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## **RECOGNITION AND MANAGEMENT OF DISEASES OF WOODY ORNAMENTALS IN THE LANDSCAPE**

While problems of woody ornamentals are frequently associated with living factors, problems attributed to cultural and environmental factors are also common and are becoming increasingly more prevalent given the weather extremes of the past few years and as populations increase and urbanization continues. In many cases there is little that can be done about these problems once they are observed so prevention is usually the best approach.

### **I. STEPS FOR DISEASE PREVENTION AND CONTROL:**

#### **A. *Diagnosis-***

knowing what you're trying to control; **accurate diagnosis is critical for successful disease control;**

#### **B. *Assessing the Severity of the Problem-***

##### **1. Nature of pest problem-**

type of disease, i.e., root vs. foliar, systemic vs. localized

##### **2. Level of disease-**

loss threshold, i.e., amount of disease, number of years with problem; number of trees affected

#### **C. *Control Options-***

##### **1. Culture:**

this includes cultural methods that modify the plant's growing conditions; maintaining optimum plant vigor by proper site selection, proper watering and fertilizing; avoiding mechanical injuries and soil compaction; appropriately timed pruning and transplanting, adequate spacing between plants, improving tilth and pH of the soil;

##### **2. Sanitation:**

this involves the use of vigorous, healthy, disease-free cuttings or plants, pruning of affected plant parts; raking and removing affected plant parts such as fallen leaves; disinfesting tools such as pruning shears and spades;

##### **3. Resistance:**

this involves the use of resistant/tolerant cultivars; plants with genetic resistance to specific diseases; refer to lists of cultivars with specific types of resistance;

##### **4. Chemical:**

this involves the use of pesticides which are registered for control of specific diseases; proper selection and timing of pesticide applications are *very* important; it is also very important to **thoroughly** read the pesticide label; the current status of many fungicides is unstable and labels are frequently being modified;

### **II. COMMON PLANT HEALTH PROBLEMS:**

**A. Abiotic (caused by non-living agents)**

1. Culture
2. Environment

**B. Biotic (caused by living agents)**

1. Fungi
2. Bacteria
3. Phytoplasmas
4. Viruses
5. Nematodes

**III. FACTORS TO CONSIDER IN PLANT SELECTION:**

*"The right plant for the right site!"*

- A. Hardiness
- B. Site Requirements vs. Site Characteristics
- C. Structure/Size of Root System
- D. Aesthetic Qualities
- E. Sensitivities
- F. Common Disease Problems

**IV. COMMON ABIOTIC PROBLEMS:**

**A. Winter Injury-**

*1. Symptoms:*

dieback, foliar browning, sunscald and bark splitting

*2. Causal Factors:*

late spring frosts (after growth has started), cool summer followed by a warm fall and drop in temperature, excessive or late season nitrogen fertilization, dry soil or root injury, frost cracking, excessive temperature fluctuations and drying winds, lack of snowcover

*3. Commonly Affected Plants:*

wide range of plants including broadleaved evergreens (rhododendron and mountain laurel), narrowleaved evergreens (arborvitae, yew, juniper, pine, and hemlock), deciduous trees and shrubs (weeping cherry, rose), and ground covers (pachysandra and ivy)

*4. Control Measures:*

- a. select appropriate site for planting
- b. have sufficient moisture in root zone before soil freezes
- c. avoid late summer and early fall fertilization
- d. mulch to increase moisture retention in winter
- e. prune out dead branches or twigs in spring and fertilize to stimulate new growth
- f. use of physical protection (e.g., burlap) or anti-transpirants or anti-desiccants

**B. Drought-**

*1. Symptoms:*

loss of turgor in needles or leaves, drooping, wilting, yellowing, premature leaf or needle drop, dieback, poor growth, stunting, plant death; predisposes plant to secondary problems and cultural injuries; symptoms often not evident until the year after drought occurs

2. *Causal Factors:*

soil water becomes deficient and results in feeder root damage and death; plant unable to take up water

3. *Commonly Affected Plants:*

broad range of deciduous and evergreen trees and shrubs; effects are particularly severe on seedlings or recent transplants but established plants are also affected; especially affected this year were maple, ash, hemlock, juniper, dogwood, rhododendron

