fort and Heffley Creek in the North Thompson River valley.

Spruce Budmoth, *Zeiraphera* sp.—This budmoth continued to damage the foliage of Sitka spruce trees for the third year on 55 ha along Deena Creek on Moresby Island, Prince Rupert Forest District. Continuous feeding on new growth has resulted in reduced height growth and altered form on up to 30% of the trees examined.

Satin Moth, *Leucoma salicis* (L.)—Trembling aspen groves totalling 1 480 ha were severely defoliated in Kamloops Forest District from Merritt to Aspen Grove, in the Douglas Lake-Nicola area and north to Kamloops.

On Red Mountain near Rossland, Nelson Forest District, 140 ha of trembling aspen were defoliated. The outbreaks of 1976 in the East Kootenay collapsed.

In Victoria, Vancouver Forest District, a row of silver poplar trees was 90% defoliated. Small larval populations persisted on Lombardy poplars in the region.

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.)—Populations collapsed in Prince George and Prince Rupert forest districts, with the exception of those on a few lightly defoliated trembling aspen stands in the Clayhurst and Cecil Lake areas in the Peace River region. No defoliation was recorded in the Progress area after three consecutive years of defoliation.

In the Yukon Territory, aspen stands were 95% defoliated around the Carmacks area in early summer; by mid-July, however, the trees were 40% refoliated. There was light defoliation for 7 km from Km 345 to 352 along Highway 2.

Conifer Sawflies, *Neodiprion* spp.—In Prince George Forest District, western hemlock trees over 64 000 ha from Purden Lake east to McBride were moderately to

severely defoliated by hemlock sawfly for a third year (see map, page 97). The most severely defoliated stands were between Hungary and Slim creeks, where trees have lost 95% of their total foliage. Understory trees in spruce–alpine fir stands were also severely defoliated in some areas.

Overmature western hemlock stands were lightly to moderately defoliated on 200 ha at Blue River and 1 600 ha in Wells Gray Park in Kamloops Forest District.

Pine sawfly larvae severely defoliated lodgepole pine on 12 000 ha in Kamloops Forest District (see map, page 97). Some 9 600 ha were severely defoliated in the Vavenby area and 2 600 ha along the Clearwater River. It is predicted that defoliation will continue in both areas in 1978 but at significantly reduced levels.

In Prince Rupert Forest District, populations persisted in shore pine stands on Porcher, Prescott and Stephens islands. Heavy tree mortality, resulting from 2 years of severe defoliation, was evident along Grenville Channel on Pitt Island for a distance of 30 km between Kxngeal Inlet and Rippon Point. At Flint Creek, south of Cedarvale, sawflies lightly defoliated immature western hemlock at the 200 m elevation. A trace of defoliation was also evident on western hemlock at Allard Bay, Kwatna Bay, Labouchere Channel and Carlson Inlet.

Winter Moth, *Operophtera brumata* L.—Since 1969, defoliation of deciduous trees in the Greater Victoria region has been attributed to the Bruce spanworm, *O. bruceata* (Hulst). However, in late 1977, the winter moth, *O. brumata*, was identified as the major defoliator. The winter moth, a European pest accidentally introduced into the Maritime Provinces in the 1930s, had not been recorded elsewhere in Canada. Severe defoliation of Garry oak, maples, fruit trees and miscellaneous ornamental trees continued over a widespread area; however, there are no indications of tree-kill, and most defoliated individuals refoliated by midsummer.

The number of adults that emerged late in the fall was the largest and most widespread observed to date. This indicated continuing severe defoliation in 1978.

A Larch Looper, *Semiothisa* sp. prob. *sexmaculata* Pack.—Severe foliar damage in western larch stands was recorded for the first time in British Columbia. There were 2 100 ha of severe, 800 ha of moderate and 1 700 ha of light defoliation in patches throughout the Slocan–Arrow Lake region—along the west arm of Kootenay Lake from Balfour to Kokanee Park, along the Kootenay River from South Slocan to Castlegar and west of Castlegar along Blueberry Creek, along the Slocan River and Slocan Lake from Passmore to Roseberry, and along Arrow Lake from Nakusp to Deer Park.

Striped Alder Sawfly, *Hemichroa crocea* (Fourc.)—For the second year defoliation was severe in the Isabella Point area of Saltspring Island and light in patches from Maple Bay to Nanoose Bay on adjacent Vancouver Island.

Spruce Aphid, *Elatobium abietinum* (Wlk.)—Large populations of the spruce aphid caused severe discoloration and premature needle drop of Sitka spruce trees on the Queen Charlotte Islands and mainland coast of Prince Rupert Forest District. Damage was most severe along the coast between Sandspit and Alliford Bay and at Cumshewa Head on Moresby Island; on Louise Island between Skedans and Girard Point; and on Graham Island at scattered locations from Queen Charlotte City north to Tlell, near Masset, along Rennell Sound and south of Van Inlet.

