PROVINCE OF BRITISH COLUMBIA

FOREST DISEASE SURVEY

A. C. MOLNAR

Forest Entomology and Pathology Laboratory, Victoria, B.C.

INTRODUCTION

Rust diseases figured prominently in the activities of the British Columbia forest disease survey in 1961. A large-scale survey was begun, enlisting the cooperation of public and private agencies, to investigate an apparently introduced Melampsora rust first found on yellow pine seedlings in 1960. This rust, morphologically indistinguishable from *Melampsora pinitorqua* Rostr., which causes pine twist rust in Europe, had not been reported previously in North America. So far this disease has not been found elsewhere in the Province, although it appeared again in 1961, in the vicinity of the previously infected test beds at Telkwa, B.C. The most significant finding of investigations in 1961 was that native trembling aspen is susceptible to infection by the rust.

A severe outbreak of sweetfern blister rust, caused by *Cronartium comptoniae* Arth., was discovered damaging young plantations of Bishop and Monterey pines on Vancouver Island. This rust, native to the region, had never been recorded previously on these two non-indigenous hosts. The discovery makes doubtful the future success of these two pines in the region and stresses the need for extra vigilance to prevent the introduction of *C. comptoniae* to other regions of the world.

A special survey of willow blight, another introduction to British Columbia, was carried out following confirmation of this disease in the Vancouver area in 1960, after having been unreported since 1941. The present survey found the disease to be widespread throughout the Fraser Valley but it was not reported elsewhere.

The excellent cooperation received from cooperators and the general public in surveys of the pine twist rust is gratefully acknowledged. Special thanks are due to the Columbia Cellulose Company, Western Tree Farms Limited, and the British Columbia Forest Service for their support.

The 1,653 disease collections submitted to the survey in 1961 are listed below by host:

Coniferous trees	Collections	
Douglas fir		480
Pine		
Lodgepole pine	62	
Western white pine	39	
Red pine	22	
Ponderosa pine	10	
Scots pine	5	
Other pines	20	
		158
Fir		
Alpine fir	91	
Amabilis fir	23	
Grand fir	10	
		124

Broad-leaved trees	Collections	
Poplar		
Trembling aspen	150	
Black cottonwood	19	
White poplar	19	
Other poplars	25	
		213
Willow		101
Alder		
Red alder	21	
Sitka alder	10	
Mountain alder	4	
Other alders	11	
		46

Coniferous trees	Collections	
Spruce		
White spruce	50	
Sitka spruce	15	
Engelmann spruce	14	
Black spruce	5	
Other spruces	6	
		90
Hemlock, western		83
Juniper		
Rocky Mountain Juniper	16	
Common juniper	14	
Other junipers	20	
		50
Cedar, western red		10
Larch		
European larch	7	
Western larch	1	
Other larches	4	
		12
Total		957

Broad-leaved trees	Collections	
Ash, mountain		17
Birch		
Western white birch	15	
Dwarf birch	6	
Other birches	10	
		31
Maple		
Broadleaf maple	5	
Douglas maple	2	
Vine maple	2	
Other maples	2	
		11
Cherry		5
Arbutus		2
Oak, Garry		1
Total		327

Miscellaneous or host not specified	269
GRAND TOTAL	1,653

IMPORTANT DISEASES

Weather Injury—There were few reports of weather injury in the Province during 1961. Scattered reports of light to moderate frost damage to alpine fir and lodgepole and jack pines in northern British Columbia and the Yukon Territories appear to represent a chronic situation involving frost pockets.

An area of severe bark beetle (*Dendroctonus pseudotsugae* Hopk.) mortality surveyed in the Farwell Creek drainage, 35 miles west of Williams Lake, was attributed to predisposition by frost injury during the winter of 1952-53. It could not be determined what proportion of the dead trees resulted from direct injury by frost. Similar damage was noted in this general area in 1956 and was also attributed to frost and subsequent bark beetle damage.

Foliage Diseases—There was no overall climatic influence indicated in the behaviour of foliage diseases during 1961. Needle blight of yellow pine caused by *Elytroderma deformans* (Weir) Darker, continued at outbreak levels in all areas heavily infected during the last three years. Only minor fluctuations in disease intensity occurred and there was little indication of spread outside the previous boundaries of the outbreak. Light mortality among understory trees continued and measurable losses in increment may be expected in the heavily defoliated trees.

The severe outbreak of Douglas fir needle blight, caused by *Rhabdocline pseudotsugae* Syd., subsided following two successive years of weather conditions unfavourable to spore dispersal.

Hypodermella laricis Tub. caused moderate to heavy foliage killing of western larch in a number of localized areas, but infection was generally less evident than in previous years.