4. *Control Measures:*

- a. water in periods of low soil moisture
- b. select appropriate site and use proper planting practices
- c. select native plants adapted to local seasonal and annual variations in the water supply; drought sensitive (e.g., dogwood, many oaks, arborvitae, many *Viburnum*) vs drought tolerant species (e.g., most pines, many *Prunus*, eastern larch, some junipers)
- d. prune out dead branches or twigs in spring

### C. Excess Water-

1. *Symptoms:*

highly variable, including epinasty (downward bending of petioles), stem swelling, chlorosis, edema, reduced and stunted growth, twig dieback, wilting, leaf drop, root and plant death

2. *Causal Factors:*

root damage in flooded or waterlogged soils associated with oxygen deficiency; damaged fibrous roots die, decay, and plants are unable to take up water; predisposed plants are subject to secondary invaders and opportunistic pests

3. *Commonly Affected Plants:*

seedlings and new transplants are more sensitive than established ones; dormant plants tolerate flooding longer than those in active growth; angiosperms are generally thought to be more tolerant than gymnosperms; particularly affected are yews, hemlocks, maples, rhododendrons

4. *Control Measures:*

- a. avoid plant stress by appropriate site selection and proper planting practices
- b. maintain vigor by fertilization to stimulate good growth
- c. select appropriate species for site and soil conditions, water tolerant species (e.g., red maple, eastern larch, forsythia, green ash) vs water intolerant species (e.g., gray and paper birch, crabapple, dogwood, eastern hemlock)
- d. prune dead or dying tissues to minimize problems from secondary invaders

### D. Air Pollution-

1. *Symptoms:*

highly variable, depending upon type of pollutant and plant host; typically classified as **acute** or **chronic**; **acute injury** normally involves the death of cells and develops within a few hours or days following exposure to high levels of pollutants; symptoms include stippling or altered pigmentation, flecking, bleaching, chlorosis, interveinal and marginal necrosis, and tip necrosis; **chronic injury** typically develops more slowly, within days or weeks following exposure;

this type of injury usually appears in response to long-term, low-concentration exposure; in some cases, visible symptoms are not present but exposure results in suppressed photosynthesis rates, stimulated respiration, and suppressed growth; symptoms are often subtle and easily confused with other problems such as normal senescence, nutritional disorders or other environmental stresses

2. *Causal Factors:*

major classes of phytotoxic air pollutants, in descending order of direct damage are: oxidants (ozone O<sub>3</sub>, PAN), sulfur dioxide (SO<sub>2</sub>), and fluorides (hydrogen fluorides HF)

3. *Commonly Affected Plants:*

significant differences in sensitivity of plant species to specific pollutants occur; particularly sensitive tree species to specific pollutants are:

O<sub>3</sub>-- white ash, eastern white pine, black cherry, catalpa, honey locust

SO<sub>2</sub>-- larch, birch, American elm, eastern white pine

HF-- young, expanding needles of pines and spruces, paulownia, Douglas fir, serviceberry

4. *Control Measures*

- a. plant resistant or tolerant species where pollutants are known problems
- b. maintain good plant vigor by proper cultural practices

### E. Misapplied Pesticides-

Injury from misapplied pesticides, mostly herbicides, has increased dramatically over the past few years. In part, this increase can be attributed to widespread use of broadleaved weed controls applied to turf in addition to careless application methods or misapplication of herbicides in the root zones of woody ornamentals.

1. *Symptoms:*

symptoms vary with compound and plant species and can develop several days to weeks after exposure or in some cases, even the following spring; chlorosis, necrotic spotting, marginal scorch, twisting, growth abnormalities, leaf/needle drop, dieback, general decline, tree/shrub death

2. *Causal Factors:*

the herbicides 2,4-D, MCP, and dicamba cause frequent problems; these compounds act as plant hormones that disrupt normal growth processes in affected plants; doses can be lethal or sub-lethal; non-target plants are injured in basically three ways:

- a. spray drift- direct plant contact from droplets containing the compound
- b. vapor drift- direct plant contact through gaseous, vaporized compounds, usually associated with highly volatile pesticides or with high temperatures
- c. root absorption- herbicides are leached into the soil and root zones of non-target plants

3. *Commonly Affected Plants:*

plant species vary with regard to their reaction to specific pesticides; lists of relative sensitivities of various species are available

4. *Control Measures:*

- a. **Prevention!!** careful application
- b. avoid drought stress since drought-stressed plants are more vulnerable

- c. dormant plants are usually less sensitive
- d. select less sensitive species in areas where continued herbicide use is necessary

## F. De-icing Salts-

De-icing salts damage woody species through direct foliar contact ("spray zone") and through chemical soil modification (soil absorption). The two most commonly applied de-icing salts are sodium chloride (rock salt) and calcium chloride. Sodium chloride is less expensive and easier to handle than calcium chloride but it is also more damaging to vegetation.

