Can You Spot Evergreen Diseases

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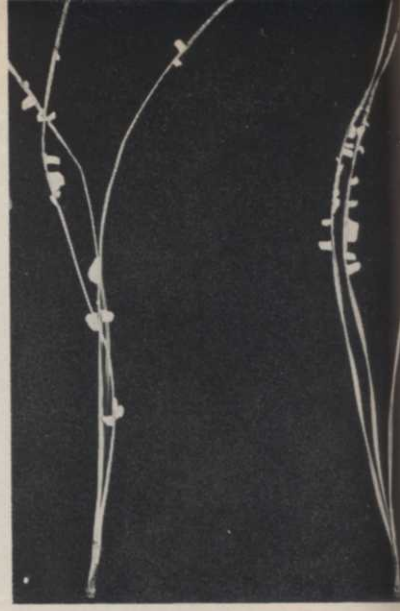


Pustules on needles of red pine caused by the needle rust fungus *Coleosporium*.

EVERGREENS have long been considered relatively free of insect and disease problems as compared with shade and ornamental trees and shrubs. Low maintenance costs in the nursery as well as in the permanent planting site have provided a positive stimulus leading to the extensive, and at times overenthusiastic, use of evergreen varieties in landscape plantings. Intensive cultivation of large numbers of evergreens over the past 20 to 30 years, however, has resulted in a tremendous increase in diseases and insect pests. Measures to control them are frequently required to realize a profit on evergreens in the nursery, landscaping and arborist industries.

Although research on control of pests has lagged behind both production of evergreens and introduction of new varieties and selections, effective control measures have been worked out for many evergreen pests and should be employed wherever possible. The effective use of proven pest control practices will not only benefit the plants being injured but will aid in preventing the buildup of disease organisms and insect populations. This, in turn, will help prevent the spread of these pests to other potential host plants. Control recommendations for many plant pests may be obtained from state and federal research organizations and are usually based on scientific experimentation. Such recommendations, if followed closely, will give better results in the long run than hit-or-miss measures suggested by the untrained or poorly informed.

Because of similarities in symptoms and control measures, diseases of evergreens may be separated into four categories: leaf or needle diseases, twig and stem diseases, root diseases, and diseases or injuries not resulting from disease-causing organisms. Control practices for specific diseases within each category are usually quite similar, and some of the practices are effective on several diseases within the group.

Many needle diseases of evergreens are common and widely distributed; others rarely occur except when climatic conditions are optimum for disease development. Some cause little damage and are of interest only on specimen plants, whereas others can result in severe injury and loss of desirable plants. Nurserymen, landscapers, and arborists alike should become familiar with most of the common needle diseases and their control measures. Those evergreen diseases which occur most frequently in the Midwest will be discussed in this paper.

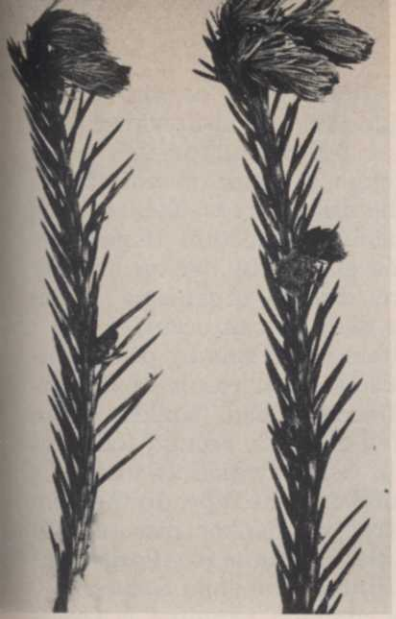
Cedar-apple and cedar-hawthorn rust are two of the most prevalent and widespread evergreen diseases in the Midwest. Cedar-quince rust also occurs, but is less common.

Woody Galls Formed

The cedar rust fungi invade the needles of susceptible juniper varieties. As the disease progresses, small to large, green, woody galls are formed by the cedar-apple and cedar-hawthorn rust fungi, and pustules are formed on stems by the cedar-quince rust fungus. Occasionally the galls or pustules enlarge and stem tissues are invaded by the fungus to the point where the stem is girdled. When this happens, the portion of the branch extending outward from the girdle dies.

During moist periods in the spring, bright orange, sticky spore horns form on the galls, giving them a striking, unsightly appearance. When the spore horns dry up, masses of spores are released and may be blown to alternate pomaceous hosts, such as susceptible crabs and hawthorns, causing leaf spot and defoliation. Alternate infections of evergreen and pomaceous hosts are necessary for the cedar rust fungi to complete their life cycle.