There were reports of severe but sporadic defoliation by foliage rusts from the northern half of the Province.

Pine Twist Rust—A Melampsora rust indistinguishable from *Melampsora pinitorqua*, the cause of pine twist rust in Europe, was discovered infecting seedling yellow pine at Telkwa, British Columbia, in 1960 (Ziller, W. G. 1960. Pine twist rust (*Melampsora pinitorqua*) in North America. Plant Dis. Reptr. 45(5): 327-329.). This discovery was the first record of a Melampsora rust infecting pine in North America, and the first record of the rust on yellow pine. Telkwa is situated about 400 miles northwest of the natural limit of yellow

pine. The seedlings in the infected test bed were destroyed, although it was thought highly improbable that the disease would be eradicated by this procedure. The implications of this possible introduction made an early examination of the problem necessary.

A large scale and intensive survey was begun in 1961 to trace the source of pine infection at Telkwa and, if possible, the source of initial infection; to determine the host range of the rust in British Columbia; and to determine the distribution of European white poplar (*Populus alba* L.) which was the only known poplar host of *M. pinitorqua* within the effective range of the infected seedlings for basidiospore dispersal. The results of the survey in 1961 are summarized below.

The rust appeared again in 1961 on freshly germinating seedlings of yellow pine set out in suspect areas. It appeared only at Telkwa in approximately the same location as in 1960, although the seedlings were placed out at Terrace and in the Fraser Valley, which were also designated suspect areas. In addition to those placed out in seed flats, planted and naturally-occurring yellow and other pines were examined in the vicinity of white poplars throughout the Province, but the rust was not found on pine outside Telkwa.

Inoculation tests with aeciospores obtained from the infected pine at Telkwa gave positive results on the native trembling aspen and negative results on European white poplar, consistently in three replications. The negative results are not considered conclusive.

A series of controlled infection tests on Douglas fir and yellow pine with basidiospores obtained from over-wintered trembling aspen leaves near the infection site at Telkwa gave positive results on the fir and negative results on the pine. These studies were completed in June, two weeks before the appearance of natural infection on the pine. The results would confirm the suggestion that the rust on the over-wintered aspen leaves was *Melampsora albertensis* Arth. They would not, however, preclude the possibility that another rust, with later developing basidiospores was also present and carried infection to the pine. Aspen appears to be the source of pine infection at Telkwa.

The survey of the distribution of European white poplar included observations on this host for the presence of Melampsora rust, but only one instance of Melampsora infection on white poplar was found, at Hope, B.C. It was not possible to associate this rust with that causing the pine infection at Telkwa. Yellow pine seedlings placed near this tree did not become infected during the summer. Infection studies on 46 species and varieties of poplars inoculated with urediospores obtained from this tree gave positive results on European white poplar, trembling aspen, the hybrids *Populus nigra* x *trichocarpa*, and probably *P. candicans* x *berolinensis* (identity of this host requires verification), and the poplar variety 'Gelrica'. The negative results obtained on the remaining test trees are not considered conclusive. The rust on European white poplar at Hope, was tentatively identified as *Melampsora populnea* (Pers.) Karst. because of the host, keeping in mind that it can not be distinguished from *M. albertensis* on the basis of the existing knowledge of this group.

European white poplar was found to be quite generally distributed throughout the populated areas of the Province, having been widely planted as an ornamental. It was found to be particularly numerous throughout the yellow pine zone, the Fraser Valley, and on Vancouver Island. This species has not been demonstrated to be a host of the pine rust found at Telkwa. Furthermore, since it has a much more restricted distribution than trembling aspen, which was shown to be highly susceptible to the rust, it would have a relatively minor role in the spread of the disease, even if it should later prove to be susceptible.

At this point little can be said about the distribution of the yellow-pine-infecting *Melampsora* found at Telkwa because it cannot be distinguished on its poplar host. It is encouraging that it has not been found on pine elsewhere in the Province, although light infections may well have escaped detection on pine.

A number of important facts have come to light, but many questions remain to be answered. Determination of the species of rust on poplar by cross inoculations with basidiospores to pine at various times during the summer, and under various conditions, should throw further light on the subject. The absence of a morphological basis for the separation of the various *Melampsora* species and races on poplar appears to be the greatest obstacle in the way of rapid progress on this problem.

Willow Blight—Willow blight was confirmed in British Columbia in 1960 for the first time since 1941 (Bloomberg, W. J. and Funk, A. 1960. Willow blight in British Columbia. Can. Dept. Agr., For. Biol. Div., Bi-monthly Prog. Rept., 16(5): 3.). An intensive survey of the disease in 1961 in the Fraser Valley, and general observations for its presence throughout the Province revealed the disease to be widespread throughout the Fraser Valley on both sides of the Fraser River. To date it has not been found elsewhere in the Province, although there is no reason to expect that it should be confined to the lower mainland.

