

# PROVINCE OF BRITISH COLUMBIA

## FOREST DISEASE SURVEY

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## INTRODUCTION

There was a further shift in emphasis in 1953 from general mycological collecting to organized surveying of specific diseases, fungi, and hosts. Progress in this direction was brought about in part through the initiation of two projects, within the framework of the Forest Disease Survey, designed to provide an evaluation of disease distribution and infection level within well-defined sampling limits. These projects, entitled "Fungus Flora of Douglas Fir Forest Association" and "Survey of the Fungi Associated with Decay of Interior Douglas Fir", are discussed briefly in the "Important Diseases" section of this report. In addition there has been more collecting of a specific nature carried out by forest biology rangers. This included the surveying of two fungi of outstanding importance and the gathering of data on the distribution of two diseases being studied at the Victoria Laboratory.

Notwithstanding the recognized need for an organized survey of the more important diseases and hosts, general collections of disease material and fungi will continue to contribute valuable information to the Forest Disease Survey. Many of the reports of new diseases and of unusual occurrence or activity of known ones will come to light as a result of chance observations.

Twenty-five new records for British Columbia are included in the total of 2,454 collections made in 1953. These are listed under "Noteworthy Diseases". Of particular interest among these was the report of flagging and mortality of ponderosa pine caused by *Cenangium ferruginosum* Fr. This is the first record of the fungus occurring on ponderosa pine in British Columbia and shows the behaviour of the fungus to be different from that previously reported from other regions.

The number of collections of fungus samples for 1953 were as follows:

## ON SOFTWOODS (CONIFERS)

Cedar—		Larch—	
Western red.....	67	Western.....	23
Yellow.....	2		
Fir—		Pine—	
Alpine.....	48	Lodgepole.....	45
Amabilis.....	18	Ponderosa.....	20
Douglas.....	193	Shore.....	13
Grand.....	23	Western white.....	23
Hemlock—		Spruce—	
Western.....	122	Black.....	21
Juniper—		Engelmann.....	15
Dwarf.....	4	Sitka.....	2
Rocky Mountain.....	3	White.....	88

TOTAL number of collections on softwoods—730

## ON HARDWOODS (DECIDUOUS)

Alder—		Cottonwood—	
Red.....	35	Black.....	16
Arbutus.....	7	Dogwood—	
Ash—		Western flowering.....	1
Dwarf mountain.....	2	Hawthorn—	
Western mountain.....	3	Columbia.....	1
Aspen—		Maple—	
Trembling.....	75	Broadleaf.....	6
Birch—		Willow—	
Western white.....	7	Pacific.....	2
Bunchberry.....	2	Sitka.....	1
		Others.....	62

TOTAL number of collections on hardwoods—220

## ON HERBACEOUS HOSTS OF TREE RUSTS

Chickweed.....	2	Labrador tea.....	1
Cranberry—		Paintbrush.....	4
Rock.....	1	Polypody.....	1
Fern—		Pyrola—	
Lady.....	1	One-flowered.....	7
Oak.....	5	Rhododendron.....	1
Sword.....	6	Saskatoon.....	4
Fireweed.....	5	Toad flax—	
Gum weed.....	1	Bastard.....	1
Huckleberry—		Wintergreen.....	1
Blue.....	1		
Red.....	4		

Total number of collections on herbaceous hosts of tree rusts..... 46

On forest ground cover (excluding tree rusts)..... 217

On forest soil..... 39

TOTAL number of fungus samples collected—1,252.

The number of collections from which cultures of the causal organism were made are as follows:

## ON SOFTWOODS (CONIFERS)

Cedar—		Larch—	
Western red.....	14	Western.....	45
Cypress—		Pine—	
Lawson.....	35	Lodgepole.....	43
Fir—		Ponderosa.....	137
Alpine.....	140	Western white.....	129
Douglas.....	241	Whitebark.....	3
Grand.....	151	Spruce—	
Hemlock—		Engelmann.....	3
Western.....	100	Sitka.....	6
Juniper—		Western white.....	150
Dwarf.....	5		

TOTAL number of collections on softwoods—1,202

GRAND TOTAL—2,454



*Fomes pini* (Thore) Lloyd, which causes red ring rot of conifers, and *Hypoxylon pruinaum* (Klotzsch) Cooke which causes a canker of several species of poplar were selected for special consideration in 1953. The following is a brief summary of the local importance and distribution of these two fungi.

