



**THE TREE RUSTS OF
WESTERN CANADA -
ANNOTATED LISTS WITH KEYS**

by
W. G. Ziller

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Corrections for Information Report BC-X-34 (1969)

Page 7 -- 3rd line from bottom: delete period after Presl

Page 10 -- under "Juniper": Gymnosporangium nelsonii

Page 13 -- under "Pine":

Endocronartium harknessii instead of "Peridermium harknessii"

Line after "Polypody", insert:

Polystichum munitum - see fern, sword

Under "Poplar", change:

"Spores small, 23-25 u long Melampsora medusae" to:
Spores small, 23-35 u long Melampsora medusae

Page 15 -- under "Saskatoon-berry": Gymnosporangium nelsonii

Page 18 -- under "Chrysonyxa chiogenis": delete "0 +"

Page 21 -- change "Gymnosporangium nelsoni" to Gymnosporangium nelsonii

Page 23 -- replace entry under "Peridermium harknessii" with:

Endocronartium harknessii (J. P. Moore) Y. Hiratsuka
(= Peridermium harknessii J. P. Moore) - western gall rust.
0 (rare) + III (aecidioid telia) on branch galls of hard pines
(Pinus spp.), includ. jack, lodgepole, ponderosa, Scots,
Monterey, Austrian, bishop, cluster, and mountain pine.

After "Pucciniastrum epilobii": delete period after Otth

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INTRODUCTION

An inventory of the tree rusts of western Canada is presented in the form of two lists: a check list of hosts with their rusts, and a check list of rusts with their hosts. The lists contain results of 20 years of survey and research, and include all species and varieties of rust known to parasitize trees in western Canada. They are intended as a guide to the preliminary identification of regional tree rusts, and should be useful primarily to foresters, forest pathologists and botanists, as well as to mycologists.

Although there are between 47 and 63 rusts parasitizing trees in western Canada, their identification, even by amateurs, is not nearly as difficult as it may seem because, as a rule, each tree rust occurs on only a limited number of hosts. Thus, in many cases recognition of the host leads directly to the identification of the rust. For example: typical yellow rust pustules are observed on the foliage of sweet gale; the only rust that is known to occur on sweet gale is Cronartium comptoniae (sweet-fern blister rust), as shown in the "List of Hosts with Keys to their Rusts". In checking Cronartium comptoniae in the "List of Rusts with their Hosts", we find that sweet-gale is the secondary, or "alternate", host of this rust, its primary hosts being several species of native and

exotic hard pines. But in many cases one host may be susceptible to more than one rust (17 rusts occur on fir!). Identification then becomes increasingly difficult. It necessitates the study of the rust itself with the aid of "keys", such as provided below in the List of Hosts. Examples of hosts with many rusts are pine, spruce, fir, etc. Furthermore, plant rusts (Uredinales) other than tree rusts may occur on alternate hosts of tree rusts, e.g. on asters, currants, raspberries and fire-weed. Such non-tree rusts, although included in the List of Hosts, are put in brackets to distinguish them from tree rusts.

In several instances, rusts listed under one host are lumped together into groups without being keyed out to species; for example: all rusts of anemone, and some rusts of bedstraw, fir and juniper. This indicates that the rusts included in such groups are difficult to distinguish from each other. Their identification should therefore be left to a specialist.

To make the lists useful to those less familiar with scientific nomenclature and mycology, as well as to rust specialists, I have attempted to present the information in the simplest form. In particular, the use of technical terms has been avoided; common as well as scientific names for all host plants and rust diseases have been used; and preference has been given to host symptoms and macroscopic, rather than microscopic, characteristics in my keys. Nevertheless, identification of several of the tree rusts listed and keyed out requires microscopic observation.

The following symbols denote the spore states that occur during the life cycles of most tree rusts:

- O -- pycnial state, on primary hosts;
- I -- aecial state, on primary hosts;
- II -- uredinial state, on secondary (alternate) hosts;
- III -- telial state, on secondary (alternate) hosts.

Nearly all species of trees in western Canada can be protected from rust by preventing the occurrence of alternate hosts in their vicinity.

LIST OF HOSTS

with Keys to their Rusts

(Rusts in brackets do not occur on trees)

Abies spp. -- see fir.

Amelanchier alnifolia vars. -- see saskatoon-berry.

Anemone spp. -- see anemone.

Anemone (Anemone spp.)

Tranzschelia discolor

(Tranzschelia anemones (Pers.) Nannf.)

(Puccinia gigantispora Bub.)

(Puccinia pulsatillae Kalchb.)

(Puccinia recondita Rob. ex Desm.).

Arbutus menziesii Pursh -- see madrone.

Arctostaphylos alpina -- see bearberry, alpine.

Arctostaphylos uva-ursi -- see kinnikinnick.

Aspen, trembling -- see poplar.

Aster spp. -- see aster.

Aster (Aster spp.)

Spores orange-yellow, 1-celled

Spores borne openly in pustules

Coleosporium asterum

Spores enclosed in minute cups

(Puccinia dioicae P. Magn.)

Spores dark brown, 2-celled

(Puccinia asteris Duby).

