

# PROVINCE OF BRITISH COLUMBIA

## FOREST DISEASE SURVEY

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### INTRODUCTION

Weather conditions in 1958, which resulted in one of the most costly forest fire years in British Columbia history, were also responsible for direct losses in the form of drought injury, radiation damage, and heat defoliation. Reports of damage were received from most sections of the Province, but the symptoms of drought injury were most conspicuous in the normally humid Vancouver Island and lower Coast Region. In general, damage was confined to marginal sites and individual trees, but it must be remembered that delayed effects of this drought may not show up until the 1959 growing season or even later, and that these less conspicuous losses may be more severe.

An unusually severe outbreak of needle blight caused by *Elytroderma deformans* (Weir) Darker affected yellow pine, and to a less extent lodgepole pine, throughout the range of the former host, with the exception of the north Okanagan Valley and the East Kootenays where the disease incidence continued at a low level.

Other disease conditions in 1958 were not considered abnormal. The large list of new records in the "Noteworthy Diseases" section resulted from the broadening sphere of the Survey's activities rather than from new or unusual disease outbreaks.

The British Columbia Disease Survey Section has been strengthened by the appointment of a Research Officer to study dieback and canker and canker diseases of conifers with particular reference to their cultural identification. Special attention to this important group of diseases will be of considerable aid to the Survey in meeting both its local and national objectives.

While the Survey has been strengthened locally reliance will continue on the support of the Mycology Unit, Botany and Plant Pathology Division, Ottawa, and of many other co-operators whose valuable help is gratefully acknowledged.

A total of 2,443 collections were submitted in 1958 including 133 new additions to the herbarium, some of which are listed under "Noteworthy Diseases". A summary of these collections according to host tree is as follows:

Coniferous Trees	Collections	Broad-leaved Trees	Collections
Fir		Alder	
Alpine.....	574	Red.....	20
Grand.....	22	Sitka.....	1
Amabilis.....	15	Miscellaneous alders.....	10
	611		31
Douglas fir.....	602		

Coniferous Trees		Collections	Broad-leaved Trees		Collections
Spruce			Willow.....		31
White.....		335	Aspen, trembling.....		29
Sitka.....		11	Cottonwood, black.....		25
Engelmann.....		3	Maple, broadleaf.....		11
Black.....		1	Arbutus.....		10
Miscellaneous spruces.....		3	Cherry.....		6
			Birch, western white.....		3
			Ash, mountain.....		2
		353	Total.....		148
Pine					
Ponderosa.....		141			
Lodgepole.....		65			
Western white.....		64			
Miscellaneous pines.....		11			
		281			
Hemlock, western.....					60
Cedar					
Yellow.....		23			
Port Orford.....		17			
Western red.....		14			
		54			
Cypress, Monterey.....					45
Larch					
Western.....		12			
European.....		5			
Miscellaneous larch.....		2			
		19			
Juniper, Rocky Mountain....		1			
Yew, western.....		1			
		2,027			
		Miscellaneous or host not specified... 268			
		Grand Total..... 2,443			

#### IMPORTANT DISEASES

**Weather Injury**—As a result of an exceptionally dry and hot summer, with below average precipitation and above average temperatures prevailing from May to August, a considerable number of reports of damage directly or indirectly attributable to these conditions were received from most regions of the Province. Signs of injury were recorded as early as the end of June, but did not become conspicuous until late July and early August.

A survey on Vancouver Island, where symptoms of drought injury were particularly conspicuous, indicated the visible damage to be most prevalent on rocky and excessively drained sites. The majority of the damage was recorded on reproduction and sapling sizes in both natural and planted stands, although scattered damage in the form of red tops was noted in older age groups. All tree species and a great variety of shrubs and herbs were affected. With Douglas fir it was not uncommon to find mortality, and trees suffering severe branch and stem kill tantamount to mortality, extending over 5 to 10 acres, consistent with the area of unfavourable edaphic conditions. Injury to individual trees took a great variety of forms from various degrees of browning through light to severe branch kill and mortality.

