

## Chapter Seven

# DISEASES OF SHADE TREES AND SHELTERBELTS

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## **GENERAL DISEASE CONTROL METHODS FOR SHADE TREES AND SHELTERBELTS**

Good health and avoidance of severe deformation or death are more important in the production of shade trees than the yield of an agricultural commodity. For this reason, disease control is approached from a different viewpoint from that used with most other crops. Destructive diseases of ornamental and shade trees must be treated accordingly. Many others should be considered as 'natural phenomena' where no control measure is needed or advised.

### **Selection of trees for planting**

Tree diseases often result directly from planting trees in a climatically unsuitable area. Therefore, it is important to select tree species or cultivars to suit the particular climatic zone. Often nursery stock raised in milder climatic zones is sold in areas where it may not be hardy enough to survive. This is particularly true in the Prairie Provinces where purchasers have access to planting stocks from milder areas of British Columbia, Ontario, and United States either through local retail outlets or through catalogues. Typically such planting stock dies-back year after year even though it may have performed well when first planted.

### **Tree planting conditions**

Careful selection of planting sites is very important to the continued health of ornamental trees. Some species need more moisture than others. Some species prefer shady locations and others need full exposure to sun to grow properly. Conditions of the soil (acidity, nutrient supply, texture, etc.), water drainage, and wind protection of the site are often critical for the survival and growth of trees. Previous history of the site in terms of disease occurrence, especially with relation to soil-borne pathogens such as the root rotting and crown rotting pathogens, should also be considered when selecting the site for certain tree species. When one or more of the above mentioned planting conditions are not favourable, the tree becomes predisposed to attack by certain diseases.

Many shade and shelterbelt trees are produced in natural forests or in nurseries surrounded by natural forests and consequently may be diseased by the time they are selected for transplanting. A common disease known to be introduced in this manner is western gall rust (*Endocronartium harknessii*). Therefore; always select disease-free trees for transplanting.

Condition of planting stock is also important. When root systems are severely damaged during transplanting and handling the result may be poor survival and performance.

### **Tree care and maintenance**

Good general cultural practices such as pruning, watering, fertilizing, and weed control can often reduce the effects of adverse conditions.

### **Root Rots**

Root rots caused by both the structural root rots of basidiomycete decay fungi and the small root feeders of water mold origin can be minimized by keeping trees vigorous and avoiding wounds in the root system and near the base of the tree. Infected trees may require removal if damage is severe, and roots and stumps should be removed before replanting.

### **Cankers**

Cankers may be reduced by avoiding all unnecessary wounds and by employing sound pruning techniques, removal of all infected tissues and by maintaining good host vigour by regular watering and applications of balanced fertilizers to reduce stress on trees.

## **Leaf or Foliage Diseases**

Control of leaf and foliage diseases is not usually recommended unless the health of the tree is threatened, trees are under severe stress, or the aesthetic value of the tree would be lost. Once the leaf disease is noticed, it is usually too late to control the disease but it may be possible to prevent new infections from occurring. Fungicides must be applied before infection occurs. The use of resistant varieties, when available, offers the best control. Sanitation by removing leaves in fall or spring before spore release may be of some help if leaves are the overwintering site. This will not be effective if the disease overwinters in the buds, on the bark, or on dead twigs.

## **Wilts**

Wilt disorders caused by pathogenic organisms are controlled mainly by protection of susceptible trees against insect vectors, by eradication of infected hosts to minimize disease spread and by prevention of infection by root grafts. Knowledge of the disease cycle and its spread is of utmost importance to reduce the spread of wilt diseases. Therapeutic treatments of trees infected with wilt diseases have had minimal success.

## **Decays**

Decay of trees, in most instances, should be considered as a natural condition of mature and over-mature trees. The incidence and extent of decay, however, can be reduced by proper pruning and treatment of pruning and other wounds since decay fungi usually enter through branch stubs and stem wounds. Decay itself does not kill trees. Decay fungi attack the dead part of the tree (heartwood). However, the decay weakens the structure of the tree and breakage may result.

## **Hazard Trees**

A hazard tree may be defined as any tree structurally weakened and likely to fail. The failure of one or more of its parts may result in property damage and/or personal injury. The main concern is the failure potential (a defect), the failure impact (the target - a person or object which it might hit) and the environment that may contribute to that failure (wind or ice). Trees may be classified as hazard trees if internal decay, cankers, root rots and poor structural configuration may contribute to their structural failure and collapse. Removal of hazard trees of high risk to human safety or property damage may be necessary. Pruning or repair of damaged parts may be feasible.

## **Winter injury**

The primary cause of many so-called 'die-back' and 'canker' diseases is winter injury. Extremely low temperatures in winter or alternate periods of freezing and thawing may cause 'winter injury'. Selection of suitably hardy species for the area and careful location of the planting site will reduce damage of this type. If possible, avoid low lying "frost" hollows.

## **Chemical injury**

The injury of shade and shelterbelt trees by chemicals, especially by nonselective herbicides and soil sterilants, is fairly widespread. Spray drift from fields or gardens adjacent to trees and penetration into the root zone of chemicals applied to the soil are the two main sources of chemical injury. The symptoms expressed depend on the chemical responsible and on the manner in which it came into contact with the tree.

