

Pesticide Certification Information

#23

DISEASES
OF
FOREST TREES

WEST VIRGINIA UNIVERSITY
EXTENSION SERVICE
AN EQUAL OPPORTUNITY/
AFFIRMATIVE ACTION INSTITUTION

DISEASES OF FOREST TREES

GENERAL DISEASES

LEAF SCORCH

Leaves of ash, beech, dogwood, elm, maple, and oak often are affected by a noninfectious disease which causes a browning between veins or along margins of the leaves. Scorch usually develops during July and August and is especially severe following periods of drying winds and high temperatures, when the roots are unable to supply enough water to the tree to replace the large amount of water lost through the leaves. The condition may also result from shallow soils, roots which girdle the base of the tree, a diseased root system, drought, and diseases which weaken the tree. Fir, pine, and spruce often show leaf scorch as a brown discoloration of needle tips. Scorch on needles may be the result of hot, dry weather or of high winds during cold weather.

POWDERY MILDEW

Fungi of the powdery group infect the leaves of various trees, producing patches of white or gray powdery coating on the leaf surface. Tiny, black fruiting bodies of the powdery mildew fungus are often found on the white patches.

SOOTY MOLD

Various fungi grow as saprophytes on honeydew secretions of such insects as aphids and scales. These fungi form a heavy sooty growth which partially or completely covers the needles of several evergreens and the leaves of elm, linden, magnolia, maple, and tulip trees. Although the heavy coating of mold on leaves is unsightly, it does not seem to interfere seriously with food manufacture within the leaf.

DISEASES OF SPECIFIC TREES

ASH

Anthracnose or Leaf Spot -- The fungus, Gloeosporium aridum, causes large irregular brown spots, usually along the edges of the leaves. Affected leaves fall prematurely. The fungus overwinters in fallen diseased leaves.

Leaf Scorch -- See GENERAL DISEASES

Rust -- The fungus, Puccinia sparganioides, causes swollen distorted areas on leaves and twigs. The swollen areas become covered with minute cups, within which yellow powdery spore masses develop. These spores cannot reinfect ash leaves and twigs, but they infect certain marsh grasses on which overwintering spores are formed. Reinfection of ash occurs in the spring from spores formed on grasses.

ASPEN

See POPLAR

BASSWOOD

See LINDEN

BEECH

Beech Bark Disease -- This disease is caused by the combined attack of the woolly beech scale and the fungus Nectria coccinea. Infestations of the scale always precede the attack on the tree by the fungus. The fungus is not capable of damaging a tree in the absence of the scale insects. Feeding punctures of the scale insects serve as points of entrance for the fungus which kills the bark. As large areas of the bark are killed the tree declines and dies. The disease may kill many beech trees in forested areas.

BLACK LOCUST

Brooming Disease -- A virus causes abnormal development of buds into short, spindly shoots which have smaller than normal leaves. Buds on these spindly branches also develop abnormal branches, resulting in the broom-like appearance of the tree. The brooming usually occurs late in summer, and the shoots often die during winter. Roots of infected trees are shorter, darker, and more brittle than normal. Excessive rebranching of the roots gives a broom-like appearance to the roots.

BUTTERNUT

Dieback -- The fungus, Melanconis juglandis, produces a dark discoloration of the bark on small branches, causing a dieback which progresses down the branches to the trunk. The severely affected trees eventually die. Dead branches are covered with small, black, pimple-like fruiting bodies of the causal fungus. In wet weather, spores ooze out in a black inky mass from fruiting bodies and are splashed and blown to infect other branches.

Anthracnose or Leaf Spot -- This fungus-caused (Gnomonia leptostyla) disease creates irregular dark-brown spots on the leaves. Severe infection results in premature defoliation.

CHESTNUT

Blight -- This disease is caused by the fungus Endothia parasitica. Cankers form on twigs, branches, and trunks of infected trees. On young wood the cankers are swollen, yellow-brown, oval or irregular areas. On older wood they are brownish, circular or irregular areas with slightly raised or depressed edges. Partial or complete girdling of stems by cankers causes leaves to yellow and brown. Dead leaves and burrs cling to diseased branches long after normal leaf fall.