On Vancouver Island, premature loss of 1- to 3-year-old needles exceeded 75% on Sitka spruce trees in the eastern and north coastal and Quatsino Sound regions. On the Mainland, severe defoliation of native and exotic spruce trees was common in parks and residential areas, along roadways from Vancouver to Hope and on the Sechelt Peninsula.

Balsam Woolly Aphid, *Adelges piceae* (Ratz.)—Two collections of this species, from amabilis fir trees at Honeymoon Bay and near Bear Creek Reservoir, on Vancouver Island, Vancouver Forest District, expanded the infestation zone boundary slightly for the second year. A special survey to detect any additional expansion is planned for early 1978.

OTHER NOTEWORTHY INSECTS

Insect	Host(s)	Locality	Remarks
Actebia fennica (Tausch.) Black army cutworm	Soil	Fulton Lake, Buck Creek	Few larvae.
Adelges cooleyi (Gill.) Cooley spruce gall aphid	Douglas-fir Spruce, Sitka	Vancouver Forest District, Windermere Valley	Common.
Altica ambiens Lec. Alder flea beetle	Alder, red	Vancouver Island	Localized light populations.
Archips cerasivoranus Fitch Uglynest caterpillar	Chokecherry	Upper Columbia Valley	Common, light damage.
Argyresthia cypressella Wlshm. Cypress tip moth	Juniper spp. (ornamentals)	Victoria	Widespread discoloration.
Bucculatrix sp. A birch skeletonizer	Birch, white	West Kootenay, Fraser River valley	Light discoloration.
Contarinia spp. Douglas-fir needle midges	Douglas-fir	Windermere Valley	Significant decrease.
Dichelonyx sp. A leaf beetle	Douglas-fir Christmas trees Birch, white	Windermere Valley, Brisco	Light damage.
Epirrita autumnata Gn. Green velvet looper	Hemlock, western Fir, amabilis	West side of Kitimat Valley	Collapse of 1976 outbreak.
Griselda radicana Wlshm. A spruce tortricid	Spruce, Sitka	Pacific Rim National Park	Third year of light damage.
Halisidota argentata Pack. Silver-spotted tiger moth	Douglas-fir	East coast region of Vancouver Island	Common, light damage.
Hylobius warreni Wood Pine root weevil	Pine, lodgepole	Plantations, Prince George Forest District	Widespread, minor damage.
Hyphantria cunea Drury Fall webworm	Deciduous trees and shrubs	Duncan, Cowichan, Castlegar, Nakusp	Tents common, light damage.
Ips pini (Say) Pine engraver beetle	Pine, lodgepole, ponderosa	Grasmere, Elko	50 groups of 2-20 trees attacked.
Lyonetia sp. A leafminer	Alder, mountain Willow Birch, white	Tête Jaune Cache, McBride	Severe discoloration.

OTHER NOTEWORTHY INSECTS (Concluded)

Insect	Host(s)	Locality	Remarks
Malacosoma californicum pluviale (Dyar) Western tent caterpillar	Alder, red, mountain Aspen, trembling	Vancouver Island, Gulf Islands, Golden	Localized light-to-heavy populations.
Operophtera bruceata (Hulst) Bruce spanworm	Deciduous trees and shrubs	Fort St. John	Localized light defoliation.
Orgyia pseudotsugata (McD.) Douglas-fir tussock moth	Douglas-fir	Kamloops	Two small infestations.
Otiorhynchus sulcatus (F.) Black vine weevil	Douglas-fir	Pacific Forest Research Centre nursery	6% mortality of container seedlings.
Phyllocnistis populiella (Cham.) Aspen leaf miner	Aspen, trembling	Hazelton, Kispiox, McBride	100% infested.
Pineus sp. A woolly aphid	Spruce, white	Sweetin River, Perow, Date Creek	Up to 50% infested.
Pikonema spp. Spruce sawflies	Spruce, white, black	Wasa Lake, Yukon Territory	Moderate defoliation.
Pissodes strobi (Peck) Sitka spruce weevil	Spruce, Sitka	Coastal Prince Rupert and Vancouver forest districts	Common.
Pyrrhalta carbo (Lec.) Pacific willow leaf beetle	Willow	Columbia River and Slocan valleys, Arrow Lakes	Common.
Tipula pallidosa (L.) European crane fly	Douglas-fir Spruce, white	Surrey nursery	Damaged and killed seedlings.
Trypodendron lineatum (Oliv.) Striped ambrosia beetle	Hemlock, western Fir, amabilis, alpine Spruce, white Pine, lodgepole	Vancouver Island, Prince George Forest District	Common in dryland log sort areas and windthrow.

IMPORTANT FOREST DISEASES

Winter Drying—Large areas of lodgepole pine were severely discolored from Monkman Pass north to Pine Pass, and along the Alaska Highway near Trutch, where a second year of injury resulted in loss of up to 80% of the old needles. Foliar browning was severe on white and black spruce trees on 100 ha near the Aishihik power plant, Yukon Territory, where a thick ice sheet resulting from a midwinter water leak still covered the root systems and inhibited water translocation in July.