The hosts recorded in 1961 included golden willow (*Salix alba vitellina* (L.) Stokes) and weeping willow (*S. babylonica* L.). Both these hosts are commonly regarded as resistant to the disease, but damage to several infected trees of both these species in the Fraser Valley indicated that they were highly susceptible. Native willows in close proximity to diseased trees on the University of British Columbia campus appeared to be immune. The symptoms of the disease were characteristic, as described in the 1960 Report.

Examinations several times during the summer turned up both fungi of the complex reported to cause the disease namely, *Fusicladium saliciperdum* (All. & Tub.) Lind. and *Physalospera miyabeana* Fuk., but only the *Gloeosporium* (imperfect) state of the latter was found.

Willow blight does not pose a threat from a forestry standpoint, even though the causal fungi were introduced to the continent and the disease is a potential problem in the Midwest, where willow is used in flood control. In British Columbia, willow does not have much commercial value, nor does it play an important role in flood control. But, since many of the susceptible varieties of willow are widely planted as ornamentals, spread and intensification of the disease has some economic implications.

Diseases of Non-indigenous Trees—The examination of exotic pine plantations in 1961 revealed a severe outbreak of the native sweetfern blister rust caused by *Cronartium comptoniae* (Molnar, A. C. An outbreak of *Cronartium comptoniae* on Monterey and Bishop pines on Vancouver Island, British Columbia. Plant. Dis. Rept. 45: 854-855. 1961.). Five-year-old plantations of Monterey and Bishop pines sustained up to 95 and 75 per cent infection of the stems, respectively. Ten of the 12 Monterey pine and 5 of the 8 Bishop pine plantations were infected by this rust. Mortality was estimated at less than one per cent in all the infected stands but, since most infections involved the stem, heavy mortality may be expected in the future.

In the six plantations where these two species were planted together, Bishop pine invariably suffered a lower incidence of infection than Monterey pine, but this difference would not have any practical significance. The apparent resistance of cluster pine, which was present and free from infection in 8 of the 10 plantations containing infected Monterey pine was much more striking. Cluster pine is, however, recorded as a host of *C. comptoniae* (Boyce, J. S. 1943. Host relationships and distribution of conifer rusts in the United States and Canada. Trans. Conn. Acad. Arts Sci. 35: 331-382.). In another plantation, where 83 per cent of Monterey pine was infected, Austrian pine, cluster pine, and the hybrids, *P. echinata* x *taeda*, *P. murrayana* x *banksiana*, and *P. rigida* x *taeda*, were free from attack.

Bishop and Monterey pines are new hosts for *C. comptoniae* and the outbreak of infection recorded on Vancouver Island should caution against further planting of these pines in the region until more is known about the distribution of the alternate host, *Myrica gale* L., and other factors promoting outbreak conditions. Especial vigilance is indicated to prevent the introduction of *C. comptoniae* into regions of the world where Bishop or Monterey pines are valuable forest species.

Peridermium harknessii J. P. Moore, the cause of the western gall rust, has reached damaging infection levels in a Scots pine plantation in the lower Fraser Valley. This blister rust was also found infecting cluster and Monterey pines, which are new hosts for this fungus in Canada.