The surface of older cankers is covered with minute pinpoint fruiting bodies of the blight fungus. During wet weather, yellowish spore masses ooze from fruiting bodies. These spores are carried by rain, birds, and insects. New infection follows when spores enter through wounds.

American and European chestnuts are very susceptible to this disease. Chinese and Japanese chestnuts are resistant but not immune.

Leaf Spot -- The causal fungus, Marssonina ochroleuca, infects leaves causing small, circular, yellow to brown spots with concentric markings. The spots may drop out and leave small holes in the leaf. Premature defoliation may follow.

DOGWOOD

Crown or Trunk Canker -- The disease is caused by a fungus, Phytophthora cactorum. Trees with low vitality, particularly those growing in poorly drained soil or those suffering from drought, are often infected. The leaves of infected trees, smaller and lighter green than normal, turn red prematurely in late summer. Later, twigs and even large branches die. A canker may be found on the lower trunk at or near soil level where the fungus invaded bark, cambium, and outer sapwood and caused a discoloration of infected tissues. The cankers enlarge slowly for several years, extend completely around the base of the trunk or root collar, and kill the tree. For a few years before their death, infected trees often bear large flowers and fruit crops.

Flower and Leaf Blight -- Flowers are infected at the end of their bloom period. The fungus, Botrytis cinera, causes irregular, brown, wrinkled patches on the bracts. If the weather remains humid, these patches may be covered with a grayish mold. Infected bracts may fall on the young leaves and cause leaf infections. Infected leaves may fall, but the leaf drop is usually not serious.

Leaf Scorch -- See GENERAL DISEASES

Leaf Spot -- Angular grayish spots with dark purple margins occur on leaves. The disease, caused by the fungus Septoria cornicola, is most common during wet seasons.

Powdery Mildew -- See GENERAL DISEASES

Spot Anthracnose -- A fungus, Elsinoe corni, causes a spotting of the flowers and of the leaves, stems, and fruit. The spots on bracts are reddish-purple and may be as large as 1/10 inch in diameter. Spotting of bracts may be so severe that flowers are disfigured. Badly infected flower buds may never open.

Spots on leaves appear as circular to angular dark purple areas usually less than 1/25 inch in diameter. Diseased leaf tissues often drop out, leaving holes or ragged edges. Severely infected leaves may be reduced in size or be killed.

Spots on fruit and stems may be abundant. The surrounding tissue may be dark, and the spots are often slightly raised.

Twig Blight -- Twigs of native dogwood die back. This disease, caused by the fungus Myxosporium everhartii, may be confused with the more extensive dying back of trees infected with crown canker.

ELM

Black Leaf Spot -- This disease is caused by the fungus Gnomonia ulmea. Leaves become infected as they unfold in the spring; grayish, irregular spots occur on the upper leaf surface. Later the spots enlarge to about 1/8 inch in diameter and shiny black dots appear in the center. Infected leaves turn yellow, and during wet seasons, premature leaf fall may be heavy.

Dothiorella Wilt or Dieback -- The fungus, Dothiorella ulmi, infects trees through wounds, causing a wilting and yellowing of leaves. Cankers are formed which cause a dieback of affected branches. Diseased bark on the cankers becomes shrunken and reddish-brown with black, raised pustules appearing in the dead bark. A brown discoloration of the sapwood may be confused with that caused by Dutch elm disease or Verticillium wilt.

Dutch Elm Disease -- Dutch elm disease was first observed in the United States in Ohio in 1930. Since then it has spread throughout the east as far west as Idaho. All American elm species are susceptible. This disease has eliminated elms from many Eastern and Midwestern communities.

Dutch elm disease is caused by a fungus, Ceratocystis ulmi, which invades and plugs the water-conducting system of the tree. The foliage wilts and turns yellow, usually first on one or more individual branches, but soon on the whole tree. Leaves may curl and turn yellow before falling, or may wither and fall suddenly while still green. Infected trees may die within a few weeks or may decline slowly over a period of one year or more. Affected branches develop a brown discoloration in the outer layers of sapwood just under the bark. On the ends of cut twigs, the discoloration may appear as a complete browning of one or more of the outermost annual rings.