Discoloration was moderate on lodgepole pine over 1 600 ha near Johnny Lake east of Tweedsmuir Provincial Park, and moderate to severe along Hawkins Creek, Nelson Forest District, where some mortality of regeneration may occur in the valley bottom.

Frost Damage—Late frosts killed up to 80% of the new shoots on young Sitka spruce and western hemlock trees in low-lying areas of the Kalum and Kitimat river valleys.

Terminal buds of many young white spruce trees in the Hixon and McGregor River areas were apparently killed after water froze in the partly opened buds.

Damage to new shoots of Douglas-fir was widespread from Anarchist Mountain west to Last Mountain in the Kamloops Forest District. Deformed foliage and dieback of twigs on trembling aspen occurred along the Stewart River and between Stewart Crossing and Carmacks, Yukon Territory.

Drought Damage—Above-normal temperatures and reduced summer precipitation in southern British Columbia resulted in significant tree mortality and dieback. Young lodgepole pine trees were killed in numerous exposed plantations in Nelson Forest District, particularly in the Driftwood and Lodgepole creek valleys. In the Bull River and Crawford Creek areas, dieback of understory yew was severe and some mortality is expected.

On the east coast of Vancouver Island, tree mortality and terminal dieback of individual and small groups of young Douglas-fir trees were common on exposed and poor sites.

Fume Damage—Severely discolored foliage, typical of sulphur dioxide injury, occurred on some ornamental conifers in residential areas of Trail.

At Hunter Creek, near Hope, broadleaf maple trees over 1 km^2 were severely discolored after the derailment and burning of several rail cars carrying sulphur.

On northern Vancouver Island, severe interveinal discoloration occurred to 80% of the foliage of various herbaceous plants in small patches over 250 ha northeast of the pulpmill at Port Alice.

Total discoloration with moderate bud-killing on most shore pine trees over 30 ha followed a chlorine gas emission on April 20 from a pulpmill near Port Edwards. Foliar discoloration typical of fluoride injury was very light on the terminal growth of western hemlock, amabilis fir and western red cedar and on some herbaceous understory growth in a small area immediately adjacent to the smelter at Kitimat.

Salt Damage—Young roadside western red cedar, western hemlock, Engelmann spruce and lodgepole pine trees were severely discolored along the Trans Canada Highway for 21 km from Glacier west to the Glacier National Park boundary. Some mature Douglas-fir trees adjacent to the highway east of Golden have been killed by repeated applications of salt.

Animal Damage—Many thousands of immature western larch trees and some lodgepole pine in Nelson Forest District have been damaged in recent years by porcupine feeding. Top-kill, multiple leader development and tree mortality occurred in patches over 100 km^2, including Bloom, Caven, Blueberry and Cayuse creeks.

Scattered pockets of 10 to 100 porcupine-killed lodgepole pine trees occurred from Terrace to Flint Creek and along both sides of the Skeena River. Small groups of dead and top-killed trees occurred at Clio Bay, Lean-to and Coates creeks and Guess and Mooseskin Johnny lakes.

In Prince George Forest District, along the south side of Chuchi Lake, 150 immature lodgepole pine trees were killed.

Small groups of three to four western red cedar trees were stripped of bark at the base and for distances up the boles, by bears at several locations on the mainland coast and in the Seymour River watershed, Vancouver Forest District.

Root Rots—Root rots continued to cause significant damage in forested areas. Douglas-fir trees killed by armillaria root rot, *Armillaria mellea* (Vahl ex Fr.) Kummer, were common throughout the Province, particularly in a thinned Douglas-fir stand near Firvale, and in lodgepole pine and trembling aspen stands near Vanderhoof and Prince George. Small groups of 3 to 25 recently killed Douglas-fir trees were recorded near Fairmont, Windermere, Invermere and Radium and at Deer Creek on Lower Arrow Lake.

Black Stain Root Disease, Verticicladiella wagenerii Kendr.—Since first being recorded in the Region in 1976, additional infections have been detected in lodgepole pine stands near Nancy Greene, Christina, Conkle and Joe Dandy lakes; at Nicholson, Goatskin and Dale creeks near Greenwood; and at Naswhito Creek near Vernon, where numerous infection centers of 1-25 trees were scattered over 8 000 ha (see map, page 98). Small groups of infected Douglas-fir trees were recorded on Texada Island and near Metchosin, Duncan and Nanaimo.

Dwarf Mistletoe, Arceuthobium spp.—The first natural infection of Douglas-fir by hemlock dwarf mistletoe, *A. tsugense* (Rosend.) Jones, was collected from a mixed stand on West Redonda Island. At Seymour Inlet, up to 50% of the residual western hemlock trees in four recently logged stands were infected and capable of infecting the regeneration. Near Mackenzie, in a 280 ha logged area, clusters of lodgepole pine saplings numbering 25 to 60 per hectare were infected by *A. americanum* Nutt. ex Engelm.; in a recently logged stand west of 100 Mile House, 45% of the advanced regeneration was infected.