Athyrium filix-femina -- see fern, lady.

Balsam -- see fir.

Bearberry, alpine (Arctostaphylos alpina (L.) Spreng.)

Pucciniastrum sparsum.

- Bedstraw (Galium spp.)
Spores yellow and spiny Pucciniastrum guttatum
Spores not yellow and spiny (Puccinia punctata Link var. trogloodytes
(Lindr.) Arth.)
(Puccinia rubefaciens Johans.)
(Puccinia difformis Kunze).
- Betula spp. -- see birch.
- Bilberry -- see huckleberry.
- Birch (Betula spp.)
Melampsorium betulinum.
- Bluebell (Campanula spp.)
Spores orange, 1-celled Coleosporium campanulae.
- Blueberry -- see huckleberry.
- Bramble, arctic and hairy -- see raspberry.
- Buckthorn, cascara (Rhamnus spp.)
Puccinia coronata.
- Buttercup (Ranunculus spp.)
Spores borne in cups, 1-celled
Spores yellow-brown Tranzschelia discolor
Spores orange-yellow (Puccinia recondita Rob. ex Desm.)
(Uromyces dactylidis Otth)
Spores borne in open pustules, 2-celled, dark brown
(Puccinia blyttiana Lagerh.).
- Campanula persicifolia L. -- see bluebell.
- Cascara -- see buckthorn.
- Cassandra (Chamaedaphne calyculata (L.) Moench)
Chrysomyxa ledi var. cassandrae.
- Castilleja spp. -- see paint-brush.
- Cerastium spp. -- see chickweed.
- Chamaecyparis nootkatensis -- see cypress, yellow.
- Chamaedaphne calyculata -- see cassandra.

- Chickweed (Stellaria and Cerastium spp.)
Spores reddish-orange, 1-celled, spiny
Melampsorella caryophyllacearum
Spores dark-brown, 2-celled, smooth
(Puccinia arenariae (Schum.) Wint.).
- Chimaphila umbellata -- see pipeis sewa.
- Comandra, northern (Geocaulon lividum (Richards.) Fern.)
Cronartium comandrae.
- Comandra, pale (Comandra umbellata (L.) Nutt. var. pallida (A.DC.) M. E. Jones)
Spores reddish-orange, 1-celled, spiny
Cronartium comandrae
Spores dark-brown, 2-celled, smooth
(Puccinia comandrae Peck).
- Comandra umbellata var. pallida -- see comandra, pale.
- Cottonwood, black -- see poplar.
- Cow-wheat (Melampyrum lineare Desr.)
Spores orange-yellow, 1-celled, spiny
Cronartium coleosporioides.
- Crab-apple, Pacific (Malus diversifolia (Bong.) Roem.)
Spores yellow, borne in cups Gymnosporangium nootkatense
Spores brown, borne in horns Gymnosporangium cornutum.
- Cranberry (Oxycoccus spp.)
Pucciniastrum vaccinii.
- Crataegus spp. -- see hawthorn.
- Crowberry (Empetrum nigrum L.)
Chrysomyxa empetri.
- Cryptogramma crista var. acrostichoides -- see fern, parsley.
- Currant, including gooseberry (Ribes spp.)
Spores orange-yellow, 1-celled
Spores borne on open pustules
Melampsora epitea f. sp.
Spores borne under a rounded cover (peridium) with a central pore
Cronartium ribicola
Spores borne in cups (Puccinia caricina DC.)
Spores dark-brown, 2-celled
Spore wall smooth (Puccinia parkerae Diet. & Holw.)
Spore wall with warts (Puccinia ribis DC.).

Cypress, yellow (Chamaecyparis nootkatensis (D. Don) Spach)
Gymnosporangium nootkatense.

Cystopteris fragilis -- see fern, fragile.

Dryopteris austriaca -- see fern, spiny wood.

Eleagnus commutata -- see silverberry.

Empetrum nigrum -- see crowberry.

Epilobium spp. -- see willow herb.

Fern, bracken (Pteridium aquilinum (L.) Kuehn.)
Spores with spines Uredinopsis hashiokai
Spores with 2 rows of warts Uredinopsis pteridis.

Fern, fragile (Cystopteris fragilis (L.) Bernh.)
Hyalopsora polypodii.

Fern, lady (Athyrium filix-femina (L.) Roth.)
Uredinopsis longimucronata.

Fern, licorice (Polypodium vulgare L.)
Milesia laeviuscula.

Fern, oak (Gymnocarpium dryopteris (L.) Newm.)
Spores yellow when fresh Hyalopsora aspidiotus
Spores white when fresh Uredinopsis phegopteridis.

Fern, ostrich (Matteuccia struthiopteris (L.) Todaro)
Uredinopsis struthiopteridis.

Fern, parsley (Cryptogramma crispera (L.) R. Br. var. acrostichoides (R. Br.)
C. B. Clarke) Milesia darkeri.

Fern, spiny-wood (Dryopteris austriaca (Jacq.) Woytn.)
Milesia dilatata.

Fern, sword (Polystichum munitum (Kaulf.) Presl.)
Spores spiny Milesia polystichi
Spores smooth Milesia vogesiaca.