### 1. Symptoms:

vary with concentration and length of exposure; foliar browning, tip necrosis, marginal scorch, leaf/needle drop, tip/branch dieback, premature fall coloration (deciduous species), death of vegetative and flower buds, and outright tree death

### 2. Causal Factors:

sodium chloride, calcium chloride

*on foliage*-- burning by direct contact of salt solutions with foliage

*in soil*-- chloride ions in soil are transported to growing tips and leaves

where they accumulate to toxic levels; sodium ions compete with other ions in the soil and result in selective uptake; when this occurs, plants may develop symptoms of potassium and phosphorus deficiency

### 3. Commonly Affected Plants:

species vary in their tolerance to salt exposure;

*salt-tolerant* (autumn olive, honeylocust, Japanese black pine, yew, white oak);

*salt-sensitive* (winged euonymus, viburnum, sugar maple, little-leaf linden, sycamore, eastern white pine, balsam fir)

### 4. Control Measures:

a. prevention is the best strategy

b. salt can be washed off the foliage or leached from soil with water; these should be done as soon after exposure as possible

c. in certain circumstances, gypsum applications can be helpful (50 lb./100 sq. ft. incorporated into the top 6 inches of soil at the drip line)

d. where salt is a problem, select salt-tolerant species

## V. COMMON BIOTIC PROBLEMS:

### A. Leaf Spots, Anthracnoses, and Needlecasts-

#### 1. Symptoms:

most prevalent plant diseases; appear as dead areas scattered over the leaf or needle surface; can develop in 3 phases including leaf spot, shoot blight, and cankering; often some defoliation; severe infections result in twig and branch dieback; most serious during wet springs

#### 2. Causal Agents:

wide range of fungi and some bacteria including *Septoria*, *Colletotrichum*, *Discula*, *Gloeosporium*; most require water on the leaf or needle surface for infection to occur

#### 3. Commonly Affected Plants:

broad range of deciduous and broadleaved evergreen trees and shrubs and ground covers; common are anthracnose of sycamore, ash, maple, dogwood; scab of crabapple; oak leaf blister; cedar-apple rust; Rhabdocline needlecast of Douglas fir; Rhizosphaera needlecast of spruce

4. *Control Measures:*

- a. maintain tree or shrub vigor by fertilization and watering during periods of drought
- b. rake and remove symptomatic fallen leaves in autumn
- c. prune out dead branches or twigs in spring
- d. use resistant cultivars when available; for example, scab- and rust-resistant crabapple
- e. most leaf spots and needlecasts are not serious enough to warrant chemical control; however, there are exceptions with regard to the value of the shrub or tree, the specific host and type of leaf spot involved, the nature of the host-associated damage, and the timing of defoliation; most available fungicides are protectants and must be applied to developing foliage **before** symptoms appear; the number of sprays required for control will vary with weather conditions; check pesticide labels for plant host, pathogen, dosage rates, and safety precautions

## B. Blights and Diebacks

1. *Symptoms:*

usually sudden and conspicuous leaf and growing tip damage, blackening or wilting of growing tips, death of shoots and growing tips; often more severe during wet weather or on plants which have been stressed by other factors

2. *Causal Agents:*

wide range of fungi and bacteria including *Botrytis*, *Phytophthora*, *Alternaria*, and *Erwinia*

3. *Commonly Affected Plants:*

broad range of deciduous and evergreen trees and shrubs; especially prevalent were *Botrytis* blight; fireblight of apple and pear; *Phytophthora* dieback of rhododendron and azalea; *Phomopsis* and *Kabatina* tip blight of juniper; *Diplodia* tip blight of pine