Dothistroma Needle Blight, Scirrhia pini Funk and Parker—Discoloration and premature loss of needles of lodgepole and western white pine were more obvious and widespread throughout the Region than in recent years (see map, page 98). Localized infections were common in young open-grown and roadside stands from Nelson to Salmo, from Creston to Cranbrook, and in the Kettle, Granby, Slocan and White River valleys.

Discolored lodgepole pine stands were common between Smithers and Kitwanga, particularly in the Moricetown area, and covered 40 ha at Anzac north of Prince George.

In the Salmon River and Anderson Lake regions, severe browning covered 80 ha, and light infections were common elsewhere throughout Kamloops Forest District.

Foliar browning was moderate and widespread in immature lodgepole pine stands throughout Cariboo Forest District, particularly along the Dean River on 3 200 ha, Spanish Lake on 1 200 ha and Moffat Lake on 100 ha.

Needle Rusts—Fir needle rust, *Pucciniastrum epilobii* Otth, was common on the current year's foliage of alpine fir in most high elevation stands in the Kootenay and Columbia rivers drainages, and near Topley Landing, Chapman Lake, Moricetown and Nash. In the Prince George Forest District, infections were common and affected up to 80% of the foliage at several scattered locations. The fir-blueberry rust, *P. goeppertianum* (Kuehn) Kleb., was very heavy in Nelson Forest District on a 40 ha immature alpine fir stand along Slewiskin Creek but light in Prince Rupert Forest District in the Morice River-Francois Lake roads area and along Bigman Creek. Conifer-cottonwood rust, *Melampsora occidentalis* Jacks., infected 60 to 100% of the current year's foliage on much of the Douglas-fir regeneration in the

Lardeau, New Denver and Fauquier regions, and lighter infections were common in the Kootenay, Slocan and Arrow Lakes region. *M. paradoxa* Diet. & Holw. heavily infected western larch over 20 ha at Sheep Creek in the Nelson Forest District. Various foliar rusts were common throughout the Region on Douglas-fir, alpine fir and willow, infecting up to 85% of the current year's needles in some localized areas. Light infections of a pine needle rust, *Coleosporium asterum* (Diet.) Syd., occurred on older needles of 80% of the lodgepole pine along the Morice River access road and on about half the trees at Km 17 Telkwa River road. Discoloration caused by spruce needle rust, *Chrysomyxa ledicola* Lagh., was common and severe on the current year's foliage of Sitka spruce between Tlell and Port Clements on the Queen Charlotte Islands, particularly those growing near the alternate host, Labrador-tea.

Needle Casts—A spruce needle cast, *Lirula macrospora* (Hartig) Darker, caused discoloration and premature needle drop of up to 100% of the 1- and 2-year-old needles on immature and mature Sitka spruce trees along the Deena River and near Alliford Bay, Queen Charlotte Islands; light infections were common elsewhere on Graham and Moresby islands, and near the coastline, aphid damage was also present. East of Atlin, up to 30% of the needles on a quarter of the white spruce were infected for 10 km along O'Donnel Creek.

Browning and premature needle drop caused by the larch needle cast, *Hypodermella laricis* Tub., were moderate in mature western larch stands covering 400 ha north of Sparwood, and in numerous scattered pockets of 5 to 40 ha in the Beaverdell area, along Nicholson, State and Grouse creeks; from the Little Slocan River to Little Slocan Lake, at Arrow Park Creek and from the Halfway River to Galena Bay.

Moderate-to-severe foliar discoloration occurred on 4 500 ha along Highway 6 from Harris Creek to Monashee Pass, on 2 800 ha from Mission Creek south to Lorna and on 900 ha near Mara Lake.

Up to 85% of the old foliage on most of the lodgepole pine trees over 5 000 ha in the Rancheria River valley between Km 1110 and 1150 Alaska Highway, Yukon Territory, was infected by a lodgepole pine needle cast, *Lophodermella montivaga* Petr. and light damage was common along the Campbell Highway at Km 1070 Alaska Highway, and near Opatcho Lake, where about one-third of the foliage on more than half of the trees was infected.

A Needle Blight, Lophodermium pinastri (Schrad. ex Hook) Chev.—Infection of 1975 and 1976 shore pine needles was common in the Tofino-Ucluelet and east coastal areas of Vancouver Island, up to 80% of the needles being infected on half of the trees in some stands.

A Bud Necrosis, Camarosporium strobilinum Bomm., Rouss. and Sacc.—Shoot dieback was recorded for the first time in 1976 on white spruce in Prince Rupert Forest District. In 1977, infection of seedlings in three areas along Ganokwa Creek ranged from 8 to 64%, and averaged 39% at Parrott Creek, 34% near Division Lake, 28% at Sam-Goosly Lake and 20% at Decker Creek and Whitesail Lake.

Spruce Broom Rust, Chrysomyxa arctostaphyli Diet.—This rust was common on white and black spruce throughout much of the Yukon Territory. At 10 random

locations, from 2 to 14% of the trees were infected and each had three or more brooms. Dead, broken or multiple tops were recorded on 20% of the infected trees.