## ALDER (*Alnus* spp.)

### HYPOXYLON CANKER

*Entoleuca mammata*

**Cultural:** Prune out cankers to sound wood. Fertilize and water trees to ensure vigorous growth.

**Resistant Cultivars:** None.

**Chemical:** None.

### OTHER DISEASES

The following diseases of alder are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Catkin Blister** (*Taphrina robinsoniana*)

**Leaf Spot** (*Septoria alnifolia*)

**Leaf Blister** (*Taphrina occidentalis*)

**Powdery Mildew** (*Phyllactinia guttata*)

## APPLE (*Malus* spp.)

See Apple in Chapter 10 and Crabapple in Chapter 6.

## ASH (*Fraxinus* spp.)

### ANTHRACNOSE

*Gnomoniella fraxini*

**Cultural:** Remove cankered branches and prune trees to allow for good air circulation. Fertilize trees in spring to promote vigorous growth. Rake up fallen leaves in the autumn.

**Resistant Cultivars:** None.

**Chemical:** Mancozeb (COM) WG, WP at 10-14 day intervals beginning just prior to bud burst and continuing as long as wet weather persists in spring. Limitations: As per label.

## OTHER DISEASES

The following diseases of this host are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Ash Yellows** (phytoplasma-like organisms)

**Leaf Spot** (*Mycosphaerella effigurata*, *M. fraxinicola*)

**Powdery Mildew** (*Phyllactinia guttata*)

**Rust** (*Puccinia sparganioides*)

## ASPEN

See Poplar on page 18 in this chapter.

## BIRCH (*Betula* spp.)

### DIEBACK

Water stress, nutrient deficiency, bronze birch borer.

**Cultural:** Plant birch in protected locations away from excessive pedestrian and vehicle traffic. Fertilize regularly and water adequately especially during drought periods and especially in late fall on the prairies. Prune, at least 15 cm into healthy wood, trees showing dieback symptoms. Destroy birch borer infested parts.

**Resistant Cultivars:** None.

**Intermediate:** native white birch.

**Susceptible:** weeping birch.

**Chemical:** None.

### References:

1. Ives, W.G.H. & H.R. Wong. 1988. The bronze birch borer and its allies. *in* "Tree and Shrub Insects of the Prairie Provinces." Canadian Forestry Service Information Report NOR-X-292.
2. Manitoba Advisory Committee on Shade Tree Protection. 1981. Birch dieback. Manitoba Dep. Agric. Hort. Lines Fact Sheet.

## OTHER DISEASES

The following diseases of this host are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Armillaria Root Rot** (*Armillaria* spp.)

**Hypoxylon Canker** (*Hypoxylon mammatum*)

## CARAGANA (*Caragana arborescens*)

The following diseases of this host are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Leaf Spot** (*Septoria caraganae*)

**Crown Rot** (*Fusarium* spp.)

## CHERRY (*Prunus* spp.)

See Cherry in Chapter 10.

## COTONEASTER (*Cotoneaster acutifolia*)

See Cotoneaster in Chapter 6.

## DOGWOOD (*Cornus* spp.)

See Dogwood in Chapter 6.

## DOUGLAS FIR (*Pseudotsuga menziesii*)

### RHABDOCLINE NEEDLE CAST

*Rhabdocline pseudotsugae*

**Cultural:** None.

**Resistant Cultivars:** See Note 1.

**Chemical:** Mancozeb (COM) WG, WP applied at 10-14 day intervals from April to early June. Chlorothalonil (COM) SU, first application in spring when new growth is 1 to 2 cm in length and additional applications at 3 to 4 week intervals. Limitations: As per label.

**Notes:** ‘Pacific Coast Douglas-fir’ and many individual trees in the Inter-mountain and Rocky Mountain regions show a relatively high degree of resistance (1).

#### References:

1. Brandt, R.W. 1960. The Rhabdocline needle cast of Douglas-fir. Syracuse Univ., Coll. For., Tech. Publ. 84.

## OTHER DISEASES

The following diseases of Douglas-fir are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Adelopus Needle Cast** (*Phaeocryptopus gaeumannii*)

**Needle Rust** (*Melampsora medusae*, *M. occidentalis*) [alternate host = *Populus* spp.]

## ELM (*Ulmus* spp.)

### DUTCH ELM DISEASE

*Ophiostoma ulmi* Bism. Nannf. (*Ceratocystis ulmi*) and *Ophiostoma nova-ulmi* Brasier

**Cultural:** Trees should be kept growing vigorously by adequate watering and fertilizing. Sanitation and tree maintenance by proper pruning and removal of dead and dying trees are essential to reduce the population of elm bark beetles (See Note 2) (2, 4). All elm wood must be properly disposed of to prevent further spread of the beetles or possible breeding habitat. Pruning bans vary from province to province.

**Resistant Cultivars:** None (see Note 1).

**Chemical:** Injection of carbendazim-hydrochloric (COM) SN or propiconazole (COM) EC into roots or root flares (see Note 5) is considered effective in certain conditions and justifiable for high value trees (3). Injection of fungicide at the preventative treatment rate recommended on the product label will protect healthy elms from *O. ulmi* for a period of one year. Injection at the recommended therapeutic rate may arrest *O. ulmi* in the very early stage of infection showing less than 5% crown symptoms. Trees 13 cm or less in diameter at breast height (dbh) should not be treated.

**Limitations:** Fungicide injection must be administered by an arborist or others trained in the recognition of DED and tree injection techniques.