Fir, Douglas (Pseudotsuga menziesii (Mirb.) Franco)
Spores 19 - 26 μ long Melampsora medusae
Spores 26 - 35 μ long Melampsora occidentalis.

Fir (Abies spp.)

Spores white when fresh

Spore horns on needles of the current year's growth
Spore horns thin and fragile; apparent between June and
August on discoloured needles which are dead by September

Uredinopsis longimucronata

Uredinopsis phegopteridis

Uredinopsis struthiopteridis

Spore horns thick and robust; apparent between August and
February on discoloured needles which are dead by March

Milesia spp.

Spore horns on needles of the previous years' growth

Uredinopsis hashioakai

Uredinopsis pteridis

Spores orange-yellow when fresh (turning white when old)

Spores on needles of the current year's growth

Spores borne within spore horns

Rust causing witches' brooms; spore horns short, bullate,
and present on all needles of the broom

Melampsorella caryophyllacearum

Rust not causing witches' brooms; spore horns long,
cylindrical

Pucciniastrum epilobii^{1/}

Spores borne on flat pustules

Spores with long, cylindrical warts; spore walls thickened
at apex

Melampsora epitea var.

Spores with short, shallow warts; spore walls thickened
on opposite sides (observed on inoculated seedlings only)

Spores large, 26 - 35 μ long

Melampsora occidentalis

Spores small, 19 - 26 μ long

Melampsora medusae

Spores on needles 1 to 2 years old

Pucciniastrum goeppertianum^{1/}

Spores on needles 2 to 3 years old

Hyalopsora aspidiotus.

Fire-weed -- see willow-herb.

Galium triflorum -- see bedstraw.

Gaultheria hispidula -- see snowberry.

Geocaulon lividum -- see comandra, northern.

^{1/} Occasionally, spore horns of Pucciniastrum goeppertianum develop on
needles of the current year's growth, but not until autumn.

Goldenrod (Solidago spp.)

Spores orange to pale yellow

Spores not covered by an envelope (peridium)

Coleosporium asterum

Spores covered by an envelope

(Puccinia dioicae P. Magn.)

(Puccinia stipae Arth.)

Spores dark brown

(Puccinia grindeliae Peck)

(Uromyces sommerfeltii Hyl., Joerst.
& Nannf.).

Gooseberry -- see currant.

Gramineae -- see grass.

Grass (Gramineae)

Puccinia coronata

(Puccinia spp.; only specialists can distinguish P. coronata from the many other rusts on grass).

Grindelia integrifolia -- see gum weed.

Gum-weed (Grindelia integrifolia DC.)

Coleosporium asterum.

Gymnocarpium dryopteris -- see fern, oak.

Hawthorn (Crataegus spp.)

Spore horns with brown spores

Cells of the spore horns ridged and straight when wet

Gymnosporangium bethelii

Cells of the spore horns warted and curved when wet

Gymnosporangium clavariiforme

Spore horns with yellow spores

Gymnosporangium clavipes.

Hemlock (Tsuga spp.)

Spores borne under a shallow, cone-shaped cover with a central pore

Pucciniastrum vaccinii

Spores borne on an irregular, flat pustule without a cover

Melampsora epitea f. sp. tsugae.

Huckleberry, including bilberry, blueberry and rock cranberry
(Vaccinium spp.)

Causing witches' brooms with thickened, red-brown stems
Pucciniastrum goeppertianum

Not causing witches' brooms

Spores developed on current year's foliage under a shallow,
cone-shaped cover with a central pore

Pucciniastrum vaccinii

Spores developed on previous year's foliage on an irregular,
flat pustule

Chrysomyxa ledi var. vaccinii.

Juniper (Juniperus spp.); spores brown or yellow, gelatinizing after rain,
2-celled

Fruiting on witches' brooms of Rocky Mountain and creeping juniper
Gymnosporangium nidus-avis

Fruiting on Branch galls

Forming dark-brown spore horns on galls of Rocky Mountain and
creeping juniper

Gymnosporangium bethelii

Gymnosporangium nelsoni

Gymnosporangium corniculans

Forming brown spore crusts on galls of dwarf juniper

Gymnosporangium tremelloides

Fruiting on spindle-shaped swellings of branches

Spores yellow

Forming long, cylindric spore horns on dwarf juniper

Gymnosporangium clavariiforme

Forming spore crusts on hemispheric pustules of dwarf
juniper

Gymnosporangium clavipes

Spores dark-brown, forming wedge- or tongue-shaped spore horns
on exotic junipers

Gymnosporangium fuscum

Causing no pronounced host symptoms

Spores yellow

Forming long, cylindric spore horns on branches and twigs of
dwarf juniper

Gymnosporangium clavariiforme

Forming spore crusts on pustules of branches and twigs

On Rocky Mountain juniper

Gymnosporangium inconspicuum

On dwarf juniper

Gymnosporangium clavipes

Spores brown

On pustules of twigs and leaves of native dwarf juniper

Gymnosporangium cornutum

On pustules of twigs and leaves of exotic Chinese juniper
(Juniperus chinensis L. vars.)

Gymnosporangium haraeaeum.