**Red Ring Rot of Conifers.**—*Fomes pini* is the most important fungus causing decay of living conifers in British Columbia. Investigations have revealed that it causes appreciable cull loss in at least four of the major commercial timber species. This is illustrated in the following table.

DECAY CAUSED BY FOMES PINI IN SOME COMMERCIAL STANDS IN BRITISH COLUMBIA

	Percentage of Total Infections	Percentage of Total Decay
<b>Western Hemlock—</b>		
Alberni.....	9.1	12.8
Q. C. I.*.....	6.3	12.9
Kitimat.....	20.6	36.3
Upper Columbia.....	12.6	25.2
<b>Balsam—</b>		
Alberni.....	1.0	1.3
Kitimat.....	13.2	21.3
Upper Fraser.....	0.0	trace
<b>Spruce—</b>		
Q. C. I.....	25.0	39.7
Upper Fraser.....	9.2	30.0
<b>Douglas fir—</b>		
Vancouver Island.....	9.3	49.9

\* Q. C. I.—Queen Charlotte Islands.

Preliminary results from more recent studies show the fungus to be significant in the decay of western larch, ponderosa pine, and Douglas fir in the Interior.

A map showing the distribution of *F. pini* in British Columbia is present at the end of the report. The general distribution of the fungus throughout the province can readily be seen. The large blank areas on the distribution map indicate areas which have not been sampled to date rather than areas free from infection. The symbols indicate areas where *F. pini* was collected. Collections were made on the following hosts:

Amabilis fir.....	<i>Abies amabilis</i> (Doug.) Forb.
Grand fir.....	<i>Abies grandis</i> (Dougl.) Lindl.
Alpine fir.....	<i>Abies lasiocarpa</i> (Hook.) Nutt.
Western larch.....	<i>Larix occidentalis</i> Nutt.
Engelmann spruce.....	<i>Picea engelmannii</i> Parry
Sitka spruce.....	<i>Picea sitchensis</i> (Bong.) Carr.
White spruce.....	<i>Picea glauca</i> (Moench) Voss
Lodgepole pine.....	<i>Pinus contorta</i> Doug. var. <i>latifolia</i> Engelm.
Western white pine.....	<i>Pinus monticola</i> Dougl.
Ponderosa pine.....	<i>Pinus ponderosa</i> Laws.
Douglas fir.....	<i>Pseudotsuga taxifolia</i> (Poir.) Britton
Rocky Mountain Douglas fir.....	<i>Pseudotsuga taxifolia</i> (Poir.) Britton var. <i>glauca</i> (Mayr) Sudw.
Western red cedar.....	<i>Thuja plicata</i> Donn
Western hemlock.....	<i>Tsuga heterophylla</i> (Raf.) Serg.

It is very probable that *F. pini* has a range coincident with the range of conifers in British Columbia and is capable of infecting all native species.

**Hypoxylon Canker of Poplar.**—*Hypoxylon pruinaum* was collected in British Columbia for the first time in 1953 when intensive scouting for the fungus was begun. That it has not been collected before is largely due to the relative unimportance of its only known local host, trembling aspen. While the present data on its distribution must be considered preliminary, the very few samples of the fungus found would suggest that its occurrence, although widespread, is sparse. The possibility of *H. pruinaum* becoming a problem in the future should not be overlooked. Although not important at present, aspen may become commercially valuable, and the fungus has been known to cause appreciable damage in other regions.

**Fungus Flora of Douglas Fir Forest Associations.**—A systematic survey of the fungi inhabiting Douglas fir forest associations on Vancouver Island has been initiated to prepare a check list of fungi affecting Douglas fir and to study the seasonal and environmentally-conditioned variations in the occurrence and abundance of some of these fungi. Preliminary work has been confined to two distinct forest associations and two broad age groups. Forty sample plots, varying in size from 0.05 to 0.1 acres, have been established in representative forest associations from Campbell River to Parksville on Vancouver Island. Bi-monthly examinations, from March through November, are made. The examinations to date have not yielded sufficient data for analysis at this time.