#### Notes:

1. Siberian elm (*Ulmus pumila*) is considered to be more tolerant than American elm (*U. americana*). Japanese elm (*U. davidiana* var. *japonica*) possesses resistance and has been considered for breeding programs. Discovery elm is a commercially available selection of Japanese elm resistant to Dutch elm disease developed by Rick Durand of Portage la Prairie, Manitoba.
2. Insecticide spray to control carrier beetles (native elm bark beetles which overwinter at the base of the elm) is recommended to prevent disease spread. Insecticide spray is not recommended for control of the European elm bark beetle, which feeds and overwinters in elm canopies.
3. Federal plant quarantine regulations prohibit the transportation of elms (live plants and wood with bark) from areas known to have Dutch elm disease to the areas free of it in Canada. Importation of elm from certain countries is also prohibited.
4. Manitoba, Saskatchewan, and Alberta have mandatory control regulations.
5. Make shallow (2 cm) holes when injecting elms with systemic fungicides. Deeper holes may favour radial spread of bacterial wetwood (1).

**References:**

1. Campana, R.J. *et al.* 1980. Increased development of bacterial wetwood associated with injection holes made for control of Dutch elm disease. *Phytopathology* 70: 460.
2. Hildahl, V. 1977. Recognition and control of Dutch elm disease in the prairie provinces. *Blue Jay* 35 (2).
3. Kondo, E. and Huntley, G.D. 1974. A large-capacity injection system for chemical solution in Dutch elm disease control. Great Lakes For. Res. Cent., Can. For. Serv., Inf. Rep. 0-X-192.
4. Van Sickle, G.A. and Sterner, T.E. 1975. Sanitation: a practical protection against Dutch elm disease in Fredericton, New Brunswick. *Plant Dis. Rep.* 60: 336-338.

**SLIME FLUX (BACTERIAL WETWOOD)**

Mechanical injury and bacterial fermentation.

**Cultural:** No control known. To alleviate symptoms for cosmetic reasons, insert a perforated pipe into the bole to relieve pressure and drain liquid.

**Chemical:** None.

**References:**

1. Carter, J.C. 1969. The wetwood diseases of elm. *in* Nat. Hist. Surv., Circ. 50. 9 pp.
2. Sinclair, W.A. *et al.* 1987. Diseases of trees and shrubs. Cornell University Press. 574 pp.

**WILT AND DIEBACK**

*Verticillium albo-atrum*, *V. dahliae*, *Dothiorella ulmi*.

**Cultural:** Verticillium wilt - avoid planting susceptible trees in soil where other plants are known to have died from the disease. Dothiorella wilt - prune infected branches several feet below last visible vascular discoloration.

**Resistant Cultivars:** None (see Notes).

**Chemical:** None.

**Notes:** Individual trees with resistance to Verticillium wilt have been identified. None are currently available from commercial sources.

**References:**

1. Rausher, K.J. *et al.* 1974. Response of elm species and clones to inoculation with *Verticillium albo-atrum*. *Phytopathology* 64: 702-705.
2. Stipes, R.J. and Campana, R.J. (ed.). 1981. Compendium of elm diseases. Am. Phytopath. Soc., St. Paul, Minn.

**OTHER DISEASES**

The following diseases of elm are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Leaf Spot** (*Gnomonia ulmea*)

**FIR (*Abies* spp.)**

The following diseases of fir are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Brown Felt Blight** (*Herpotrichia juniperi* = *H. nigra*)

**Needle Cast** (*Isthmiella abietis*, *I. quadrispora*, *Lirula nervata*, *Lophomerum autumnale*)

**Needle Rust** (*Pucciniastrum epilobii*, *P. goeppertianum*)

**Snow Blight** (*Phacidium abietis*, *Nothophacidium abietinellum*)

**Yellow Witches'-broom** (*Melampsorella caryophyllacearum*)

**HAWTHORN (*Crataegus* spp.)**

See Hawthorn in Chapter 6.

**JUNIPER (*Juniperus* spp.)**

See Juniper in Chapter 6.

**LILAC (*Syringa* spp.)**

See Lilac in Chapter 6.

**MAPLE (*Acer* spp.)****TAR SPOT**

*Rhytisma acerinum*, *R. punctatum*

**Cultural:** None.

**Resistant Cultivars:** None.

**Chemical:** None.

## OTHER DISEASES

The following diseases of maple are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Nectria Canker** (*Nectria cinnabarina*)

**Powdery Mildew** (*Uncinula circinata*)

**Verticillium Wilt** (*Verticillium dahliae*)

## MOUNTAIN ASH (*Sorbus* spp.)

See Mountain Ash in Chapter 6.

## OAK (*Quercus* spp.)

### ANTHRACNOSE

*Gnomonia veneta*

**Cultural:** Remove cankered branches and prune trees to allow for good air circulation. Fertilize trees in spring to promote vigorous growth. Rake up fallen leaves in the autumn.

**Resistant Cultivars:** None.

**Chemical:** Chlorothalonil (COM) SU; mancozeb (COM) WG, WP. Make first application at dormant bud swell and at 7-14 day intervals as required. Limitations: As per label.

**Notes:** Chlorothalonil is registered only for oak in the red oak group.

### SUDDEN OAK DEATH

*Phytophthora ramorum*

**Cultural:** None.

**Resistant Cultivars:** None.

**Chemical:** Fosetyl-Al (COM) WG; metalaxyl M & S (COM) EC. These chemicals received Emergency registration until September 30, 2007 for control or suppression of sudden oak death for field grown ornamentals in nurseries and conifers grown in nurseries and plantations.