OTHER NOTEWORTHY DISEASES

Host	Organism	Locality	Remarks
Alder, red	*Fomes annosus* (Fr.) Cooke	Mesachie	Fruiting in root crotches and causing the uprooting of a 6-inch-DBH alder tree. Rarely attacks broad-leaved trees. Probably the first world host record of its occurrence on red alder.
	Tympanis alnea (Pers.) Fr.	Halfmoon Bay	Associated with dieback. First herbarium record.
Aspen, large-toothed	*Melampsora albertensis* Arth.	Vancouver	Causing severe foliage rust. Probably the first world host record.
Aspen, trembling	*Melampsora* sp.	Yukon Territory: Dawson, Beaver Creek, Watson Lake, Teslin	Causing foliage rust, light damage. The rust is probably *M. medusae* Thüm., causing a needle rust of larch, its alternate host. First record for Yukon Territory.
Birch, scrub	*Melampsoridium betulinum* (Fr.) Kleb.	Yukon Territory: Dawson, Beaver Creek	Causing light to medium damage to the foliage. Not yet found on larch, its alternate host, in western North America. First host record for Yukon Territory.
Birch, western white	*Fomes igniarius* (L. ex Fr.) Kickx	Yukon Territory: Dawson, Teslin, Mayo	Causing white trunk rot of living mature trees. First host record for Yukon Territory.
	Melampsoridium betulinum (Fr.) Kleb.	Yukon Territory: Dawson, Beaver Creek, Snag	Causing medium to heavy damage to foliage. First host record for Yukon Territory, although reported from Alaska.
Cedar, western red	*Polyporus hirtus* Quél.	Saanichton	Causing butt rot of coniferous trees, considered to be rare. First host record for B.C.
Cottonwood, black	*Macrophoma tumefaciens* Shear	Bella Coola	Causing globose galls on twigs of cottonwood. First record for B.C.
Fir, alpine	*Camarosporium* sp.	Prince Rupert	Apparently causing bud necrosis. A similar or identical parasite causing bud necrosis of Douglas fir (Ann. Rept. For. Ins. Dis. Surv. p. 109. 1959) has been under observation since 1955. First record for B.C.
	Melampsorella caryophyllacearum Schroet.	Calument, Y.T.	Causing witches' brooms. First record for Yukon Territory.
	Micropera sp.	Smithers	Associated with dieback. Identified from culture. First herbarium record.
	Peridermium holwayi Syd.	Yukon Territory: Dawson, Teslin	Causing needle rust, very light damage to mature trees. First record for Yukon Territory.
	Pucciniastrum epilobii Otth	Teslin, Y.T.	Causing needle rust, light damage to reproduction. First host record for Yukon Territory. Alternate host: fire-weed (*Epilobium* spp.).

OTHER NOTEWORTHY DISEASES—concluded

Host	Organism	Locality	Remarks
Fir, Douglas	*Polyporus balsameus* Peck	Victoria	Causing brown butt rot of coniferous trees. First herbarium host record.
	Poria nigrescens Bres.	Vancouver Island	Causing decay of coniferous and broad-leaved trees. First record for B.C.
	Wallrothiella arceuthobii (Peck) Sacc.	Creston	A hyperparasite of the Douglas fir mistletoe, suppressing seed production of the mistletoe plant and therefore beneficial to forestry. First record of its occurrence on *Arceuthobium douglasii* Engelm. in B.C.
Hemlock, western	*Diplodina* sp.	Cameron	Associated with branch canker and dieback. First host record for B.C.
	Retinocyclus olivaceus Fuckel	Terrace	Associated with branch canker. First host record for B.C.
Pine, cluster	*Peridermium harknessii* J. P. Moore	Coombs	Causing gall rust on branches of seedlings in a small forest plantation. Lodgepole pine diseased with gall rust grew in the vicinity. First host record for Canada.
Pine, Monterey	*Peridermium harknessii* J. P. Moore	Coombs	See remarks for cluster pine, above.
Pine, sugar	*Cronartium ribicola* J. C. Fischer	Campbell River	Causing blister rust on the stems and branches of seedlings in a plantation. First herbarium host record.
Pine, white-bark	*Polyporus leucospongia* Cooke & Harkn.	Creston	Causing brown cubical rot of sap- and heartwood. First record in Canada.
Plum, cherry	*Ganoderma applanatum* (Pers. ex Wallr.) Pat. var. *brownii* (Murrill) Humphrey & Leus	Victoria	Causing white mottled rot on living, mature, cultivated tree. First host record and first record of the variety in Canada.
Poplar, balsam	*Venturia populina* (Vuill.) Fabric.	Haines Junction, Y.T.	Causing leaf and twig blight of balsam poplar. First record of the fungus occurring in western North America. Ref.: Can. Jour. Botany, 39: 875–890. 1961.
Poplar, white	*Melampsora* sp.	Hope	Causing leaf rust. The identity of this rust could not be determined until the alternate host has been found by inoculation experiments scheduled for 1962. If the alternate host proves to be pine, the rust fungus is probably *Melampsora pinitorqua* Rostrup. First record of a rust fungus occurring on white poplar in Canada.
Spruce, Colorado	*Chrysomyxa pirolata* Wint.	Smithers	Causing cone rust and total destruction of the seed crop. First world host record.
Spruce	*Chrysomyxa arctostaphyli* Diet.	Throughout B.C. and Y.T.	It has recently been demonstrated (Science, 134: 468–469. 1961) that the fungus causing yellow broom rust of spruce (*Peridermium coloradense* (Diet.) Arth. & Kern) is the aecial state of a leaf rust on kinnikinick (*Arctostaphylos uva-ursi* (L.) Spreng.) caused by *Chrysomyxa arctostaphyli*. Hence, *C. arctostaphyli* is now the appropriate name for the broom rust of spruce.