4. *Control Measures:*

- a. avoid plant stress and maintain good vigor by fertilization and watering during periods of drought
- b. protect plants from winter injury
- c. use resistant cultivars when available; for example, *Phomopsis* resistant *Chamaecyperis pisifera* and *Juniperus chinensis*
- d. prune, remove, and destroy diseased portions of plants, especially spent flowers and leaf debris
- e. fungicides are helpful in some host-pathogen combinations; many are protectants and need to be applied before symptoms appear; the effectiveness and number of sprays required for control will vary with weather conditions

## C. Wilts-

1. *Symptoms:*

loss of rigidity, wilting, yellowing of foliage, drooping of plant parts; often followed by premature defoliation; gradual dieback may be evident; "flagging" may occur when one limb or branch becomes symptomatic at a time; infected trees will occasionally produce a heavy crop of seed and have leaves that are smaller than normal; infected branches may develop characteristic brown or greenish streaks in the sapwood

2. *Causal Agents:*

several genera of fungi; most commonly *Verticillium* (Verticillium wilt) and *Ophiostoma ulmi* (Dutch Elm Disease)

3. *Commonly Affected Plants:*

depending upon causal agent, **many** tree species; including maple, elm, mimosa, and oak; trees under drought, nutrient, or salt stress are generally more sensitive

4. *Control Measures:*

- a. prune and remove affected branches or limbs as soon as symptoms are evident
- b. plant resistant species where possible
- c. maintain overall plant health by proper fertilization and irrigation during drought
- d. avoid tree stress by appropriate site selection
- e. variable success with fungicide injections when disease is recognized in early stages

#### D. Root Rots-

1. *Symptoms:*

non-specific symptoms; leaves turn yellow, wilt, and droop; twig and branch dieback; general decline, reduced or stunted growth, root and plant death

2. *Causal Agents:*

variety of fungi including *Phytophthora*, *Verticicladiella*, and *Armillaria*

3. *Commonly Affected Plants:*

wide range of hardwoods and conifers including pine, spruce, oak, and maple; plants under stress are more susceptible; *Phytophthora* root rot of rhododendron; *Armillaria* root rot of oak

4. *Control Measures:*

- a. protect plants from drought or flooding
- b. maintain tree vigor by appropriate fertilization and cultural care
- c. remove and destroy affected trees; stump removal is often prudent and necessary
- d. plant resistant species, where possible
- e. certain root rots can be *prevented* (not cured) by fungicides

#### E. Cankers-

1. *Symptoms:*

infections may appear as definite areas that vary in color from the surrounding healthy bark; necrotic, often sunken or swollen lesions occur on twigs, branches, limbs or main trunk; when cankers girdle the twig or branch, leaves wilt, drop, and the distal portion of the branch dies; small fruiting structures of causal fungi may be evident in the canker

2. *Causal Agents:*

wide range of fungi and bacteria, including *Botryosphaeria*, *Nectria*, *Cytospora*, and *Sirococcus*

3. *Commonly Affected Plants:*

wide range of hardwoods and conifers including blue spruce, beech, maple, and butternut; *Cytospora* canker of blue spruce; butternut canker

4. *Control Measures:*

- a. prune and remove symptomatic branches or surgically trim and excise trunk cankers during dry weather
- b. fertilize to encourage good growth and overall vigor
- c. avoid wounds and pay careful attention to pruning techniques

## VI. PROBLEMS OF UNDETERMINED CAUSE:

### A. "Decline" Syndromes-

Tree decline is characterized by progressive deterioration due to loss of vigor and health. Trees can decline for **many** reasons and although one factor may be responsible, in most cases decline results from several factors. These factors, which are often both biotic and abiotic, can act singly or in combination. A key aspect of tree decline is that the causal factors are active **over a period of years**.