**Notes:**

1. There is no known cure for plants already showing symptoms of Sudden Oak Death (SOD). The first introduction of SOD occurred in British Columbia in 2003; additional detections occurred in 2004 and 2005 at nurseries and garden centres. Strict regulatory measures are in place. Avoid introduction of *P. ramorum* into Canada by complying with import policy D-01-01 “Phytosanitary requirements to prevent the entry of *Phytophthora ramorum*, associated with Sudden Oak Death into Canada”. The regulation can be viewed at <http://www.inspection.gc.ca/english/plaveg/protect/dir/d-01-01e.shtml>.
2. See also Chapter 6 of these Guidelines, Diseases of Ornamentals, FACTS ON RAMORUM BLIGHT AND DIEBACK (Sudden Oak Death-SOD) - A Quarantine Disease.
3. A current list of known host species, and a complete list of symptoms and diagnostic guide may be found at the California Oak Mortality Task Force homepage at <http://www.cnr.berkeley.edu/comtf/>.

**References:**

1. Government of British Columbia. Ministry of Agriculture, Food and Fisheries. 2006. Sudden Oak Death. <http://www.agf.gov.bc.ca/cropprot/sod.htm> (accessed March 8, 2007)

**OTHER DISEASES**

The following diseases of oak are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Anthracnose** (*Apiognomonia errabunda*)

**Armillaria Root Rot** (*Armillaria* spp.)

**Leaf Spot** (*Pestalotia unicolor*)

**QUARANTINE DISEASES**

The following disease of oak does not occur at present or is of limited distribution in Canada and is under quarantine regulations:

**Oak Wilt** (*Ceratocystis fagacearum*)

**PEAR (*Pyrus communis*)**

See Pear in Chapter 10.

## PINE (*Pinus* spp.)

### DWARF MISTLETOE

*Arceuthobium americanum*

**Cultural:** Eradicate old infested trees in the vicinity of younger trees and do not plant pines close to old, heavily diseased stands (1, 2).

**Resistant Cultivars:** None.

**Chemical:** None (see Note 1).

**Notes:**

1. Control by herbicides has been unsuccessful.
2. Attacks mainly hard pines (lodgepole, jack, Scots, and ponderosa).

**References:**

1. Baranyay, J.A. 1970. Lodgepole pine dwarf mistletoe in Alberta. Can. For. Serv., Publ. 1286. 22 pp.
2. Van Sickle, G.A. and Wegwitz, E. 1978. Silvicultural control of dwarf mistletoe in young lodgepole pine stands in Alberta and British Columbia. Pac. Res. Cent., Can. For. Serv., Inf. Rep. 0C-X-80.

### DOTHISTROMA NEEDLECAST, RED BAND DISEASE

*Dothistroma pini* (= *D. septospora*)

**Cultural:** Do not prune or shear trees during wet weather.

**Resistant Cultivars:** Austrian pine (*Pinus nigra*) from Yugoslavian seed source.

**Susceptible:** Austrian, lodgepole, red pine, jack pine.

**Chemical:** None.

**References:**

1. Peterson, G.W. 1965. Dothistroma needle blight of Austrian pine: infection and control. Plant Dis. Rep. 49:124-126.

### LOPHODERMIIUM NEEDLECAST

*Lophodermium pinastri*

**Cultural:** None

**Resistant Cultivars:** None.

**Chemical:** Beginning in August and at 3- to 4-week intervals, apply chlorothalonil (COM) SU; mancozeb (COM) WG, WP. Limitations: As per label.

**References:**

1. Ormrod, D. J. 1976. Control of lophodermium needle cast of Scots pine Christmas trees in British Columbia. Can. Plant. Dis. Surv. 56: 69-72.

**SCIRRHIA BROWN SPOT**

*Scirrhia aecicola*

**Cultural:** None.

**Resistant Cultivars:** None.

**Chemical:** Apply chlorothalonil (COM) SU in spring when new shoot growth is 1 to 5 cm in length. Repeat applications at 3 to 4 week intervals as required. Limitations: As per label.

**SIROCOCCUS TIP BLIGHT**

*Sirococcus strobilinus*

**Cultural:** None.

**Resistant Cultivars:** None.

**Chemical:** Beginning in early November, apply chlorothalonil (COM) SU at 2- to 4-week intervals as required. Limitations: As per label.

**Notes:** This disease also occurs on spruce.

**References:**

1. Smith, R.S. Jr. *et al.* 1972. Control of Sirococcus tip blight of Jeffry pine seedlings. Plant Dis. Rep. 56: 241-242.

**STALACTIFORM BLISTER RUST, COMANDRA BLISTER RUST,  
SWEET FERN BLISTER RUST**

*Cronartium coleosporioides*, *C. comandrae*, *C. comptoniae*

**Cultural:** Infection of ornamental pines usually started before the trees were transplanted. Trees should be checked carefully before planting for possible infection. Remove all infected branches or remove whole trees with main stem cankers.

**Resistant Cultivars:** None.

**Chemical:** None.

**Notes:** Hard pine species (jack, lodgepole, ponderosa, and Scots) are susceptible. The alternate host is Indian Paint-brush (*Castilleja miniata*).

**References:**

1. Hiratsuka, Y. and Powell, J.M. 1976. Pine stem rusts of Canada. Can. For. Serv., Tech. Rep. 4. 103 pp.
2. Hiratsuka, Y. 1987. Forest tree diseases of the prairie provinces. Can. For. Serv. Inf. Rpt. NOR-X-286. 142 pp.

**WESTERN GALL RUST**

*Endocronartium harknessii*

**Cultural:** Prune branch galls or remove trees with main stem galls. Avoid planting susceptible pine near diseased, natural stands.