Juniperus spp. -- see juniper.

Kinnikinnick (Arctostaphylos uva-ursi (L.) Spreng.)

Forming waxy, yellow spore crusts

Chrysoomyxa arctostaphyli.

Labrador tea (Ledum spp.)

Fruiting on upper surface of leaves

Chrysoomyxa ledicola

Fruiting on lower surface of leaves

Forming large, irregular, pale-yellow crusts and causing loose
witches' brooms

Chrysoomyxa woroninii

Forming small, round, orange-yellow pustules without causing
witches' brooms

Chrysoomyxa ledi vars.

Larch, including tamarack (Larix spp.)

Spores borne on flat pustules

Spores with short warts, spore walls thickened on opposite sides

Spores large, 26 - 35 μ long

Melampsora occidentalis

Spores small, 19 - 26 μ long

Melampsora medusae

Spores with longer warts, spore walls not thickened on opposite
sides

Melampsora epitea var.

Spores, borne within short spore horns (not yet found in western
Canada)

Melampsorium betulinum.

Larix spp. -- see larch.

Ledum spp. -- see Labrador tea.

Madia sativa -- see tar-weed.

Madrone (Arbutus menziesii Pursh)

Spores orange-yellow, 1-celled, spiny

Pucciniastrum sparsum.

Malus diversifolia -- see crab-apple, Pacific.

Matteuccia struthiopteris -- see fern, ostrich.

Melampyrum lineare -- see cow-wheat.

Moneses uniflora vars. -- see single-delight.

Mountain-ash (Sorbus sitchensis Roem. vars.)

Spores yellow

Fruiting on leaves; spores borne in robust cups

Gymnosporangium nootkatense

Fruiting on fruit and twigs; spores borne in fragile horns

Gymnosporangium clavipes

Spores brown

Spores 30 - 45 μ long, borne in cups

Gymnosporangium tremelloides

Spores 21 - 29 μ long, borne in horns

Gymnosporangium cornutum.

Myrica gale -- see sweet-gale.

Oxycoccus spp. -- see cranberry.

Paint-brush (Castilleja spp.)

Cronartium coleosporioides.

Pear (Pyrus spp.)

Spore horns borne on orange-yellow leaf spots, spores brown

Spore horns 0.5 - 1.0 mm in diameter, acorn-shaped, and beginning to rupture along the sides when mature; on common pear (Pyrus communis L.) only

Gymnosporangium fuscum

Spore horns 0.2 - 0.4 mm in diameter, cylindrical, and beginning to rupture at the apex when mature; rarely on common pear, mostly on Chinese pear (Pyrus sinensis Lindl.)

Gymnosporangium haraeaeum.

Picea spp. -- see spruce.

Pine (Pinus spp.)

Fruiting on needles only

Spores borne in spore horns, on needles older than 1 year

Coleosporium asterum

Spores borne on shallow, open pustules, on needles younger than 1 year

Spores small, 19 - 26 μ long

Melampsora medusae

Spores large, 26 - 35 μ long

Melampsora occidentalis

Fruiting on stems, branches and twigs only

On "soft" (5- needle-) pines

Cronartium ribicola

On "hard" pines

Causing woody, globose, pear-shaped or hemispheric galls, including so-called "hip cankers"

Peridermium harknessii

Causing more or less pronounced swellings or cankers

Spores distinctly pear-shaped, up to 70 μ long

Cronartium comandrae

Spores ellipsoid to egg-shaped, up to 35 μ long

Cronartium coleosporioides

Cronartium comptoniae.

Pinus spp. -- see pine.

Pipsissewa (Chimaphila umbellata (L.) Bart. vars.)

Spores yellow, 1-celled, spiny

Pucciniastrum pyrolae.

Plum, garden (Prunus domestica L.)

Spores spiny, brownish-yellow and 1-celled or chestnut brown and 2-celled

Tranzschelia discolor.

Polypodium vulgare -- see fern, licorice.

Polypody -- see fern, licorice.

Poplar, including aspen and cottonwood (Populus spp.)

Spores small, 23 - 25 μ long Melampsora medusae

Spores large, 32 - 48 μ long Melampsora occidentalis.

Populus spp. -- see poplar.

Prince's pine -- see pipsissewa.

Prunus domestica -- see plum, garden.

Pseudotsuga menziesii -- see fir, Douglas.

Pteridium aquilinum vars. -- see fern, bracken.

Pyrola (Pyrola spp.)

Spores spiny, borne under a shallow, rounded cover with a central pore

Pucciniastrum pyrolae

Spores not spiny, borne on round, open pustules

Chrysomyxa pirolata.

Pyrola, one-flowered -- see single-delight.

Pyrola spp. -- see pyrola.

Pyrus spp. -- see pear.

Ranunculus spp. -- see buttercup.

Raspberry, including bramble (Rubus spp.)

Spores borne under a shallow, rounded cover with a central pore

Pucciniastrum americanum

Pucciniastrum arcticum

Spores borne on round, open pustules

(Gymnoconia peckiana (Howe) Trott.)

(Kuehneola uredinis (Link) Arth.)

(Phragmidium spp.).