While it is generally true that diseases accompanied by excessive foliage discoloration appear more damaging than they actually are, it is also true that direct injury may be negligible compared to the losses attributable to secondary

invasion following weakening. Delayed effects should be anticipated in the early years following a severe drought and may be expected to show up in stands where little or no injury was apparent by the early conspicuous discoloration. In order to follow the progress of some of the more severely damaged stands, seven sample plots were established in the Campbell River area for subsequent observation.

Drought damage in the Interior was sporadic and became apparent late in the season. Interestingly, yellow pine, which occupies drier sites in regions characterized by hot summers, appeared to have suffered considerable damage. With this species secondary effects of dieback associated with *Cenangium ferruginosum* Fr. may be anticipated.

Frost damage was only infrequently reported during the past field season, which followed an unusually mild winter. A late spring frost apparently accounted for red belt damage to lodgepole pine at mile 386 and mile 400 to 406 on the Alaska Highway, and at Cassiar. Damage in all these areas was recorded at about 4,400 feet elevation.

**Foliage Diseases**—Yellow-pine needle blight caused by *Elytroderma deformans* (Weir) Darker reached a high level of infection not experienced since the initiation of an organized disease survey in British Columbia. An intensive survey conducted throughout the range of the host showed the infection to be general, reaching 100 per cent incidence in some localities. The Kamloops, Merritt, and Clinton areas were the most heavily hit with over 80 per cent of the trees sampled losing 25 per cent or more of their foliage. The North Okanagan and East Kootenay regions suffered only very light scattered infection. All severely affected stands contained a high percentage of trees with brooms indicating infections of long standing. This condition would suggest that such stands may be rated as high-hazard stands which by virtue of their particular location, topography, or stand characteristics frequently provide favourable conditions for infection. Further processing of survey data and study of weather records will be necessary to substantiate this observation. Several sample plots have been established for future observation.

Douglas fir needle blight caused by *Rhabdochline pseudotsugae* Syd. reached the highest intensity of infection recorded since 1950 in the East Kootenay region, maintaining its role as the major disease problem affecting the Christmas tree industry. Particularly heavily affected were the stands around Invermere. A research project on this problem is continuing.

Reports of other foliage diseases indicated an average year with some fairly heavily infected stands in localized areas.

#### **Pullularia pullulans Build-up in Spruce Budworm Infestation Areas**

—It was reported in 1957 that *Pullularia pullulans* (de Bary) Berkhout was recovered from 95 per cent of a large sample of white spruce buds showing a slight necrosis at their tips. The sample had been collected following a report of excessive bud mortality from unknown causes in areas in the Babine Lake region defoliated by the spruce budworm, *Choristoneura fumiferana* (Clem.). Sampling from healthy trees outside the infestation showed the slight tip necrosis to be the usual condition for spruce buds. Isolations from these latter samples yielded little or no *Pullularia* in culture.

Monthly collections from inside and outside the budworm infestation at Babine Lake during the winter and spring, followed by a field examination in late May and early June clarified the situation considerably. The incidence of *P. pullulans* was in fact nine times as high in bud samples taken from inside the infestation area as those taken outside the infestation area, averaging 74 per

cent inside as compared to 8 per cent outside. However, this difference bore no relationship to the incidence of bud mortality of unknown origin inside or outside the infestation. Bud mortality, other than that caused by budworm mining, was relatively light in both areas, based on felled-tree sampling from the upper, middle, and lower crown. Bud mortality in the lower crown was found to be much heavier in both areas. This condition is apparently quite normal and consistent with weakening and self-pruning of lower branches. The original report of excessive bud mortality was probably based on a lower crown sample taken with pole pruners.

It may be concluded that heavy budworm defoliation and mining has not led to excessive fungus-induced or physiological mortality of white spruce buds. The extraordinary build up of *Pullularia pullulans* is interesting and appears to be due to the fact that budworm frass provides an excellent growth medium for the fungus. Isolations from a large sample of frass planted as single pellets on malt agar yielded 88 per cent *Pullularia*. However, the fungus has been reported on a number of occasions as a mild parasite and may be capable of invading weakened twigs or branches.