**Resistant Cultivars:** Red pine.

**Susceptible:** Jack, ponderosa, and Scots pine.

**Chemical:** None.

**References:**

1. Hiratsuka, Y. and Powell, J.M. 1976. Pine stem rusts of Canada. Can. For. Ser., Tech. Rep. 4. 103 pp.
2. Hiratsuka, Y. 1987. Forest tree diseases of the prairie provinces. Can. For. Serv. Inf. Rpt. NOR-X-286. 142 pp.

**WHITE PINE BLISTER RUST**

*Cronartium ribicola*

**Cultural:** Remove infected trees or prune infected branches. Remove all alternate hosts (*Ribes* spp.) for at least 300 m.

**Resistant Cultivars:** All hard pines.

**Susceptible:** Soft pines (western white, eastern white, white bark, limber).

**Chemical:** None.

**Notes:** Progress has been made toward the production of resistant cultivars of major white pines. Trees not yet available in Canada.

**References:**

1. Hiratsuka, Y. and Powell, J.M. 1976. Pine stem rusts of Canada. Can. For. Ser., Tech. Rep. 4. 103 pp.
2. Mallett, K.I. 1990. Personal communication. Forestry Canada, Edmonton AB.

## OTHER DISEASES

The following diseases of pine are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Armillaria Root Rot** (*Armillaria* spp.)

**Atropellis Canker** (*Atropellis piniphila*)

**Naemacyclus Needlecast** (*Naemacyclus minor*)

**Needle Rust** (*Coleosporium asterum*)

**Snow Mold** (*Herpotrichia coulteri*)

**Wilt** (*Bursaphelenchus xylophilus* = pinewood nematode)

## QUARANTINE DISEASES

The following disease does not occur or is of limited distribution in Canada because of quarantine regulations:

### SCLERODERRIS CANKER

*Gremmeniella abietina*

**Cultural:** Remove infected trees.

**Resistant Cultivars:** None.

**Chemical:** Chlorothalonil (COM) SU. Make first application in spring when new shoot growth is 1 to 5 cm in length. Make additional applications at 3 to 4 week intervals until conditions no longer favour disease development. Limitations: As per label.

**Notes:**

1. Two strains have been identified in North America. The North American strain causes only minor injury to mature trees. The European strain, presently of limited distribution has been reported to attack mature Scots pine (*Pinus sylvestris*) and red pine (*P. resinosa*).
2. Information on the quarantine regulations pertaining to Scleroderris canker can be found at <http://www.inspection.gc.ca/english/plaveg/pestrava/greabi/greabie.shtml>

**References:**

1. Dorworth, C.E. 1971. Diseases of conifers incited by *Scleroderris lagerbergii* Gremmen. A review and analysis. Environ. Canada, Can. Forestry Serv., Ottawa, Ontario. Publication 1289.
2. Dorworth, C.E. and Davis, C.N. 1982. Current and predicted future impact of the North American race of *Gremmeniella abietina* on jack pine in Ontario. Environ. Can., Can. For. Serv., Great Lakes For. Res. Cent., Sault Ste. Marie, Ontario. Inf. Rep. 0-X-342.
3. Manion, P.D., Editor. 1984. Scleroderris canker of conifers. Proceedings of an international symposium on Scleroderris canker of conifers, Syracuse, New York, June 21-24, 1983. Forestry Services Vol. 13. Martinus Nijhoff/Dr. W. Junk Publishers, The Hague.

## POPLAR AND ASPEN (*Populus* spp.)

### BRONZE LEAF

*Apioplagiostoma populi*

**Cultural:** Avoid planting susceptible species or clones. Poplar clones *Populus* × *canescens* ‘Tower’ (Tower poplar) and *P. tremula* ‘Erecta’ (Swedish columnar aspen) are known to be highly susceptible. Hybrids between trembling aspen and bigtooth aspen and between bigtooth aspen and white poplar are known to be highly susceptible. Remove and destroy fallen leaves. Prune to remove dead branches and to increase air circulation. Avoid dense planting, as this reduces air flow and encourages accumulation of dead leaves.

**Susceptible Species and Hybrids:** *P. alba*, *P. canescens*, *P. × canescens*, *P. grandidentata*, *P. tremula*, *P. tremuloides*, *P. alba* × *grandidentata*, *P. alba* × *tremuloides*, *P. alba* × *sieboldii*, *P. alba* × *dauriana*, *P. canescens* × *grandidentata*, *P. grandidentata* × *tremuloides*, *P. grandidentata* × *dauriana*, *P. tremula* × *tremuloides*, *P. tremuloides* × *canescens*, *P. tremuloides* × *dauriana*.

**Chemical:** None.

**Notes:** Infected leaves tend to remain attached to trees, so removal of fallen leaves will be of limited effectiveness.

#### References:

1. Northover, P.R. and Desjardins, M. 2003. First report of bronze leaf disease on hybrid poplar (*Populus* × *canescens* ‘Tower’) caused by *Apioplagiostoma populi* in Manitoba, Canada. *Plant Dis.* 87: 1538.
2. Sinclair, W.A, Lyon, H.H. and Johnson, W.T. 2005. *Diseases of Trees and Shrubs*. 2<sup>nd</sup> Edition. Cornell University Press. p. 94.
3. Smith, J.A., Blanchette, R.A., Ostry, M.E., and Anderson, N.A. 2002. Etiology of bronze leaf disease of *Populus*. *Plant Dis.* 86: 462-469.

### LEAF SPOT

*Septoria* spp., *Marssonina* spp.