The causal fungus is carried from tree to tree by two species of elm bark beetles -- the smaller European elm bark beetle and the native elm bark beetle.

The infection cycle begins in the spring during May when adult bark beetles emerge from infected trees. If overwintering took place in trees killed by Dutch elm disease, then many of the emerging beetles will have sticky spores of the Dutch elm fungus on their bodies. The emerging beetles seek living, healthy elms where they feed in crotches of small twigs. Fungus spores are deposited in water-conducting tubes opened by the feeding injury. Elms so inoculated usually

develop the disease during that summer. The majority of the beetles feed 600 feet or less from the dead wood in which they overwintered. Where elms are scarce, beetles may fly several miles in search of feeding sites.

After feeding for a few days, the beetles seek a suitable egg-laying site. They require dying or recently dead elm wood with the bark still tightly attached. This may be a standing dead tree, a log, a weakened tree, or a weakened branch on a healthy tree. Wood also may be inoculated during the egg-laying activities of beetles carrying the fungus. Thus, elms weakened or killed by any means may become infected with the fungus and become a source of a new brood of infectious beetles.

Beetles will not infest wood without bark or with loose, cracked bark such as that on old logs or on trees dead more than a year. Beetles reproduce in all species of elm.

Although broods of bark beetles may occur every 35 to 40 days during the summer, much of the spread of the disease is associated with the feeding injuries of the first spring brood. At this season, the long water-conducting tubes in the wood of elms are near the surface and are easily opened by the beetles' feeding.

An important factor in the spread of the disease is the egg-laying site of the last brood of the season. If these adults lay eggs in Dutch elm diseased killed trees, it is likely that beetles emerging next spring will be coated with fungus spores. If such trees are removed during the winter, the threat of infection is greatly reduced.

Elms Resistant to Dutch Elm Disease -- Although none of the species of elms is immune to Dutch elm disease, some are highly resistant; however, these species are smaller and lack the desirable vase-shaped form of the American elm. Resistant species are Ulmus pumila, the Siberian elm, and Ulmus parvifolia, the Chinese elm. A Netherlands elm, the Christine Busman elm, is also resistant. However, this selection is susceptible to the elm leaf beetle and is not winter hardy in the northernmost range of the American elm.

Leaf Scorch -- See GENERAL DISEASES

Phloem Necrosis -- This destructive disease of American elms is caused by a mycoplasma. Leaves turn bright yellow, then brown, and they finally fall off. Trees infected during spring or early summer may live through the winter, produce a thin crop of leaves, and die the next summer.

The inner layers of bark of the roots and lower trunk of affected trees, when freshly peeled, show a butterscotch color and have a faint odor of wintergreen. The mycoplasma causing this disease is spread from tree to tree by leafhoppers.

Sooty Mold -- See GENERAL DISEASES

Verticillium Wilt -- Leaves yellow and wilt. Browning of the sapwood under the bark resembles that caused by Dutch elm disease.

Wetwood (slime flux) -- The bacterium Erwinia nimipressuralis causes this disease by infecting the wood of elm and other hardwoods, such as maple, birch, oak, poplar, sycamore, and willow. The infection results in an increase of internal sap pressure. Sap seeps out of infected areas through cracks, wounds, and pruning cuts and flows down the trunk soaking large areas of bark.

The seepage often becomes contaminated with bacteria and yeasts, resulting in a foul-smelling substance called slime flux. The slime flux may prevent healing of wounds and may kill bark and wood over which it flows. Toxic sap from infected wood may be carried to branches, where wilting and defoliation may occur. A browning of the tissues between veins along edges of leaves is found on affected branches. The wood under the bark of wilted branches often shows grayish-brown streaks similar to those found with Dutch elm disease.

HACKBERRY

Witches' Broom -- A powdery mildew fungus and a specific gall mite are usually associated with broom-like growths on branches of hackberry. Several hundred galls may be found on a single

tree, causing an unsightly appearance in the winter. Affected branches are weakened and break easily during wind storms; the broken wood is exposed to wood-decay fungi. Affected buds are larger, more open and hairy than normal. Mites may be found inside the buds along with small black fruiting bodies of the mildew fungus. Threadlike strands of mildew are found on the outside of the bud. Branches that develop from these buds are dwarfed and clustered, giving the witches' broom effect.