**Dryocoetes-Leptographium Complex on Alpine Fir**—In 1957 it was reported that heavy alpine fir mortality in the McGillivray Lake region of the Kamloops Forest District could only be explained in part by attacks of the bark beetle *Dryocoetes confusus* Sw. Fungus-induced lesions centred at bark beetle entrance holes were frequently of sufficient extent to girdle and kill trees. Cultural studies and pathogenicity tests have since revealed the fungus causing the lesions to be a species of *Leptographium* with a *Ceratocystis* perfect stage. There seems to be a close association between the fungus and the insect; after the examination of hundreds of insect galleries none was found without the characteristic lesions from which the fungus was readily isolated. Galleries 1 or more years old consistently bore the perfect fruiting stage of the fungus.

Another area has been found at Bolean Lake where several hundred acres of alpine fir are suffering mortality from this insect-disease complex and several other areas of apparently similar mortality have been spotted from the air.

Studies of the insect and the fungus are continuing to determine more specifically the nature of their relationship and the factors leading to host mortality.

**Dieback on Douglas Fir Christmas Tree Stock**—An early season report expressed concern over the possible spread of dieback in Christmas tree stands of Douglas fir in the Invermere and Canal Flats regions of the Nelson Forest District. Examination showed the condition to be of long standing and of general light incidence on the poor sites used for Christmas tree production. A number of localized areas of 2 to 3 acres in extent were found where the incidence exceeded 25 per cent of the stems.

The disease was characterized by dying back of branches with extensive cankers frequently being formed at the junction with the stem. Such cankers often girdled the stem, thus killing the distal portion. Signs of the causal agent were not found on diseased material, but isolates of diseased tissue on agar prepared at various times during the season produced fungus growth typical of *Hypoxyylon* sp.

On the basis of this year's examination there is no reason to anticipate a sudden rapid spread of the disease. However, to confirm these findings, five

sample plots have been established in affected stands, and field and cultural studies are continuing.

**Diseases of Non-indigenous Trees**—Annual observations of exotic tree plantings since 1956 have provided sufficient background information to set up a rotation system for field examinations to be started in 1959. A total of 118 plantations are now registered with the Laboratory, an increase of 53 over 1957. It is no longer necessary, or physically possible, to carry out annual observations over the whole inventory. Only a representative series will be examined annually. The following outlines the basis on which the proposed rotation system is to be set up:

1. A portion of the plantations of each species will be selected for annual observations on the basis of site representation and geographic distribution.
2. The remaining plantations will be rotated to receive less frequent attention, probably at 5-year intervals.
3. A noteworthy disease outbreak affecting any species will receive special attention in all plantations of that species.

The 1958 examinations continued to demonstrate the relative importance of animal browsing as a major hazard to young plantations. Added to the list of offenders are moles and mice which cause severe damage in poplar plantations. Moles undermine the bases of young trees and mice cause severe girdling injury to roots and root crowns. In one poplar plantation 50 per cent mortality was attributed to damage by these rodents.

The severe drought took its toll of exotic trees along with their native counterparts, with damage being reported from many regions. Three very young plantations of Scots, red, and pinaster pine in the central Interior appeared to have suffered nearly 100 per cent mortality, as did a young plantation of European larch in the same region. Thirty-year-old larch and big tree (*Sequoia*) in the Fraser Valley suffered severe sunscald when a thinning, designed to remove competing weed species, was followed by abnormally high temperatures and drought.

Fungus-caused diseases in the predominantly young plantations of exotic species continue to be relatively unimportant compared with weed competition, animal damage, and climatic factors. Often too, the weight of these damaging agents tends to mask the symptoms and signs of fungus diseases which may otherwise be manifested. Each year, however, one or more new records of native diseases on exotics extends the list of potentially damaging diseases to be kept under observation. A new record for 1958 is a foliage disease on Lombardy poplar caused by *Taphrina populina* Fr. Only a few leaves on scattered trees were affected but observations will be continued. The disease has been seldom recorded in western North America and, although more common in the eastern United States and Canada, it has not caused severe damage.