Rhamnus spp. -- see buckthorn.

Rhinanthus crista-galli -- see yellow-rattle.

Rhododendron (Rhododendron spp.)

Spores small, 19 - 29 μ long Chrysomyxa ledi var. rhododendri

Spores large, 40 - 65 (up to 77) μ long

Chrysomyxa piperiana.

Rhododendron spp. -- see rhododendron.

Ribes spp. -- see currant.

Rubus spp. -- see raspberry.

Salix spp. -- see willow.

Saskatoon-berry (Amelanchier alnifolia Nutt. vars.)

Spore horns with yellow spores; chiefly on fruit, rarely on twigs

Gymnosporangium clavipes

Gymnosporangium inconspicuum

Spore horns with brown spores; chiefly on leaves, rarely on fruit or twigs

Gymnosporangium clavariiforme

Gymnosporangium corniculans

Gymnosporangium nelsoni

Gymnosporangium nidus-avis.

Shepherdia canadensis -- see soopolallie.

Silverberry (Eleagnus commutata Bernh.)

Spore cups crowded; spores small, 16 - 24 μ long

Puccinia coronata

Spore cups not crowded; spores slightly larger, 19 - 29 μ long

(Puccinia caricis-shepherdiae).

Single-delight (Moneses uniflora (L.) A. Gray vars.)

Spores spiny, borne under a rounded cover with a central pore

Pucciniastrum pyrolae

Spores not spiny, borne on open pustules

Spore warts crowded and regular in shape

Chrysomyxa pirolata

Spore warts not crowded, irregular in shape

Chrysomyxa monesis.

Snowberry (Gaultheria hispidula (L.) Muhl.)

Chrysomyxa chiogenis.

Solidago spp. -- see goldenrod.

Soopolallie (Shepherdia canadensis (L.) Nutt.)

Spore cups crowded; spores small, 16 - 24 μ long

Puccinia coronata

Spore cups not crowded; spores slightly larger, 19 - 29 μ long

(Puccinia caricis-shepherdiae).

Sorbus sitchensis vars. -- see mountain-ash.

Spruce (Picea spp.)

Fruiting on needles of the previous year's growth only

Chrysoomyxa weirii

Fruiting on needles or cone scales of the current year's growth only

Causing witches' broom and fruiting on all needles of the infected broom

Chrysoomyxa arctostaphyli

Causing shoot blight and fruiting on all needles of the infected young shoot

Chrysoomyxa woroninii

Causing cone rust and fruiting on all scales of the infected cone

Spore warts crowded and regular in shape

Chrysoomyxa pirolata

Spore warts not crowded, irregular in shape

Chrysoomyxa monesis

Causing needle cast and fruiting on single, infected needles, rarely on single cone scales

Spores borne under rounded covers, or in cups, or in short spore horns

Spores very long and slender, 40 - 126 μ long

Chrysoomyxa piperiana

Spores medium long, 27 - 47 μ , globose to ellipsoid

Chrysoomyxa ledicola

Chrysoomyxa empetri

Spores small, 18 - 33 μ long, globose to ellipsoid

Spores with a smooth spot and maturing in early summer

Pucciniastrum americanum

Pucciniastrum spp.

Spores without a smooth spot and maturing in late summer

Chrysoomyxa ledi vars.

Spores borne on shallow, open pustules (observed on inoculated seedlings only)

Spores small, 19 - 26 μ long

Melampsora medusae

Spores large, 26 - 35 μ long

Melampsora occidentalis.

Stellaria spp. -- see chickweed.

Sweet-gale (Myrica gale L.)

Cronartium comptoniae.

Tamarack -- see larch.

Tar-weed (Madia sativa Mol.)

Spores orange-yellow

Coleosporium madiae

Spores brown

(Puccinia nuda Ell. & Ev.).

Tsuga spp. -- see hemlock.

Vaccinium spp. -- see huckleberry.

Willow (Salix spp.)

Melampsora epitea vars. & f. sps.

Willow-herb, including fire-weed (Epilobium spp.).

Spores borne under a round cover with a central pore, orange-yellow,
1-celled, spiny

Spores not as above

Pucciniastrum epilobii

(Puccinia dioicae P. Magn.)

(Puccinia epilobii DC.)

(Puccinia gigantea Karst.)

(Puccinia oenotherae Vize)

(Puccinia pulverulenta Grev.)

(Puccinia scandica Johans.)

(Puccinia veratri Duby).

Wintergreen -- see pyrola.

Yellow-rattle (Rhinanthus crista-galli L.)

Cronartium coleosporioides.