HAWTHORN

Rust -- Rust on hawthorn may be caused by either of two fungi. The fungus Gymnosporangium clavipes causes severe deformation of leaves, twigs, and fruit. The orange-colored spores of the causal fungus are produced in tiny, whitish tubes on the surface of the fruit and on swollen parts of the twigs.

Another fungus, G. globosum, infects leaves, causing gray to brown spots. The fruit also may be infected and covered with the brownish, horn-shaped fruiting bodies. Both of these rust fungi require the presence of red cedars and other species of juniper for continued spread of the disease.

HEMLOCK

Twig and Branch Canker -- Cankers caused by the fungus Cytospora sp. form on twigs and branches. Branches girdled by cankers die. Embedded fruiting bodies of the causal fungus break through the bark of the cankers and produce threadlike masses of spores during wet weather.

HICKORY

Leaf Spot -- A fungus, Gnomonia caryae, causes irregular, reddish-brown spots on the upper leaf surface and brown spots on the lower leaf surface. Severe infection may cause leaf fall. The fungus overwinters in fallen leaves.

JUNIPER, RED CEDAR

Rusts -- The causal fungus, Gymnosporangium juniperi-virginiana, stimulates leaves of red cedar to form small, deep-red smooth, globular galls in the first spring after infection.

The galls mature in the second spring after infection, and may be as large as two inches in diameter. Galls are greenish-brown, globular to irregular-shaped, and corky. Their surface becomes covered with small pit-like depressions, the center of each pit having a small pimple-like protuberance. During spring rains, many gelatinous, orange spore-horns protrude from these horns and are carried by wind and insects to leaves or fruits of nearby alternate host plants such as apple and ornamental crabapple. These alternate host plants are needed for the completion of the life cycle of the rust fungus, since the spores produced on juniper are unable to reinfect juniper. If the alternate hosts are removed, the life cycle is broken and the rust fungus cannot survive.

Other rust fungi commonly found on junipers are hawthorn rust, which forms smaller galls on the leaves; quince rust, which forms slight swellings on twigs and branches; and service-berry or shadbush rust, which stimulates the formation of witches' brooms.

LINDEN, BASSWOOD

Anthracnose or Leaf Blotch -- The fungus Gnomonia tiliae, causes small, circular to irregular brown spots which grow together and form blotches along the main veins of leaves, leaf stems, and twigs. A conspicuous black margin is found between healthy and dead tissue. In wet seasons, leaf fall may be severe.

Leaf Scorch -- See GENERAL DISEASES

Leaf Spot -- The causal fungus, Cerospora microsora, infects leaves, causing small, circular light-brown spots with dark margins. Where the spots are numerous, they may grow together and cause leaves to fall prematurely.

Powdery Mildew -- See GENERAL DISEASES

Sooty Mold -- See GENERAL DISEASES

MAPLE

Anthraxnose -- On Norway maple, narrow, purple to brown streaks occur along the veins of leaves; on sugar maple, large, irregular, green-brown or red-brown areas occur along and between the veins extending out to the edge of leaves. On sugar maple, infected leaves may be confused with leaves showing scorch symptoms resulting from drought and heat injury. (Small grown fruiting bodies of the causal fungus, Gloeosporium apocryptum, are found along the veins of leaves infected with anthracnose, and are not found on leaves showing scorch symptoms.) During wet seasons, infection may be severe enough to cause partial defoliation.

Leaf Spot -- The fungus, Phyllosticta minima, infects leaves causing small, irregular, circular brown spots, with a pronounced purple border. The spots may be only one-quarter inch in diameter, or they may grow together to involve half the leaf. Tiny, black fruiting bodies of the causal fungus are formed on the upper surface of the spots. In wet seasons, leaf fall may be heavy.