**Cultural:** None.

**Resistant Cultivars:** None.

**Chemical:** Apply thiophanate-methyl (COM) 2-3 times per season at 10-day intervals beginning in mid June or apply chlorothalonil (COM) SU beginning applications at spring bud break. Repeat at 7-14 day intervals until conditions are no longer favourable for disease development. Limitations: As per label.

**Notes:** Chlorothalonil is registered for *Marssonina* leaf spot only.

#### References:

1. Carlson, L.W. 1974. Fungicidal control of poplar leaf spots. *Can. Plant Dis. Surv.* 5: 81-85

## HYPOXYLON CANKER

*Hypoxylon mammatum*

**Cultural:** Fertilize and water high value trees during drought periods and keep trees vigorous and unwounded. Once a tree is heavily infected with the disease, it should be cut down and replaced with other species (1).

**Resistant Cultivars:** *P. deltoides*.

**Susceptible:** *P. tremuloides*.

**Chemical:** None.

**Notes:** Balsam poplar and cottonwood are resistant (1).

### References:

1. Anderson, R.L. 1959. Hypoxylon canker of aspen. U.S. Dep. Agric., For. Pest Leaflet. 6.
2. Anderson, R.L. 1967. Hypoxylon canker of aspen. Pp. 193-194 in A.G. Davidson and R.M. Prentice (eds.). Important forest insects and diseases of mutual concern to Canada, the United States, and Mexico. Can. Dep. For. Rural Dev., Publ. 1180.

## OTHER DISEASES

The following diseases of poplar and aspen are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Branch Gall** (*Diplodia tumefasciens*)

**Leaf Blight** (*Linospora tetrasperma*)

**Leaf Rusts** (*Melampsora medusae*, *M. occidentalis*)

**Rough Bark** (*Rhytidiella moriformis*)

**Septoria Canker** (*Septoria musiva*)

**Shoot Blight** (*Venturia macularis*, *V. populina*)

**Silver Leaf** (*Chondrostereum purpureum*) See Cotoneaster, SILVER LEAF in Chapter 6.

**Slime Flux** (mechanical injury and bacterial fermentation)

## RUSSIAN OLIVE (*Elaeagnus angustifolia*)

The following diseases of Russian olive are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Dieback** (*Camarosporium eleagnellum*)

**Leaf Spot** (*Septoria elaeagni*, *Cercospora manitobana*)

**Wilt** (*Verticillium albo-atrum*)

## SASKATOON (*Amelanchier alnifolia*)

See Saskatoon in Chapter 10.

## SPRUCE (*Picea* spp.)

### CONE RUST

*Chrysomyxa pirolata*

**Cultural:** Eliminate nearby alternate hosts *Pyrola* sp. and *Moneses uniflora*.

**Resistant Cultivars:** None

**Chemical:** Apply ferbam (COM) WG. Spray to run off at pollination. Two sprays, one week before and one week after pollination may be necessary. Limitations: As per label.

#### References:

1. Summers, D. *et al.* 1986. Inland spruce cone rust (*Chrysomyxa pirolata*) control: relation of ferbam application to basidiospore production, rainfall, and cone phenology. *Can. J. For. Res.* 16:360-362.

### CYTOSPORA CANKER

*Cytospora kunzei*

**Cultural:** Prune off infected branches. Improve tree vigor through cultural practices such as fertilization and watering during periods of drought. Avoid wounding trees.

**Resistant Cultivars:** None.

**Intermediate:** White spruce (*Picea glauca*).

**Susceptible:** Colorado blue (*Picea pungens*).

**Chemical:** None.

### LOPHODERMIIUM NEEDLECAST

*Lophodermium picea*

**Cultural:** None

**Resistant cultivars:** None

**Chemical:** Copper oxychloride (DOM, COM) WP; chlorothalonil (COM) SU. Begin applications in mid-July to early August before infection occurs. Make additional applications at 3 to 4 week intervals until conditions no longer favour disease development. Limitations: As per label.

**NEEDLE RUST***Chrysomyxa ledicola***Cultural:** Avoid planting spruce near Labrador tea (*Ledum groenlandicum*)**Resistant Cultivars:** None.**Chemical:** None.**Notes:** Several other needle rusts, with different alternate hosts, occur on spruce (1).**References:**

1. Ziller, W.G. 1974. The tree rusts of western Canada. Can. For. Ser., Publ. 1329. 272 pp.

**RHIZOSPHAERA NEEDLECAST***Rhizosphaera kalkhoffii***Cultural:** Do not prune or shear trees during wet weather. Sterilize pruning tools by dipping in 70% alcohol for 3 minutes.**Resistant Cultivars:** None.**Intermediate:** White spruce (*Picea glauca*).**Susceptible:** Blue spruce (*Picea pungens*).**Chemical:** Apply chlorothalonil (COM) SU. Make first application in spring when new shoot growth is 1 to 5 cm in length apply several times at 3 to 4 week intervals until conditions no longer favour disease development. For use in nursery beds, apply the highest rate specified on a 3 week schedule. Limitations: As per label.**Notes:**

1. Chlorothalonil has been found effective when applied in 2 or 3 sprays at 10 day intervals starting in early June.
2. The fungus *Stigmina lautii* also occurs on *Picea* spp. and can be mistaken for *Rhizosphaera kalkhoffii* when a diagnosis is made on the basis of symptoms without the aid of magnification (1). Little is currently known about *Stigmina* and it is unknown whether fungicide application is effective against it.