Broadleaf Maple Decline—Discoloration of broadleaf maple trees was widespread and more obvious than in recent years on Vancouver Island and the lower Mainland. Discoloration is initially a marginal chlorosis that becomes necrotic, leaves being sometimes dwarfed and complete stands often affected. No causal agents have been identified, but leafhoppers and below-normal rainfall may be contributing factors.

Leaf and Twig Blight of Poplar, Venturia macularis (Fr.) E. Muell. & Arx—Moderate-to-severe foliar browning and shoot dieback were prevalent in trembling aspen stands, particularly in the Watson Lake and Frances and Rancheria rivers region of the Yukon and in interior British Columbia along the Liard River valley; from Williston Lake west to Germansen Lake; from Mackenzie north to Finlay Forks; near Hazelton and Kitwanga; along the Nass River between Cranberry Junction and the Kiteen River; near Brookmere; and from Williams Lake to Quesnel in the Horsefly-Likely region and the Big Lake-Beaver Valley areas.

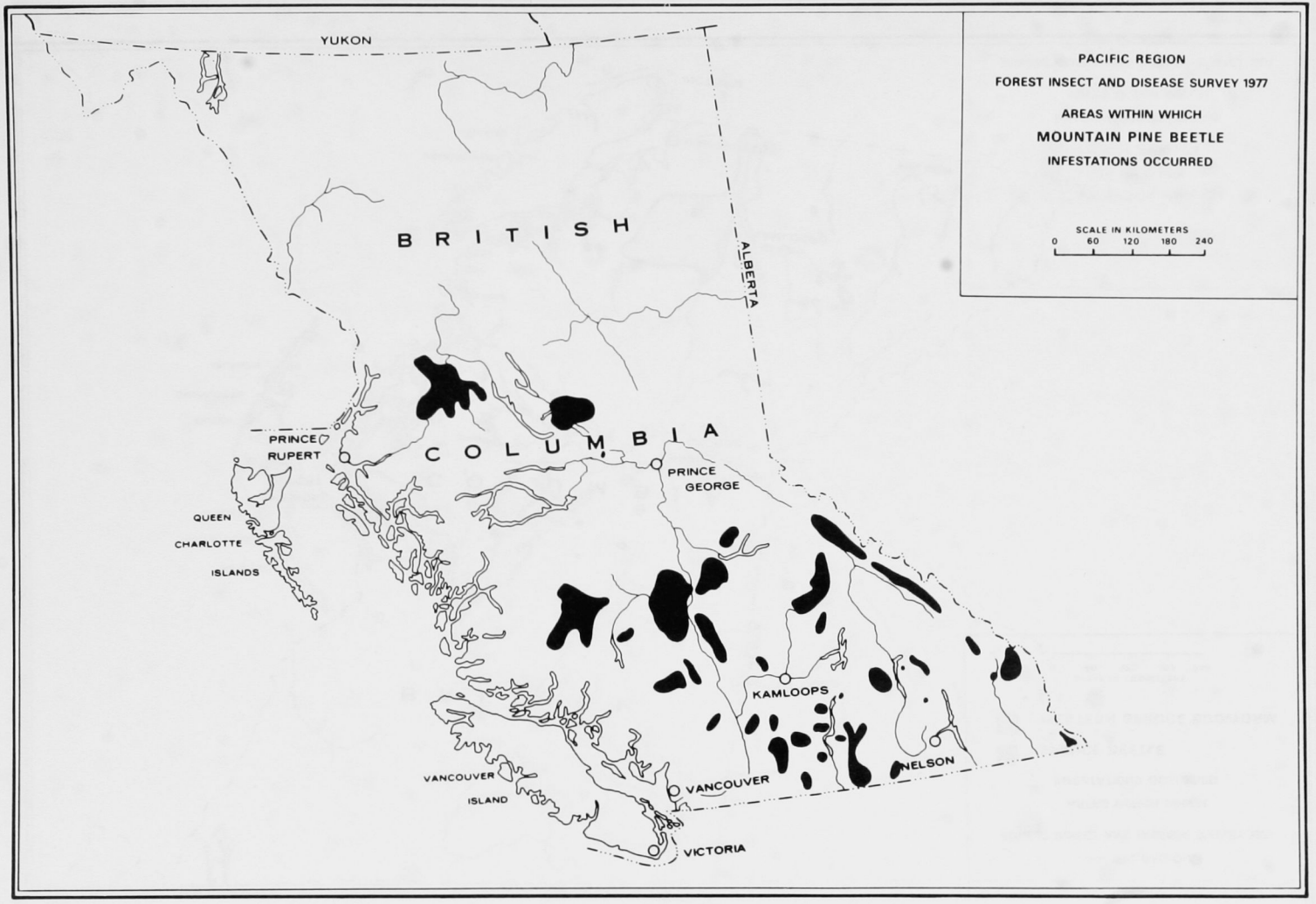
Black cottonwood in valley bottom stands in the Williams Lake-Quesnel region and along the Mad River were heavily infected by *V. populina* (Vuill.) Fabric.