Leaf Scorch -- See GENERAL DISEASES

Sooty Mold -- See GENERAL DISEASES

Tar Spot -- Two fungi infect the leaves of red and silvermaple, causing oval to irregular, shiny black, thickened, raised spots. One fungus, Rhytisma acerinum, causes spots about 1/4 to 1/2 inch in diameter; the spots caused by the other fungus, R. punctatum, are not more than 1/8 inch in diameter and they create a more speckled effect on the leaves.

OAK

Anthraxnose -- Leaves of infected white oaks have brown dead areas that follow the veins out to the edge of the leaf. Severely affected leaves become curled and twisted, and in wet seasons, leaf fall may be common. Leaves on the lower branches are generally more severely affected than those on the upper branches. The fungus, Gnomonia quercina, may spread into the twigs, forming cankers which may result in twig dieback.

Large Leaf Spot -- In late summer, the causal fungus (Monochaetia desmazierii) infects leaves of white and red oaks, causing circular spots up to 2 inches in diameter. The spots have pale green or yellowish centers and reddish-brown margins. Target-like rings may be formed around the spots as the disease progresses.

Leaf Blister -- During cool, wet springs, this fungus, Taphrina coerulescens, infects leaves of red and other oaks, and causes circular, raised, wrinkled, yellowish-white areas up to 1/2 inch in diameter on the upper leaf surface. Affected leaves remain attached to the tree and usually continue to function as normal leaves.

Leaf Scorch -- See GENERAL DISEASES

Oak Wilt -- The losses from this disease occur primarily in oak forests along ridge tops.

The disease-causing fungus, Ceratocystis fagacearum, invades and plugs the water-conducting system of the tree. The leaves wilt, turn bronze (usually on one or more branches at first), and then fall. Premature shedding of foliage is a visible diagnostic symptom of oak wilt. Infected over a 2- to 3-year period. Some infected white oaks may recover.

Affected branches develop a brown discoloration in the outer layers of sapwood just under the bark. On the ends of cut twigs, the discoloration may appear as a complete browning of one or more of the outermost annual rings.

The fungus may be carried from tree to tree by various insects. Sap-feeding beetles are of

major importance in short-range spread of the fungus. Trees that wilt in late summer or early fall may bear spore-producing mats of the causal fungus under their bark during the following spring. As these mats develop, the bark ruptures, exposing the fungus. The odor of the mats attracts sap-feeding beetles which also feed on the fungus and become coated with the sticky spores. If these insects then feed on fresh bleeding wounds on healthy trees, fungus spores are deposited in water-conducting tubes opened by the injury. Research indicated that oak bark beetles which breed under the bark of dying trees and feed on small twigs and branches may be responsible for long-range spread of the fungus.

Susceptibility of oaks to oak wilt -- All tested species of the red oak group are very susceptible and normally die within a few weeks of infection. Although no species of the white oak group is resistant, some species contain resistant individuals. White oak is more resistant than chestnut oak or bur oak. American, Chinese, and European chestnuts, tanbark oak, and bush chinquapin are susceptible.

Twig Canker -- The fungus, Diplodia quercus, infects twigs of chestnut and other oaks, causing a sudden blighting of leaves on occasional twigs and branches. Dead leaves remain attached to twigs and give the tree the appearance of severe locust injury. On trees growing on rocky ridges or suffering from prolonged drought, the fungus may kill large branches or even the entire tree. Fruiting bodies of the causal fungus are found on blighted twigs.

PINE

Needle Blight -- This disease appears on current growth of white pines. From late spring to midsummer the new needles brown and die back, from the tips downward. The needles are often stunted. The cause of blight is unknown; an inadequate root system, injury to the small feeding roots, or poor soil conditions may be involved.

Needle Cast -- This disease is caused by the fungus Lophodermium pinastri. Scotch pines are susceptible to needle cast. It is particularly severe on the French and Spanish strains of Scotch pine, but also occurs on Austrian, red, and eastern white pines in nursery seed beds.

Infection occurs during the summer on the current year's needles, but no symptoms appear until the following spring when the infection needles turn yellow to brown and fall from the tree. On these fallen needles, the fungus produces spores which are ejected from fruiting bodies and are carried by wind currents to infect the new needles. Initial infection often occurs on the lower branches of the trees.