**Survey of the Fungi Associated with Decay of Douglas Fir in the Interior.**—The British Columbia Forest Service has undertaken a large-scale inventory of provincial timber resources. Included in the many phases of this work is an appraisal of loss from defect. During the past summer twenty Forest Service field parties sampled commercially important forest types throughout the Province to acquire volume and decay data essential to the preparation of cull factors.

In co-operation with the Forest Service, Forest Disease Survey personnel of the Victoria Laboratory collected data to determine the fungi associated with decay. Since a complete coverage of all sample areas established by the Forest Service was not possible, emphasis was placed on those types and species which have received little or no attention in the past.

Forty-four sample plots from 11 sample areas in the Kamloops and Nelson Forest Districts were examined in 1953. Samples were obtained and cultures prepared from 206 Douglas fir trees containing varying amounts of decay. Determinations have not been completed but indications are that Douglas fir in the Interior is relatively free from decay. About 70 per cent of the infected trees contained brown cubical butt rot apparently caused by *Polyporus schweinitzii* Fr., while red ring rot caused by *Fomes pini* (Thore) Lloyd was the most common trunk rot. These results are comparable to those for Douglas fir on the Coast.

**Dieback and Canker of Western Hemlock.**—An associated dieback and canker of western hemlock was found to be more prevalent and damaging than previously believed. The condition has been recognized for some years but was considered to be of minor importance, affecting only understory trees or those weakened by the activity of some other agent. A closer scrutiny of young hemlock in 1953 showed that the disease was causing damage in some areas.

In the Courtenay area of Vancouver Island trees from 10 to 40 years of age were found to be most commonly affected. All crown classes appeared to be equally susceptible. Infection apparently starts at the tips of twigs or the leader



and gradually works down into the main stem, where either a canker develops or the fungus continues to cause dieback, eventually killing the tree. Mortality as well as deformation is quite common.

The cause of the disease has not been determined to date. A species of *Myxosporium* has frequently been found growing on cankered and killed-back bark, but its relationship to the condition has not yet been established. While the disease has not been considered of economic importance in the past, it should be recognized as a potential problem in the stocking of second-growth forests.

**Deterioration of Looper-killed Hemlock.**—During 1953, a final analysis of the progress of deterioration in western hemlock, killed by the western hemlock looper in 1945-46, was carried out in the Wilson Creek area on lower Vancouver Island. Results of this analysis show that 66 per cent of the merchantable board foot volume contained in the trees has been lost through the action of wood-rotting fungi. Eighty-seven per cent of the decay was caused by the activity of *Fomes pinicola* (Sw.) Cooke. This fungus was responsible for most of the decay losses recorded in the earlier analyses of this timber.

**Needle Cast of Western Larch.**—An unusual abundance of the larch needle cast disease caused by *Hypodermella laricis* v. Tubeuf was reported from several regions of the Nelson Forest District in 1952. A survey at that time revealed that the disease was generally present throughout the range of western larch and had reached epiphytotic proportions in some localities. A check on the infection level in 1953 showed, that while the disease was still of general occurrence, the severity of infection had greatly decreased in most areas. Recovery from heavy defoliation appeared to be satisfactory in most areas. Although spur-shoot and twig killing was extensive the trees have generally regained their vigor.

**Flagging of Ponderosa Pine.**—A condition of severe flagging of ponderosa pine was reported from the Kelowna area of the Kamloops Forest District. A subsequent examination revealed that a 15- to 30-year-old natural stand was suffering flagging injury as a result of girdling lesions apparently caused by *Cenangium ferruginosum* Fr. (*C. abietis* (Pers.) Rehm).

This is the first report of *C. ferruginosum* causing damage to ponderosa pine in this Province. Indications are, however, that it has been present for some years. Its distribution seems to be fairly general on this pine but in most instances it is confined to the weakened lower branches.

Damage at Kelowna was not severe in terms of mortality, since less than 3 per cent of the trees were killed, but the parasitic capability of the fungus was well demonstrated. Twenty-three per cent of the trees examined suffered flagging of apparently healthy, vigorous branches in the upper crown. Some of the most heavily infected trees showed at least average vigor in terms of recent growth. These included some of the trees that were killed.