**References:**

1. Hodges, C.S. 2002. First report of *Stigmina lautii* in the United States. Plant Dis. 86: 699.
2. Skilling, D.H. and C.D. Waddell. 1975. Control of *Rhizosphaera* needlecast in blue spruce Christmas tree plantations. Plant Disease Reporter 59:841-843.

**SIROCOCCUS TIP BLIGHT**

See Pine, SIROCOCCUS TIP BLIGHT on page 15.

## OTHER DISEASES

The following diseases of spruce are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Brown Felt Blight** (*Herpotrichia juniperi*)

**Dwarf Mistletoe** (*Arceuthobium americanum*) See Pine, DWARF MISTLETOE, on page 14.

**Needle Cast** (*Isthmiella* spp., *Lirula* spp.)

**Yellow Witches'-broom** (*Chrysomyxa arctostaphyli*)

## THUJA (*Thuja* spp.)

See Thuja in Chapter 6.

## WILLOW (*Salix* spp.)

### BLIGHT

*Marssonina* spp.

**Cultural:** Destroy diseased twigs and branches during dormant season.

**Resistant Cultivars:** None.

**Susceptible:** Weeping willow (*Salix babylonica*).

**Chemical:** None.

#### References:

1. Hill, J.T. *et al.* 1977. Weeping willow blight in coastal British Columbia. *Can. Plant Dis. Surv.* 57: 71-74.

### SCAB

*Pollacia saliciperda*

**Cultural:** Destroy diseased twigs and branches during the dormant season.

**Resistant Cultivars:** White willow (*S. alba* var. *calva*) is immune (1).

**Chemical:** None.

**References:**

1. Davidson, A.G. and Fowler, M.E. 1967. Scab and black canker of willow. Pp. 201-203 in Davidson, A.G. and Prentice, R.M., (eds.), Important forest insects and diseases of mutual concern to Canada, the United States and Mexico. Can. Dep. For. Rural Dev., Publ. 1180.
2. Harrison, K.A. 1962. In Creelman, D.W. (comp.). Summary of the prevalence of plant diseases in Canada in 1961. Can. Plant Dis. Surv. 42: 92.

**OTHER DISEASES**

The following diseases of willow are currently of minor importance and/or are diseases for which no practical control measures are currently recommended:

**Black Rib** (*Ciborinia foliicola*)

**Hypoxyton Canker** (*Hypoxyton mammatum*)

**Leaf Rust** (*Melampsora* spp.)

**Powdery Mildew** (*Uncinula salicis*)

**Tar Spot** (*Rhytisma salicinum*)

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1. Allen, E., Morrison, D. and Wallis G. 1996. Common Tree Diseases of British Columbia. Natural Resources Canada, Canadian Forest Service. 178 pp.
2. Ash, C.L. (Ed.) 2001. Shade Tree Wilt Diseases. APS Press. 257 pp.
3. Benyus, J.M. 1983. Christmas Tree Pest Manual. U.S. Department of Agriculture, North Central Forest Experiment Station. St. Paul, Mn. 108 pp.
4. Callan, B.E. 1998. Diseases of *Populus* in British Columbia: A Diagnostic Manual. Natural Resources Canada, Canadian Forest Service. 157 pp.
5. Chastagner, G.A. (Ed.). 1997. Christmas Tree Diseases, Insects, & Disorders in the Pacific Northwest: Identification and Management. Washington State University Cooperative Extension. 154 pp.
6. Funk, A. 1985. Foliar fungi of western trees. Canadian Forestry Service Pacific Forest Research Centre, Victoria, B.C. Publication BC-X-265, 159 pp.
7. Funk, A. 1981. Parasitic microfungi of western trees. Canadian Forestry Service Pacific Forest Research Centre, Victoria, B.C. Publication BC-X-222, 190 pp.
8. Hansen, E.M and Lewis, K.J. (Eds.). 1997. Compendium of Conifer Diseases. APS Press. Am. Phytopathol. Soc., St. Paul, Minn. 101 pp.
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10. Hiratsuka, Y. and H. Zalasky. 1993. Frost and other climate-related damage of forest trees in the prairie provinces. Forestry Canada, Northwest Region, Northern Forestry Centre, Information Report. NOR-X-331. 25 pp.
11. Holmes, H.W. 1961. Salt injury to trees. *Phytopathology* 51: 712-718.
12. Ives, W.G.H. and H.R. Wong. 1988. Tree and shrub insects of the prairie provinces. Canadian Forestry Service Information Report NOR-X-292. 327 pp.
13. Jones, R.K and Benson, D.M. (Eds.). 2001. Diseases of Woody Ornamentals and Trees in Nurseries. APS Press. Am. Phytopathol. Soc., St. Paul, Minn. 482 pp.
14. Knowles, R.H. 1995. Woody ornamentals for the prairies. Rev. Jasper Printing. Edmonton. 205 pp.
15. Malhotra, S.S. and R.A. Blauel. 1980. Diagnosis of air pollutant and natural stress symptoms on forest vegetation in Western Canada. Information Report NOR-X-228. 84 pp.
16. Meade, J.A. 1975. Stress trees and herbicides. *J. Arboricult.* 1: 68-70.
17. Pscheidt, J.W. and C.M. Ocamb. 2005. Pacific Northwest Plant Disease Control Handbook. Oreg. State Univ., Corvallis.
18. Riffle, J.W. and Peterson, G.W. 1986. Diseases of trees in the great plains. U.S.D.A. Forest Service, General Technical Report RM-129. 149 pp.