Spore production and infection are dependent on abundance of moisture in the form of frequent rains or long-lasting dews. Thus, this disease often appears first next to dense woods where the dew persists or on the lower portions of trees in plantations where weeds have not been controlled. The dense stands of seedlings in seedbeds offer ideal conditions for infection.

Needle Rust -- This rust fungus, Coloosporium asterum, attacks needles of two- and three-needle pines. Red pine is very susceptible. The disease develops in spring as small, cream-colored, bag-like pustules on needles. The pustules rupture, and orange spores are blown to infect goldenrod and asters. The rust overwinters and can live indefinitely in the crowns of these alternate hosts. During summer and autumn, spores from goldenrods and asters infect needles of the pines. This disease may cause needle drop and may stunt young pines, but it seldom causes much damage on older trees.

Tip Blight -- The fungus, Diplodia pinea, causes a tip dieback of branches of Austrian, red, Scotch, and mugho pines. Tiny, black fruiting bodies of the causal fungus grow at the base of diseased needles and on dead twigs and cones.

White Pine Blister Rust -- The rust fungus, Cronartium ribicola, infects and kills needles of white pine and then grows into the bark of twigs and branches. Swollen, oval cankers enlarge to girdle and kill stems and branches. Trees are killed when cankers completely girdle the trunk. Three or four years after infection, yellow spore masses are produced and are carried by wind to infect

nearby currants and gooseberries. Rust spores formed on the leaves of these alternate hosts cause new infection of white pines.

POPLAR

Leaf Rust -- A rust fungus, Melampsora abietis-canadensis, produces yellowish-orange powdery pustules on the lower leaf surface. Hemlock is the alternate host for this fungus.

Scab or Shoot Blight -- This disease is caused by the fungi, Venturia populina and V. tremulae. Young leaves become black and wilt. In some cases, particularly on quaking aspen, the fungus may spread down the petiole and blacken the shoot, which then withers and appears hooked. Under moist conditions, dark-greenish spores of the fungus are formed on affected leaves and shoots.

RED CEDAR

See JUNIPER

SPRUCE

Cytospora Canker -- The causal fungus, Cytospora kunzei, attacks Norway and Colorado spruce, causing death first of the lower branches and then progressing to higher branches. The cankers produced on affected branches are inconspicuous. They may be covered with resin, which often drips to cover lower branches. During rainy weather, threadlike, yellowish, gelatinous spore masses ooze from fruiting bodies on the cankers. These spores are spread by rain, wind, or birds to other spruces, where they enter through wounds.

SYCAMORE

Anthrachnose -- This fungus, Gnomonia platani, causes twig, bud, shoot, and leaf blight. Twig blight occurs before leaves appear in the spring, and kills the tips of one year-old twigs. Small black fruiting bodies of the causal fungus appear in the bark of the dead twigs. Cankers may girdle the twigs. Repeated annual killing of twigs results in gnarled or bunchy branch growth.

Bud Blight occurs as cankers on the twigs, and causes the buds to die before they open. Shoot blight, which appears as a sudden dying of expanding shoots and immature leaves on affected branches, is often confused with frost injury. Leaf blight occurs when spores produced on the twig and branch cankers infect expanding or mature leaves. Affected leaves show irregular dead areas along the veins. Dark-brown fruiting bodies of the fungus are found on diseased leaf tissue. The fungus often grows through leaf stems into the twigs, where it becomes active the following spring.

Powdery Mildew -- See GENERAL DISEASES

TULIP POPLAR

Leaf Spot -- The fungus-caused (Gloeosporium liriodendri) leaf blotches have dark-brown borders and may be up to 1/2 inch in diameter.

Leaf Yellowing or Scorch -- During hot, dry periods in midsummer, leaves of recently transplanted or weakened trees may turn yellow and drop prematurely. Small angular, brownish specks often appear between the veins of affected leaves. The yellowing and scorch result when roots fail to supply enough moisture to replace the loss during hot, dry periods.

Sooty Mold -- See GENERAL DISEASES

WALNUT, BLACK

Anthrachnose or Leaf Spot -- The fungus, Gnomonia leptostyla, causes irregular dark-brown spots on leaflets. Severe infection results in premature leaf fall.