OTHER NOTEWORTHY DISEASES

Organism and Disease	Host(s)	Locality	Remarks
Blowdown	Fir, alpine Spruce, Engelmann	Monticola Lake	Continuous blowdown over 600 ha.
Cronartium coleosporioides Arth. Stalactiform rust	Pine, lodgepole	Bulkley Canyon, Telkwa, Morice Lake road	About 10% of trees infected at 3 locations.
Cronartium comptoniae Arth. Sweetfern blister rust	Pine, shore	Chist Creek	Cankers on 1 to 6% of trees of different provenances, but alternate host not found nearby.
Cronartium ribicola J. C. Fischer ex Rabh. White pine blister rust	Pine, western white	Upper Arrow, Trout lakes; Columbia, Lardeau, Slocan valleys	Widespread tree mortality.
Delphinella abietis E. Muell. A twig blight	Fir, alpine	Last Mountain	Dieback affected 50% of branch tips on 8 ha.
Diaporthe lokoyae Funk Phomopsis canker	Douglas-fir	Redonda Bay	Caused multiple leaders on immature trees over 50 ha.
Dichomera gemmicola Funk & Sutton A bud necrosis	Douglas-fir	Argenta, Davis creeks	Up to 5% bud mortality on 25% of immature trees.
Diplodia pinea (Desm.) Kickx Diplodia canker	Dwarf mistletoe on lodgepole pine	Valemount	Killed aerial shoots and caused resin flow.

OTHER NOTEWORTHY DISEASES (Concluded)