19. Sinclair, W.A. and Lyon, H.H. 2005. Diseases of trees and shrubs. 2<sup>nd</sup> Edition. Cornell University Press. 660 pp.
  20. Smith, E.M. 1975. Tree stress from salts and herbicides. J. Arboricult. 1: 201-205.
  21. Stipes, R. Jay *et al.* 1981. Compendium of elm diseases. Am. Phytopathol. Soc., St. Paul, Minn. 96 pp.
  22. Tattar, T.A. 1978. Diseases of shade trees. Academic Press. New York. 361 pp.
- <http://plant-disease.ippc.orst.edu/index.cfm> An Online Guide to Plant Disease Control. Oregon State Univ.

**APPENDIX I. Fungicides registered for use against diseases of trees in Canada.**

C or D = commercial or domestic registration

Active Ingredient	Example Trade Names	C or D	Formulation	PCP#	Disease
<b><i>Fraxinus:</i></b>					
mancozeb	Dithane DG Rainshield	C	75% WG	20553	anthracnose
	Dithane WSP	C	80% WP	23655	
	Manzate 200 DF	C	75% WG	21057	
<b><i>Picea:</i></b>					
ferbam	Ferbam 76	C	76% WG	20136	cone rust
chlorothalonil	Bravo 500	C	500 g/L SU	15723	<i>Lophodermium</i> needle cast, <i>Rhizosphaera</i> needle cast
	Daconil 2787	C	40.4 % SU	15724	
copper oxychloride	Copper oxychloride	C	50% WP	13245	needle cast
	Copper Spray	C	50% WP	19146	
	Later's Copper Spray	D	50% WP	16140	
<b><i>Pinus:</i></b>					
chlorothalonil	Bravo 500	C	500 g/L SU	15723	Lophodermium needle cast, Scleroderris canker, Scirrhia brown spot, Sirococcus tip blight
	Daconil 2787	C	40.4 % SU	15724	
copper oxychloride	Copper oxychloride	C	50% WP	13245	needle cast
	Copper Spray	C	50% WP	19146	
	Later's Copper Spray	D	50% WP	16140	
mancozeb	Dithane DG Rainshield	C	75% WG	20553	Lophodermium needle cast
	Dithane WSP	C	80% WP	23655	
	Manzate 200 DF	C	75% WG	21057	
<b><i>Populus:</i></b>					
chlorothalonil	Daconil 2787	C	40.4% SU	15724	Marssonina leaf spot
thiophanate-methyl	Senator	C	70% WP	25343	Marssonina and Septoria leaf spots
<b><i>Pseudotsuga:</i></b>					
chlorothalonil	Bravo 500	C	500 g/L SU	15723	Rhabdocline needle cast, Swiss needle cast
	Daconil 2787	C	40.4% SU	15724	
mancozeb	Dithane DG Rainshield	C	75% WG	20553	Rhabdocline needle cast
	Dithane WSP	C	80% WP	23655	
	Manzate 200 DF	C	75% WG	21057	
<b><i>Quercus:</i></b>					
chlorothalonil (red oaks only)	Daconil 2787	C	40.4% SU	15724	anthracnose
mancozeb	Dithane DG Rainshield	C	75% WG	20553	anthracnose
	Dithane WSP	C	80% WP	23655	
	Manzate 200 DF	C	75% WG	21057	
<b><i>Ulmus:</i></b>					
carbendazim-hydrochloric	Eertavas	C	4.7% SN	23633	Dutch elm disease
propiconazole	Alamo	C	14.3% EC	25798	Dutch elm disease

See APPENDIX II for a list of latin and common names of trees.

**APPENDIX II. Latin and common names of trees.**

<b>LATIN NAME</b>	<b>COMMON NAME</b>
<i>Fraxinus americana</i>	white ash
<i>Fraxinus nigra</i>	black ash
<i>Fraxinus pennsylvanica</i>	red ash or green ash
<i>Picea engelmannii</i>	Engelmann spruce
<i>Picea glauca</i>	white spruce
<i>Picea mariana</i>	black spruce
<i>Picea pungens</i>	Colorado blue spruce
<i>Picea rubens</i>	red spruce
<i>Picea sitchensis</i>	Sitka spruce
<i>Pinus albicaulis</i>	whitebark pine
<i>Pinus banksiana</i>	jack pine
<i>Pinus contorta</i>	lodgepole pine
<i>Pinus flexilis</i>	limber pine
<i>Pinus monticola</i>	western white pine
<i>Pinus ponderosa</i>	ponderosa pine
<i>Pinus resinosa</i>	red pine
<i>Pinus rigida</i>	pitch pine
<i>Pinus strobus</i>	eastern white pine
<i>Pinus sylvestris</i>	Scots pine
<i>Populus balsamifera</i>	balsam poplar
<i>Populus tremuloides</i>	aspen poplar
<i>Populus hybrids</i>	
<i>Pseudotsuga menziesii</i>	Douglas fir
red oaks	
<i>Quercus rubra</i>	red oak
<i>Quercus velutina</i>	black oak/yellow barked
<i>Quercus palustris</i>	pin oak/Spanish oak
other oaks	
<i>Quercus alba</i>	white oak
<i>Quercus bicolor</i>	swamp white oak
<i>Quercus garryana</i>	Garry oak
<i>Quercus macrocarpa</i>	bur oak
<i>Quercus muehlenbergii</i>	chinquapin oak/yellow oak
<i>Salix spp.</i>	willow
<i>Ulmus americana</i>	American elm/white elm
<i>Ulmus davidiana</i> var. <i>japonica</i>	Japanese elm
<i>Ulmus pumila</i>	Siberian elm