LIST OF RUSTS

WITH THEIR HOSTS

LIST OF RUSTS

with their hosts

- Chrysomyxa arctostaphyli Diet. -- spruce broom rust
O & I on needles of witches' brooms of white, black, Engelmann, Norway and Sitka spruce (Picea spp.).
III on leaves of kinnikinnick (Arctostaphylos uva-ursi).
- Chrysomyxa chiogenis Diet. -- spruce-snowberry rust
O & I on needles of spruce (Picea spp.); not known from western Canada.
II on leaves of snowberry (Gaultheria hispidula).
- Chrysomyxa empetri Schroet. ex Cumm. -- spruce-crowberry rust
O & I on needles of black, white, Engelmann and blue spruce (Picea spp.).
II on leaves of crowberry (Empetrum nigrum).
- Chrysomyxa ledi de Bary var. cassandrae (Peck & G. W. Clint.) Savile -- spruce-cassandra rust
O & I on needles of spruce (Picea spp.); not known from western Canada.
II & III on leaves of cassandra (Chamaedaphne calyculata).
- Chrysomyxa ledi var. glandulosi Savile -- spruce-Ledum rust
O & I on needles of Engelmann spruce (Picea engelmannii).
II & III on leaves of glandular Labrador tea (Ledum glandulosum).
- Chrysomyxa ledi var. groenlandici Savile -- spruce-Ledum rust
O & I on needles of white spruce (Picea glauca).
II on leaves of Labrador tea (Ledum groenlandicum).
- Chrysomyxa ledi var. ledi -- spruce-Ledum rust
O & I on needles of spruce (Picea spp.); not known from western Canada.
II on leaves of glandular and northern Labrador tea (Ledum spp.).
- Chrysomyxa ledi var. rhododendri (de Bary) Savile -- rhododendron rust
O & I on needles of spruce (Picea spp.); not known from North America.
II on leaves of cultivated and wild rhododendron (Rhododendron spp.).
- Chrysomyxa ledi var. vaccinii Ziller -- red huckleberry rust
O & I unknown, probably on needles of spruce (Picea spp.).
II & III on evergreen leaves of red huckleberry (Vaccinium parvifolium).

Chrysomyxa ledicola Lagerh. -- spruce-Ledum rust

O & I on needles of white, black, Sitka, Engelmann and blue spruce (Picea spp.).

II & III on upper leaf surface of Labrador tea (Ledum spp.).

Chrysomyxa monesis Ziller -- coastal spruce cone rust

O & I on cones of Sitka spruce (Picea sitchensis).

II & III on entire plant of single-delight (one-flowered pyrola, Moneses uniflora).

Chrysomyxa piperiana Sacc. & Trott. ex Cumm. -- spruce-rhododendron rust

O & I on needles of Sitka spruce (Picea sitchensis); not known from Canada.

II & III on leaves of California rhododendron (Rhododendron macrophyllum) and cultivated hybrids thereof.

Chrysomyxa pirolata Wint. -- inland spruce cone rust

O & I on cones of white, black, Engelmann, Sitka and blue spruce (Picea spp.).

II & III on entire plant of pyrola, wintergreen and single-delight (Pyrola spp. and Moneses uniflora).

Chrysomyxa weirii Jacks. -- Weir's spruce cushion rust

O & I absent (no primary host).

III on previous year's needles of Engelmann, white and Sitka spruce (Picea spp.).

Chrysomyxa woroninii Tranz. -- spruce shoot rust

O & I on young shoots of white and black spruce (Picea spp.).

III on leaves of witches' brooms of Labrador tea (Ledum spp.).

Coleosporium asterum (Diet.) Syd. -- pine-aster rust

O & I on needles of lodgepole, jack and Scots pine (Pinus spp.).

II & III on leaves of aster (Aster spp.), goldenrod (Solidago spp.) and gum weed (Grindelia integrifolia).

Coleosporium campanulae Lev. ex Kickx -- pine-bluebell rust

O & I on needles of pine (Pinus spp.). Not known from western Canada.

II & III on leaves of bluebell (Campanula persicifolia).

Coleosporium madiae (Syd.) Arth. -- pine-tarweed rust

O & I on needles of Monterey pine (Pinus radiata); not known from western Canada.

II & III on leaves of tar-weed (Madia sativa).

Cronartium coleosporioides Arth. -- stalactiform blister rust

- O & I (Peridermium stalactiforme Arth. & Kern) on branches and stems of jack and lodgepole pine (Pinus banksiana and P. contorta).
II & III on leaves of paint-brush (Castilleja spp.), cow-wheat (Melampyrum lineare) and yellow-rattle (Rhinanthus crista-galli).

Cronartium comandrae Peck -- comandra blister rust

- O & I on stems and branches of jack, lodgepole, ponderosa and Scots pine (Pinus spp.).
II & III on leaves of northern comandra (Geocaulon lividum) and pale comandra (Comandra umbellata var. pallida).

Cronartium comptoniae Arth. -- sweet-fern blister rust

- O & I on stems and branches of jack, lodgepole, ponderosa, Monterey and bishop pine (Pinus spp.).
II & III on leaves of sweet-gale (Myrica gale).

Cronartium ribicola J. C. Fisch. ex Rab. -- white pine blister rust

- O & I on stems and branches of eastern and western white pine, whitebark, limber and sugar pine (Pinus spp.).
II & III on leaves of wild and cultivated currant and gooseberry (Ribes spp.).

Gymnosporangium bethelii Kern -- Bethel's juniper rust

- O & I on leaves and fruit of black and Columbia hawthorn (Crataegus spp.).
III on branch galls of creeping and Rocky Mountain juniper (Juniperus horizontalis and J. scopulorum).