A report of *Peridermium* sp. on Scots pine in the 1957 "Noteworthy Diseases" section has been confirmed as *Peridermium harknessii* J. P. Moore.

**Disease conditions in forest nurseries**—Damping-off was somewhat higher than normal in the Coast nurseries and continued at a high level at Cranbrook. The major losses on the Coast in 1958, however, resulted from heat damage. Losses as high as 50 per cent were recorded in some beds at the Duncan nursery.

## OTHER NOTEWORTHY DISEASES

(V.I.—Vancouver Island; Q.C.I. —Queen Charlotte Islands)

Host	Organism	Locality	Remarks
Alder, red.....	<i>Didymosphaeria oregonensis</i> Goodding	Port Edward, Massett, Q.C.I.	Causing canker of main stem and branches of living trees. First record for B.C.
Aspen, trembling	<i>Marssonina brunnea</i> (Ellis & Everh.) Sacc.	Lillooet	Causing leaf spot of aspen. Similar to <i>M. populi</i> . First record for B.C.
Cottonwood, black	<i>Eutypa acharii</i> Tul.	Cinema	Associated with dieback. First record for B.C.
Fir, alpine.....	<i>Helminthosporium abietis</i> W. B. Cooke & Shaw pro tem.	Smithers	Sooty mold on <i>Abies amabilis</i> and <i>A. lasiocarpa</i> . New record for B.C. (?)
	<i>Peniophora separans</i> Burt	Aleza Lake	New record for B.C. From culture.
	<i>Uredinopsis hashiokai</i> Hirats. f.	Cordova Bay, V.I.	Obtained by inoculation. Ref.: W. G. Ziller, Can. J. Bot. (in press). New world host record.
	<i>Uredinopsis pteridis</i> Diet. & Holw.	Cordova Bay, V.I.	Causing perennial needle rust. Obtained by inoculation. Ref.: W. G. Ziller, Can. J. Bot. (in press). New world host record (?).
Fir, amabilis....	<i>Flammula alnicola</i> (Fr.) Quél.	Duncan, V.I.	First host record for western North America. From culture.
	<i>Merulius himantioides</i> Fr.	Duncan, V.I.	First record for western North America. From culture.
	<i>Uredinopsis pteridis</i> Diet. & Holw.	Cordova Bay, V.I.	Causing perennial needle rust. Obtained by inoculation. Ref.: W. G. Ziller, Can. J. Bot. (in press). First host record for B.C.
Fir, Douglas...	<i>Chondropodium pseudotsugae</i> White	Lake Cowichan, V.I.	Obtained in culture and identified by A. Funk. On bark of branch of D. fir.
	<i>Corticium fuscostratum</i> Burt	Clinton	New host record for western North America. From culture.
	<i>Corticium inopinatum</i> Jacks.	Sooke, V.I.	New host record for western North America.
	<i>Peniophora septentrionalis</i> Laurila	Prince George	New host record for western North America. From culture.
	<i>Tympanis pseudotsugae</i> Groves	Lake Cowichan, V.I.	Associated with dieback. Identified from culture only by A. Funk. On twigs of D. fir.
Fir, grand.....	<i>Uredinopsis hashiokai</i> Hirats. f.	Cordova Bay, V.I.	Causing perennial needle rust. Obtained by inoculation. Ref.: W. G. Ziller, Can. J. Bot. (in press). First world host record.
	<i>Uredinopsis pteridis</i> Diet. & Holw.	Cordova Bay, V.I.	Causing perennial needle rust on <i>Abies</i> spp. Obtained by inoculation. Ref.: W. G. Ziller, Can. J. Bot. (in press).
Hemlock, western.....	<i>Mollisia pinastri</i> (Cooke & Peck) Sacc.	Port Clements, Q.C.I.	New record for at least western North America on hemlock needles.
	<i>Peniophora cinerea</i> (Pers. ex Fr.) Cooke	Revelstoke	First host record for western North America. From culture.
Larch, western..	<i>Coniophora puteana</i> (Schum. ex Fr.) Karst.	Lumby	First host record for western North America. From culture.
	<i>Corticium galactinum</i> (Fr.) Burt	Lumby	First host record for western North America. From culture.
	<i>Melampsora medusae</i> Thüm.	Greenwood	First record of the fungus for B.C.
	<i>Stereum chaillatii</i> (Pers. ex Fr.) Fr.	Vernon	First host record for western North America. From culture.
	<i>Stereum sanguinolentum</i> (Alb. & Schw. ex Fr.) Fr.	Vernon	First host record for B.C. From culture.