It is important to note that the behavior of *C. ferruginosum* at Kelowna has not followed the pattern recorded elsewhere. It has generally been reported to be a dieback fungus which gains entrance to the host at or near the terminal buds. Observations in British Columbia indicate that the host is frequently attacked well below the succulent terminal regions. Infection is commonly centered at fascicle traces and girdling lesions are produced at or near these points. Following girdling the necrosis spreads downward as a dieback. Since entrance is apparently gained through older bark, an insect vector or similar association is suggested, but as yet, evidence to substantiate this view is lacking. Further study is indicated.

Since the injury at Kelowna was observed, other areas with similar damage have been noted. In all instances the severe damage was confined to a few acres.

**White Pine Blister Rust.**—An examination of the progress of white pine blister rust in white pine regeneration plots near New Denver, B.C., indicated an increase in the percentage of infected trees from 39.8 in 1947 to 65.8 in 1953. These data are based on 938 trees.

**Deterioration of Windthrown White Spruce and Alpine Fir.**—During 1953, further analyses were made of the progress of deterioration in windthrown white spruce and alpine fir in the Crescent Spur area, Prince George Forest District. *Stereum sanguinolentum* Alb. and Schw. ex Fries was again found to be the principal wood-rotting fungus associated with the deterioration of both species. *Fomes pinicola*, however, occurred more commonly in spruce than in fir while the reverse was true for *Polyporus abietinus*. *Lenzites saepiaria* Wulf. ex Fries, previously of rare occurrence, was found fruiting on numerous trees of both species but, to date, has not been associated with any appreciable volume of decay.

**Damping-off in Forest Nurseries.**—Losses from damping-off were moderate in all British Columbia Forest Service Nurseries during 1953. Stunting and most of the mortality of seedlings at the Cranbrook Nursery, Nelson Forest District, appeared to be unrelated to damping-off. It was found by the British Columbia Forest Service to be correlated with poor soil conditions, which occur in a number of areas throughout the nursery.

OTHER NOTEWORTHY DISEASES  
(V. I. = Vancouver Island)

Host	Causal Fungus	Locality	Remarks
Alder, red.....	<i>Crepidotus fulvotomentosus</i> Peck	Victoria.....	Fruiting on dead branches. First record for B. C.
Aspen, trembling	<i>Hypoxyylon pruinaum</i> (Klotzsch) Cke.	Fort George, Prince Rupert, Quesnel, Salmon Arm	Causing cankers of main stem and branches. Collected for the first time in B. C.
Cottonwood, black	<i>Taphrina populi-salicis</i> Mix.....	Lake Cowichan, V. I.	Causing a lemon-yellow leaf blister. Quite common locally. First record for B. C.
Cranberry, rock.	<i>Calptospora goeppertiana</i> Kühn	Watson Lake.....	First record on rock cranberry in B. C. of this yellow needle rust of true firs.
Fern, sword.....	<i>Milesia polystichii</i> Wineland....	Southern V. I.....	A rust the aecial stage of which probably occurs on needles of the true firs. Common on southern V. I. but not previously recorded for B. C.
Fir, alpine.....	<i>Melampsora abieticapræarum</i> Tub.	Cedarvale, Decker Lake, Needles, Palling	A rather rare needle rust of true firs. Alternate host is willow. First record for B. C.
Fir, alpine.....	<i>Pucciniastrum</i> (?).....	Aleza Lake.....	Apparently the first record of a cone rust on true firs ( <i>Abies</i> spp.). Common locally. Not known to cause serious damage.
Fir, Douglas.....	<i>Polyporus undosus</i> Peck.....	Haney.....	On dead wood. New record for B. C. on this host.
Fir, grand.....	<i>Calptospora goeppertiana</i> Kühn	Beachey Head, Nitinat River	A yellow needle rust of true firs. First record on grand fir for B. C.
Fir, true.....	<i>Hyalospora aspidiotus</i> (Peck) Magn.	General but sparse occurrence throughout B. C.	Not previously recorded on true firs in western North America. The scattered occurrence of the rust on true fir needles has caused no appreciable damage in the past.