Gymnosporangium clavariiforme (Pers.) DC. -- clavariform juniper rust

- O & I on fruit, twigs and leaves of Saskatoon-berry (Amelanchier alnifolia) and English hawthorn (Crataegus oxyacantha).
III on branch swellings of dwarf juniper (Juniperus communis vars.).

Gymnosporangium clavipes (Cooke & Peck) Cooke & Peck -- quince rust

- O & I on fruit and twigs of Saskatoon-berry (Amelanchier alnifolia), black and Columbia hawthorn (Crataegus douglasii and C. columbiana), and dwarf mountain-ash (Sorbus sitchensis var. grayi).
III on twigs, branches and stems of dwarf juniper (Juniperus communis vars.).

Gymnosporangium corniculans Kern -- Saskatoon-juniper rust

- O & I on leaves of Saskatoon-berry (Amelanchier alnifolia).
III on branch galls of creeping juniper (Juniperus horizontalis).

Gymnosporangium cornutum Arth. & Kern -- mountain-ash juniper rust

- O & I on leaves of mountain-ash (Sorbus sitchensis vars.) and Pacific crab-apple (Malus diversifolia).
III on twigs and leaves of dwarf juniper (Juniperus communis).

- Gymnosporangium fuscum Hedw. f. in DC. -- pear trellis rust
O & I on leaves, rarely fruit and twigs, of common pear (Pyrus communis).
III on twigs, branches and stems of exotic juniper (Juniperus chinensis vars., J. sabina vars. and J. squamata vars.).
- Gymnosporangium haraeaeum Syd. -- Chinese pear-juniper rust
O & I on leaves of pear (Pyrus spp.); not yet found in Canada.
III on leaves and twigs of exotic, mainly Chinese juniper (Juniperus chinensis vars.).
- Gymnosporangium inconspicuum Kern -- inconspicuous juniper rust
O & I on fruit of Saskatoon-berry (Amelanchier alnifolia).
III on twigs and branches of Rocky Mountain juniper (Juniperus scopulorum).
- Gymnosporangium nelsoni Arth. -- Nelson's juniper rust
O & I on leaves and fruit of Saskatoon-berry (Amelanchier alnifolia).
III on branch galls of Rocky Mountain and creeping juniper (Juniperus scopulorum and J. horizontalis).
- Gymnosporangium nidus-avis Thaxt. -- juniper broom rust
O & I on leaves and fruit of Saskatoon-berry (Amelanchier alnifolia).
III on witches' brooms of Rocky Mountain and creeping juniper (Juniperus scopulorum and J. horizontalis).
- Gymnosporangium nootkatense Arth. -- yellow cypress rust
O & I on leaves, rarely fruit, of western and dwarf mountain-ash (Sorbus sitchensis vars.), and Pacific crab-apple (Malus diversifolia).
II & III on foliage of yellow cypress (Chamaecyparis nootkatensis).
- Gymnosporangium tremelloides Hartig -- dwarf juniper gall rust
O & I on leaves of western and dwarf mountain-ash (Sorbus sitchensis vars.).
III on branch galls of dwarf juniper (Juniperus communis).
- Hyalopsora aspidiotus (Magn.) Magn. -- fir-oak fern rust
O & I on previous years' needles of alpine, amabilis and grand fir (Abies spp.).
II & III on fronds of oak fern (Gymnocarpium dryopteris).
- Hyalopsora polypodii (Diet.) Magn. -- fragile fern rust
O & I unknown, probably on conifer.
II & III on fronds of fragile fern (Cystopteris fragilis).

Melampsora epitea Thuem. vars. and f. sps. -- willow rust

- O & I on foliage of fir, larch, tamarack, gooseberry and currant (Abies, Larix and Ribes spp.).
II & III on foliage, rarely buds, catkins and twigs, of willow (Salix spp.).

Melampsora epitea f. sp. tsugae Ziller -- hemlock-willow rust

- O & I on needles, rarely cones, of western and mountain hemlock (Tsuga spp.).
II & III on leaves of Scouler and Sitka willow (Salix spp.).

Melampsora medusae Thuem. -- conifer-aspen rust

- O & I on needles of 18 species of conifers: Douglas fir, larch, pine, true fir, hemlock and spruce (Pseudotsuga, Larix, Pinus, Abies, Tsuga and Picea spp.), the latter three known from seedling infections only.
II & III on leaves of trembling aspen (Populus tremuloides).

Melampsora occidentalis Jacks. -- conifer-cottonwood rust

- O & I on needles of 12 species of conifers: Douglas fir, larch, pine, fir, and spruce (Pseudotsuga, Larix, Pinus, Abies and Picea spp.), the latter two known from seedling infections only.
II & III on leaves of black cottonwood, and balsam and hybrid poplars (Populus trichocarpa, P. balsamifera and Populus spp.).

Melampsorella caryophyllacearum Schroet. -- fir broom rust

- O & I on needles of witches' brooms of alpine, amabilis, balsam and grand fir (Abies spp.).
II & III on leaves of chickweed (Cerastium and Stellaria spp.).