Organism and Disease	Host(s)	Locality	Remarks
Elytroderma deformans (Weir) Darker Elytroderma disease	Pine, ponderosa	Host range	Witches' brooms common.
Endocronartium harknessii (J. P. Moore) Y. Hiratsuka Globose gall rust	Pine, lodgepole	Smithers area, Morice River road, Bulkley Canyon	Severe infection of 5-to-25-year-old roadside trees.
Leptomelanconium cinereum (Dearn.) Morgan-Jones Needle blight	Pine, ponderosa	Elko to Roosville	Severe discoloration of older foliage.
Lophophacidium hyperboreum Lagerb. Snow blight	Spruce, white	Perow, Chapman Lake	Affected one-third of lower branches on most planted trees.
Marssonina populi (Lib.) Magn. Leaf spot	Aspen, trembling	Peace River region	Light foliar discoloration in small groups of trees.
Nectria sp. Dieback	Maple, broadleaf	Vancouver Forest District	Single branch mortality common.
Rhabdocline spp. Needle casts	Douglas-fir	Canoe River west to Cluculz Lake, Prince George Forest District	Widespread moderate to severe infection.
Sunscald	Cedar, western red	Mt. Kirkup	Moderate discoloration of foliage on regeneration over 40 ha.
Trisetacus sp. Mite damage	Pine, lodgepole	Boston Bar, Kitimat	Up to 80% of specific provenances had chlorotic, twisted and stunted needles on 10% of current shoots.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COLUMBIA
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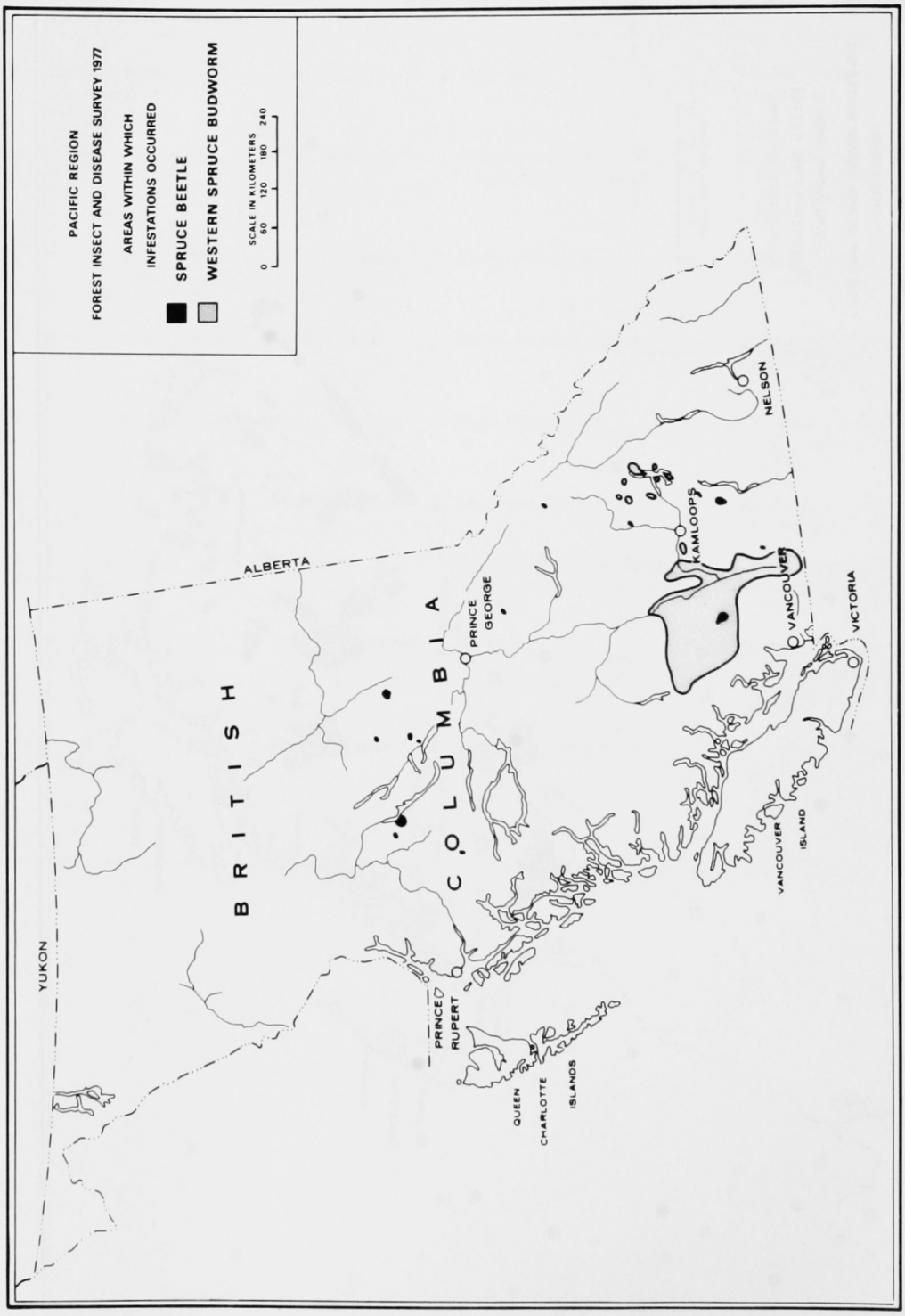
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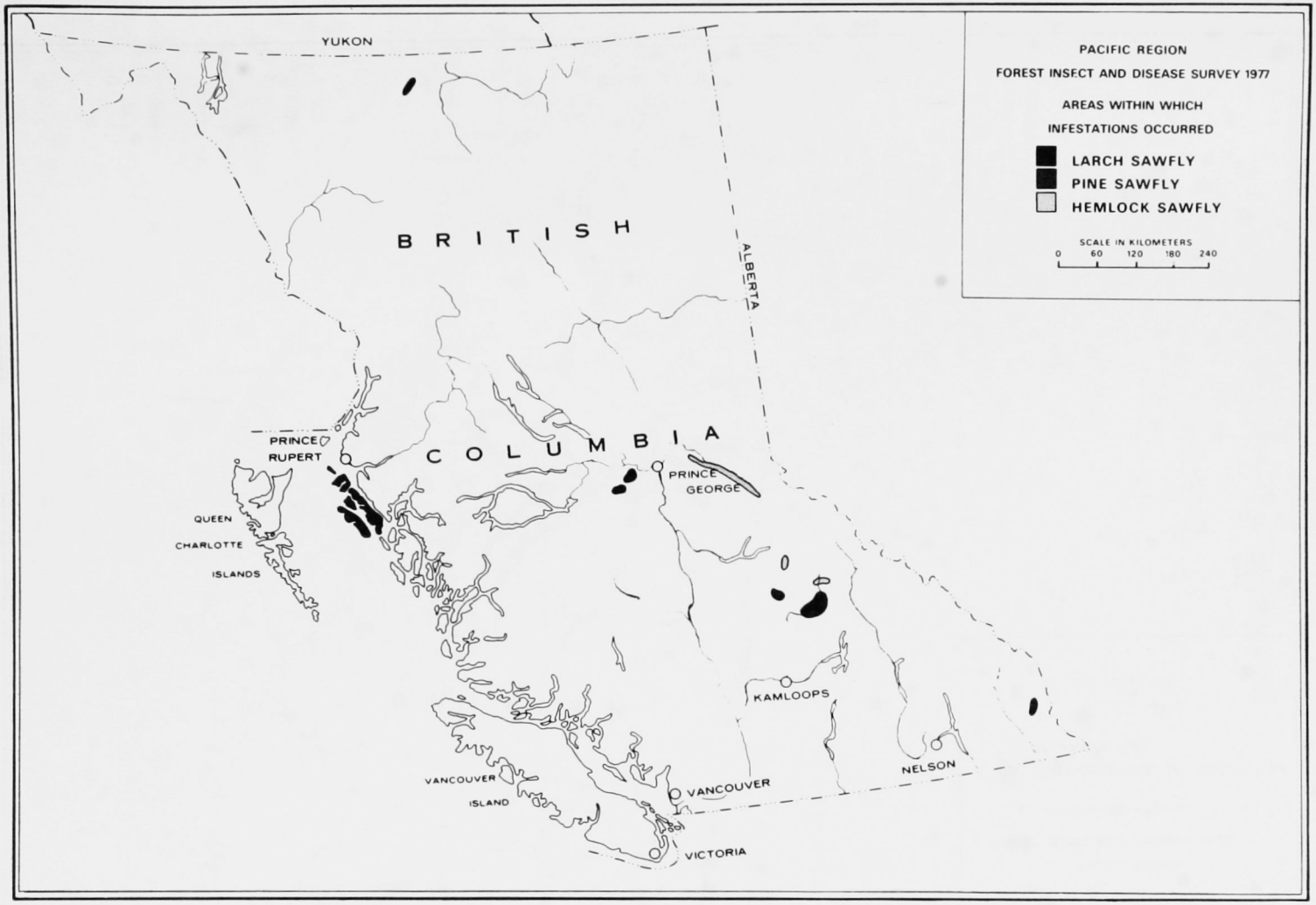
PACIFIC REGION
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PINE SAWFLY
HEMLOCK SAWFLY
SCALE IN KILOMETERS
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YUKON
BRITISH
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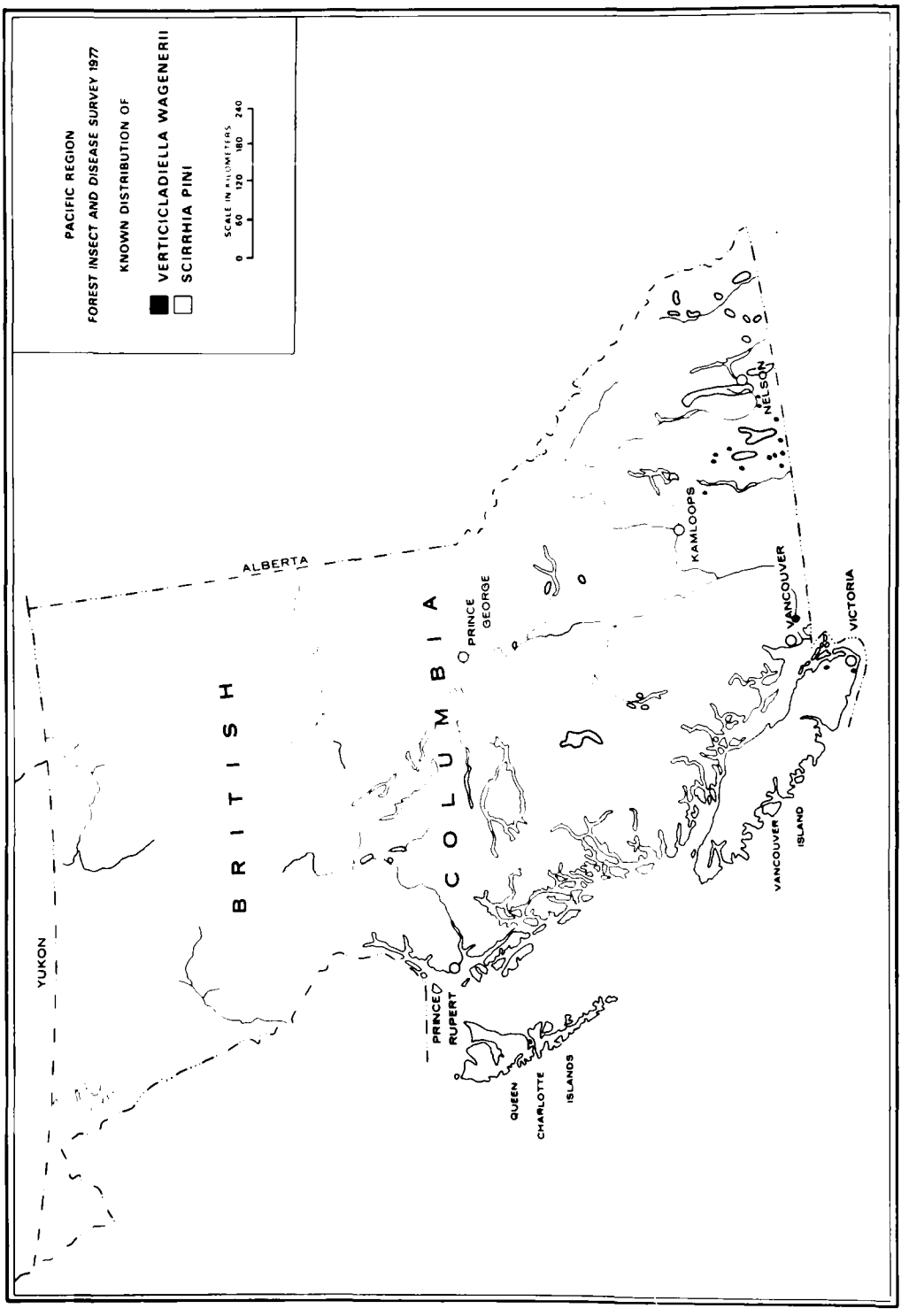
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BRITISH COLUMBIA
YUKON
PRINCE GEORGE
KAMLOOPS
NELSON
VANCOUVER
VICTORIA
VANCOUVER ISLAND
PRINCE RUPERT
QUEEN CHARLOTTE ISLANDS

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