## OTHER NOTEWORTHY DISEASES

Host	Causal Fungus	Locality	Remarks
Hemlock, western	<i>Polyporus undosus</i> Peck.....	Haney.....	New record for B. C. on hemlock.
	<i>Pterula</i> sp.....	Haney.....	On decayed twigs on ground. Not previously found on hemlock in B. C.
Huckleberry, evergreen	<i>Calypsotheca goeppertiana</i> Kühn	East Sooke, Sproat Lake.	Near true fir, on which it causes a needle disease in the alternate stage. Uncommon; first record on that host in B. C.
Juniper, Irish....	<i>Gymnosporangium clavariaeforme</i> (Jacq. ex Pers.) DC.	Vancouver.....	Girdling main stems of seedlings in nursery.
Larch, western....	<i>Dasyscypha occidentalis</i> Hahn & Ayers	Hill Siding.....	Associated with dying of larch twigs following defoliation by <i>Hypodermella laricis</i> V. Tubeuf.
Larch, western....	<i>Lachnellula chrysophthalma</i> (Pers.) Karst.	Cranbrook.....	New record for western Canada and probably a new host record. On dead branches of a felled tree.
Pine, lodgepole....	<i>Arceuthobium campylopodum</i> Engelm. forma <i>laricis</i>	Grand Forks, Christina Creek	First record of the larch for on lodgepole pine. (See B-i Mo. Prog. Rep. For. Biol. Div. Can. Dept. Agr. 9: 5 Sept.-Oct., 1953.)
Pine, ponderosa....	<i>Cenangium ferruginosum</i> Fr. ( <i>C. abietis</i> (Pers.) Rehm)	Kelowna, Hedley, Kamloops	Associated with severe flagging; first record of damage by this fungus in B. C.
Pine, western white	<i>Arceuthobium campylopodum</i> Engelm. forma <i>laricis</i>	Slocan Lake.....	First record of larch form on western white pine. (See Bi-Mo. Prog. Rep. For. Biol. Div. Can. Dept. Agr. 9: 5 Sept.-Oct., 1953.)
Pine, western white	<i>Tympanis</i> sp., probably <i>Tympanis pityla</i> (Karst.) Karst.	Arrow Park, Silverton	Common on killed-back twigs and on slash. First record for B. C.
Soil.....	<i>Sarcodon imbricatus</i> (L.) Karst.	Cinema.....	The first record for western North America. Under spruce-alpine fir forest.
Spruce.....	<i>Chrysomya empetri</i> (Pers.) Schroet.	Terrace, Hixon.....	An uncommon rust causing needle cast. New record on spruce in B. C.
Spruce, white....	<i>Chrysomya weirii</i> Jacks.....	Interior of B. C., north to Babine Lake	Causing needle cast of previous years' needles. First host record of white spruce. Occurrence sporadic.
Spruce, white....	<i>Chrysomya woroninii</i> Tranz....	Fort St. John.....	Stunting terminal shoots of seedlings. First record for western North America. Only recently reported from North America (Can. J. Res. C, 28: 328-329. 1950.)
Willow.....	<i>Daedalea confragosa</i> (Bolt.) Fr..	Campbell River.....	New record for B. C.
	<i>Fomes connatus</i> (Weinm.) Gill..	Quesnel.....	Lower bole of dead, mature tree. Only record for B. C.

## LIST OF COLLECTORS

Ainscough, G. L.  
Arlidge, J. W. C.  
Baker, F. E.  
Bertsch, L.  
Breadon, R. E.  
Browne, E. J.  
Buckland, D. C.  
Güssow, H. T.  
Hall, E. R.  
Hardy, G.  
Hobbs, H.  
Hopkins, H. J.  
Horspool, C.

Huva, G.  
Jones, W.  
Kemp, J. H.  
Knight, H.  
Krajina, V. J.  
Little, J. S.  
Lohn, L.  
Macalister, J. S.  
MacSwan, I.  
McGhee, W.  
Mercer, T.  
Moor, K. W.  
Moss, A.

Murray, J.  
Neighbor, H.  
Petty, J.  
Pogue, H. M.  
Prochnau, A.  
Rithaler, J.  
Ross, H. S.  
Rogers, G.  
Schmitt, R. L.  
Szcawinski, A. F.  
Tannhauser, R.  
Wainwright, W.  
Walsh, L. J.  
Wilcox, G. F.