1. *Symptoms:*

highly variable, dependent upon cause(s) and tree species; slow growth, sparse canopy and undersized leaves, premature leaf drop and fall coloration, excessive fruit set, and dieback of twigs and branches

2. *Causal Factors:*

wide range of abiotic (e.g. extremes of heat or moisture, girdling roots, construction damage or injuries) and biotic (e.g. primary pathogens such as *Verticillium* and phytoplasmas; opportunistic pathogens such as *Phomopsis* and *Fusicoccum*; insects causing defoliation) factors

3. *Commonly Affected Plants:*

any tree or shrub can be affected by decline but some species are more frequently affected; in Connecticut these include ash, oak, and maple (Ash Decline, Oak Decline, Maple Decline, )

4. *Control Measures:*

- a. proper plant selection based on site characteristics
- b. good cultural practices that promote and maintain overall plant health and vigor
- c. deep watering during periods of drought
- d. avoid of physical, mechanical, and chemical injuries
- e. prune and remove any dead or dying branches or limbs

## VII. ANIMAL DAMAGE:

Animals can cause significant damage to woody ornamentals in urban, suburban, and rural settings; damage results in a variety of symptoms from decline to sudden death.

### A. Voles, Meadow Mice-

### B. Deer-

## VIII. CURIOSITY PROBLEM:

**The Artillery Fungus, *Sphaerobolus stellatus*** ( Refer to the fact sheet for details)



**IX. SELECTED WOODY ORNAMENTALS AND THEIR CURRENT DISEASE PROBLEMS:**

**A. Flowering Dogwood-- *Cornus florida***

- Anthracnose
- Decline
- Powdery Mildew

**B. English Hawthorn-- *Crataegus laevigata (oxyacantha)***

- Fire Blight
- Leaf Blight
- Rusts (at least 9 types)
- Scab

**C. Crabapple-- *Malus sargentii* and *Malus spp.***

- Cedar-Apple Rust
- Hawthorn Rust
- Fire Blight
- Scab

**D. Maple-- *Acer palmatum*, *A. platanoides*, *A. saccharum***

- Anthracnose
- Decline
- Verticillium Wilt
- Phyllosticta Leaf Spot
- Tar Spot

**E. Mountain Ash-- *Sorbus aucuparia***

- Canker
- Fire Blight
- Leaf Blight
- Scab

**F. Flowering Prunus Species-- *Prunus glandulosa*, *P. serrulata*, *P. triloba***

- Black Knot
- Brown Rot
- Cytospora Canker
- Winter Injury

**G. Spruce-- *Picea abies*, *P. pungens***

- Cytospora Canker
- Chrysomyxa Rusts
- Rhizosphaera Needlecast

**H. Douglas Fir-- *Pseudotsuga menziesii***

- Rhabdocline Needlecast

**I. Pine-- *Pinus strobus*, *P. sylvestris*, *P. nigra*, *P. thunbergiana***

- White Pine Blister Rust (historical)
- Diplodia Tip Blight
- Winter Injury/Drying

**J. Eastern Hemlock-- *Tsuga canadensis***

- Drought
- Sunscorch

**K. Oak-- *Quercus spp.***

- Anthracnose
- Leaf Blister

- Powdery Mildew
- L. Elm-- *Ulmus spp.***
  - Dutch Elm Disease
  - Black Leaf Spot
- M. Horsechestnut-- *Aesculus hippocastanum***
  - Leaf Blotch
- N. Ash-- *Fraxinus spp.***
  - Anthracnose
  - Leaf Rust
  - Decline

**Table 1. Resistance of Selected Woody Ornamentals to Verticillium Wilt**

Resistant		Susceptible
Apple ( <i>Malus</i> )	Juniper ( <i>Juniperus</i> )	Ash ( <i>Fraxinus</i> )
Beech ( <i>Fagus</i> )	Katsura tree ( <i>Cercidiphyllum</i> )	Barberry ( <i>Berberis</i> )
Birch ( <i>Betula</i> )	Larch ( <i>Larix</i> )	Black Locust ( <i>Robinia</i> )
Boxwood ( <i>Buxus</i> )	Linden ( <i>Tilia</i> )	Box Elder ( <i>Acer negundo</i> )
Crabapple ( <i>Malus</i> )	Oak ( <i>Quercus</i> )	Currant ( <i>Ribes</i> )
Dogwood ( <i>Cornus</i> )	Pear ( <i>Pyrus</i> )	Maple ( <i>Acer</i> )
Fir ( <i>Abies</i> )	Pine ( <i>Pinus</i> )	Redbud ( <i>Cercis</i> )
Firethorn ( <i>Pyracantha</i> )	Spruce ( <i>Picea</i> )	Russian Olive ( <i>Elaeagnus</i> )
Ginkgo ( <i>Ginkgo</i> )	Sweet Gum ( <i>Liquidambar</i> )	Viburnum ( <i>Viburnum</i> )
Hawthorn ( <i>Crataegus</i> )	Sycamore ( <i>Platanus</i> )	Yellowwood ( <i>Cladratis</i> )
Holly ( <i>Ilex</i> )	Walnut ( <i>Juglans</i> )	
Honey Locust ( <i>Gleditsia</i> )	Willow ( <i>Salix</i> )	
Hornbeam ( <i>Carpinus</i> )	Yew ( <i>Taxus</i> )	