Melampsorium betulinum (Fr.) Kleb. -- birch rust

- O & I on needles of larch (Larix spp.); not known from western North America.
II & III on leaves of glandular, Kenai, water, white and European species of birch (Betula spp.).

Milesia darkeri Faull -- parsley fern rust

- O & I unknown; probably on needles of fir (Abies spp.).
II & III on fronds of parsley fern (Cryptogramma crispa var. acrostichoides).

Milesia dilatata Faull -- wood fern rust

- O & I unknown; probably on needles of fir (Abies spp.).
II & III on fronds of spiny wood fern (Dryopteris austriaca).

Milesia laeviuscula (Diet. & Holw.) Faull -- fir-polypody rust

- O & I on needles of grand fir (Abies grandis).
II & III on fronds of licorice fern (Polypodium vulgare).

- Milesia polystichi Wintel. ex Faull -- spiny-spored swordfern rust
O & I unknown; probably on needles of fir (Abies spp.) or lacking.
II on fronds of sword fern (Polystichum munitum).
- Milesia vogesiaca Faull -- smooth-spored sword fern rust
O & I on needles of fir (Abies spp.); not known from western Canada.
II & III on fronds of sword fern (Polystichum munitum).
- Peridermium harknessii J. P. Moore -- western gall rust
I on branch galls of hard pines (Pinus spp.) includ. jack, lodgepole, ponderosa, Scots, Monterey, Austrian, bishop, cluster, and mountain pine.
II & III lacking (no alternate host).
- Puccinia coronata Corda -- crown rust
O & I on leaves of soaplallie (Shepherdia canadensis), cascara, alderleaved and European buckthorn (Rhamnus spp.), and silverberry (Eleagnus commutata).
II & III on the blades of approximately 20 species of grasses.
- Pucciniastrum americanum (Farl.) Arth. -- American spruce-raspberry rust
O & I on needles, seldom cones, of Engelmann spruce (Picea engelmannii).
II & III on leaves of western red raspberry (Rubus melanolasius).
- Pucciniastrum arcticum Tranz. -- arctic spruce-raspberry rust
O & I on needles of white spruce (Picea glauca).
II & III on leaves of arctic and hairy bramble (Rubus arcticus and R. pubescens).
- Pucciniastrum epilobii Otth. -- fir-fireweed rust
O & I on needles, seldom cones, of alpine, balsam, amabilis, grand and white fir (Abies spp.).
II & III on leaves, seldom stems, of willow-herb (Epilobium spp.), mainly fire-weed (E. angustifolium).
- Pucciniastrum goeppertianum (Kuehn) Kleb. -- blueberry broom-rust
O & I on needles of alpine, amabilis, balsam and grand fir (Abies spp.).
III on blueberry, huckleberry and bilberry (Vaccinium spp.).
- Pucciniastrum guttatum (Schroet.) Hyl., Joerst. & Nannf. --
O & I unknown, possibly on conifer.
II & III on leaves of sweet-scented bedstraw (Galium triflorum).
- Pucciniastrum pyrolae Diet. ex Arth.
O & I unknown, possibly on conifer.
II & III on leaves of pyrola (wintergreen; Pyrola spp.) pipsissewa (prince's pine, Chimaphila umbellata) and single-delight (Moneses uniflora).

Pucciniastrum sparsum (Wint.) E. Fisch. -- spruce-bearberry rust
O & I on needles of spruce (Picea spp.); not known from America.
II & III on leaves of madrone (Arbutus menziesii) and alpine
bearberry (Arctostaphylos alpina).

Pucciniastrum vaccinii (Wint.) Joerst. -- hemlock-blueberry rust
O & I on needles of eastern, western and mountain hemlock (Tsuga spp.).
II & III on leaves of blueberry, bilberry, huckleberry (Vaccinium spp.)
and cranberry (Oxycoccus spp.).

Tranzschelia discolor (Fckl.) Tranz. & Litv. -- plum rust
O & I on leaves of poppy anemone (Anemone coronaria var.) and
buttercup (Ranunculus recurvatus).
II & III on leaves of common garden plum (Prunus domestica).

Uredinopsis hashiokai Hirat. f. -- Hashioka's fir-bracken rust
O & I on needles of all ages of grand and alpine fir (Abies spp.).
II & III on fronds of bracken fern (Pteridium aquilinum vars.).

Uredinopsis longimucronata Faull -- fir-lady fern rust
O & I on needles of alpine, amabilis and grand fir (Abies spp.).
II & III on fronds of lady fern (Athyrium filix-femina).

Uredinopsis phegopteridis Arth. -- fir-oakfern rust
O & I on needles of alpine fir (Abies lasiocarpa).
II & III on fronds of oak fern (Gymnocarpium dryopteris).

Uredinopsis pteridis Diet. & Holw. -- common fir-bracken rust
O & I on needles of all ages of grand, amabilis and alpine fir
(Abies spp.).
II & III on fronds of bracken fern (Pteridium aquilinum vars.).

Uredinopsis struthiopteridis Stoerm. ex Diet. -- fir-ostrich fern rust
O & I on needles of alpine fir (Abies lasiocarpa).
II & III on fronds of ostrich fern (Matteuccia struthiopteris).