<sup>1</sup> Complete lists of fungi collected in British Columbia and deposited at the herbarium in Victoria (DAVFP) are available at the Forest Biology Laboratory, Victoria, B.C.

## OTHER NOTEWORTHY DISEASES—Concluded

Host	Organism	Locality	Remarks
Maple, broadleaf.	<i>Schizophyllum commune</i> Fr.	Vancouver	First host record for B.C.
Oak, Garry.....	<i>Polyporus cuticularis</i> Bull. ex Fries	Victoria, V.I.	First host record for B.C. From culture.
Pine, eastern white (cultivated)	<i>Cronartium ribicola</i> J. C. Fischer	Nanaimo, V.I.	First herbarium record. From plantation.
Pine, ponderosa	<i>Coniophora puteana</i> (Schum. ex Fr.) Karst.	Moyie Lake	First host record for western North America. From culture.
	<i>Fomes pinicola</i> (Swartz ex Fr.) Cooke	Princeton	First host record for B.C. From culture
	<i>Merulius himantioides</i> Fr.	Lytton	First host record for western North America. From culture.
	<i>Merulius lacrymans</i> Wulf. ex Fr.	Princeton	First host record for western North America. From culture.
	<i>Peniophora phlebioides</i> Jacks. & Deard.	Princeton	New host record for western North America. From culture.
	<i>Polyporus tomentosus</i> Fr. var. <i>circinalis</i> (Fr.) Sartory & Maire	Princeton	New host record for B.C. From culture.
Pine, Scots (cultivated)...	<i>Peridermium harknessii</i> J. P. Moore	Prince George	In Scots pine plantation at Experimental Farm, Prince George.
Poplar, Lombardy (cultivated)...	<i>Taphrina populina</i> Fr.	Nanaimo, V.I. Sidney, V.I.	Causing yellow leaf spot. New record for B.C. (?).
Rhabdocline pseudotsugae on Douglas fir.	<i>Hymenula</i> sp.	Malahat, V.I.	Hyperparasite on <i>Rhabdocline pseudotsugae</i> Syd. One tree heavily affected. Possibly a new world host record.
Spruce, Engelmann...	<i>Arceuthobium</i> sp.	Cranbrook Grand Forks	New record for B.C. <i>A. americanum</i> reported by Kuijt at Kananaskis, Alta. Ref.: J. Kuijt. Bot. Rev. 21, No. 10, (1955) <i>Arceuthobium americanum</i> , <i>A. pusillum</i> , and <i>A. campylopodum</i> are known on <i>Picea</i> spp. None is reported by Kuijt to occur on <i>Picea engelmannii</i> . Possibly a new world host record.
Spruce, white...	<i>Corticium laeva</i> Pers. ex Fr.	Aleza Lake	New host record for western North America. From culture.
	<i>Pleurotus ostreatus</i> (Jacq. ex Fr.) Quél.	Aleza Lake	New host record for western North America. From culture.
	<i>Polyporus schweinitzii</i> Fr.	Crescent Spur	New host record for western North America. From culture.
	<i>Trechispora raduloides</i> (Karst.) Rog.	Aleza Lake	New host record for western North America. From culture.
Willow, Scouler's	<i>Merulius confluens</i> Schw.	Royal Oak, V.I.	New host record for western North America.