**Table 2. Resistance of Selected Woody Ornamentals to Crown Gall**

<b>Resistant</b>		<b>Susceptible</b>
Bald Cypress ( <i>Taxodium</i> )	Pine ( <i>Pinus</i> )	Apple ( <i>Malus</i> )
Barberry ( <i>Berberis</i> )	Serviceberry ( <i>Amelanchier</i> )	Birch ( <i>Betula</i> )
Beech ( <i>Fagus</i> )	Spruce ( <i>Picea</i> )	Crabapple ( <i>Malus</i> )
Boxwood ( <i>Buxus</i> )	Tuliptree ( <i>Liriodendron</i> )	Dogwood ( <i>Cornus</i> )
Deutzia ( <i>Deutzia</i> )	Yellowwood ( <i>Cladratis</i> )	Elm ( <i>Ulmus</i> )
Gingko ( <i>Gingko</i> )	Yew, Japanese ( <i>Taxus</i> )	Euonymus ( <i>Euonymus</i> )
Goldenrain Tree ( <i>Koelreuteria</i> )	Zelkova ( <i>Zelkova</i> )	Honeysuckle ( <i>Lonicera</i> )
Holly ( <i>Ilex</i> )		Lilac ( <i>Syringa</i> )
Hornbeam ( <i>Carpinus</i> )		Plum, Peach, Cherry
( <i>Prunus</i> )		
Larch ( <i>Larix</i> )		Rose ( <i>Rosa</i> )
Littleleaf Linden ( <i>Tilia</i> )		Walnut ( <i>Juglans</i> )
Magnolia ( <i>Magnolia</i> )		Willow ( <i>Salix</i> )

**Table 3. Common Diseases that can be Managed Using Resistant or Tolerant Species or Varieties\***

<b>Plant</b>	<b>Disease</b>	<b>Remarks</b>
Azalea and Rhododendron	Phytophthora root rot	Hybrids with resistance include: Caroline, English Roseum, Professor Hugo de Vries; Species with resistance include: <i>R. shweliense</i> , <i>R. schlippenbachii</i> , <i>R. lapponicum</i> ; many others are available
Crabapple	Cedar-Apple Rust (C) Fire Blight (F) Scab (S)	Cultivars with resistance or tolerance: Adams (F,S), David (F,S), Ormiston Roy (C,F), Dolgo (F,S), Red Baron (C,F); many other cultivars and species are available
Dogwood	Anthracnose	Consider planting <i>Cornus kousa</i> as an alternative; <i>C. florida</i> x <i>C. kousa</i> hybrids are also now available with anthracnose resistance
Hawthorn	Cedar-Apple Rust (C) Fire Blight (F) Leaf Blight (B)	Resistant plants: Cockspur thorn, yellow-fruited thorn, <i>Crataegus intricata</i> , <i>C. pruinosa</i> (C); <i>C. phaenopyrum</i> , Washington Hawthorn (B); <i>C. viridis</i> , Winter King Hawthorn (C,B)
Juniper	Phomopsis Tip Blight (P) Kabatina Tip Blight (K) Rusts (including Cedar-Apple, C)	Many resistant cultivars and species, including: <i>Juniperus chinensis</i> , Pfitzeriana (P,K,C), Femina (P,C); <i>J. communis</i> , Suecica, Depressa; <i>J. virginiana</i> , Tripartita (P,C); <i>J. procumbens</i> , Nana, Variegata (K)
Spruce	Rhizosphaera Needlecast	Norway spruce is relatively resistant

- Detailed lists of resistant or tolerant species and varieties are available upon request.

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