Several measures are useful in controlling the cedar rust fungi. One simple but effective meas-



Diplodia tip blight symptoms on young shoots of Norway spruce.

***Lophodermium* needle cast fungus** fruiting bodies on needles of *Pinus contorta*.

White pine blister rust canker caused by the fungus *Cronartium ribicola*.

ure is to pick or prune the galls or pustules from affected evergreens in late fall or early spring before the spore horns form. This will not only get rid of the unsightly galls, but will prevent spread of the rust fungi to the alternate hosts. If many diseased plants are involved, as in nursery or large juniper plantings, or if this method is impractical for other reasons, affected plants may be sprayed with cycloheximide (Acti-dione as Acti-Spray tablets) following the recommendations on the package. One spray should be applied in the spring, usually sometime in May, when spore horns are beginning to swell on the galls and are about ⅛ inch long. This spray prevents spore horn formation and consequent spread to the alternate hosts.

Since the presence of both hosts is required for the cedar rust fungi to complete their life cycle, the best control measure for rust galls on juniper is to remove susceptible crabs and hawthorns in the vicinity. This practice, unfortunately, is seldom feasible, particularly in nurseries and extensive landscape plantings.

The next best procedure is to plant juniper varieties resistant to the rust fungi. Particular attention should be given when selecting varieties of *Juniperus virginiana*, since 21 varieties or forms have been found susceptible to cedar-apple or cedar-hawthorn rust or both, and 15 forms are reported resistant to one or both fungi. *Juniperus scopulorum* and all its forms and varieties are reported susceptible to cedar-apple rust and should be planted only if other juniper species are not available or not desirable for some reason. A list of resistant and susceptible juniper varieties is available from the Illinois Natural History Survey on request.

Spraying Is Practical

If neither removal of the alternate hosts nor use of resistant varieties is practical, susceptible junipers may be protected from rust infection by three sprays applied in July and August at 3-week intervals using 2 pounds of ferbam in 100 gallons of water.

Several fungi may cause needle blights of evergreens, especially if a plant is weakened by drought, winter injury, transplanting shock, a poorly drained site, or low nutrition. Most healthy evergreens, such as spruce, fir, and pine, can be protected from needle blights by applying several sprays in the spring using one of the organic mercury fungicides or a copper-containing fungicide such as Bordeaux mixture.

One of the needle blight fungi, *Scirrhia pini (Dothistroma pini)*, is of considerable importance, since infected trees often show extensive defoliation and dieback and occasionally die. This disease may affect several species of pine but is most severe on *Pinus nigra* (Austrian pine), *P. ponderosa* (Ponderosa pine), and *P. thunbergi* (Japanese black pine) in Illinois. Yellow to tan spots appear on 1- to 2- and 3-year-old needles in late fall or early spring. By April or early May in Illinois, fruiting bodies of the fungus appear on the spots. Often a band is formed around affected needles and the portion of the needle beyond the band dies. On severely diseased trees all but the current season's needles may defoliate, resulting in weakened trees which may succumb to winter injury or other causes. The disease is most severe on pines growing in sheltered locations, groves, or windbreaks. For this reason one of the recommended controls is to thin out groves and provide better air circulation which often reduces the severity of damage.

Although spraying of both diseased and healthy needles in the spring with a copper-containing fungicide such as Bordeaux mixture has been reported to give good results, *Scirrhia* or *Dothistroma* needle blight is difficult to control, and further work on the effectiveness of fungicide spray programs is needed. Con-

Cedar-apple rust gall on twig of red cedar before spore horn formation has occurred.

***Scirrhia* or *Dothistroma* needle blight** on 1-year-old needles of Austrian pine.

siderable variation among individual Austrian pines in susceptibility to the disease has been observed in Illinois. Resistant varieties or clones may someday provide the best solution to control of this disease.

A large group of fungi may cause defoliation or needle cast on evergreens. Needle casts are not usually of enough consequence to warrant control measures, but under optimum conditions for disease development a fungus such as *Lophodermium pinastri* can cause considerable damage. Control measures are the same as for needle blights and consist of spraying in the spring with organic mercuries or copper-containing fungicides.

Needle rust of pine, usually found on *Pinus resinosa* (red pine), occurs commonly in the Midwest. White to orange pustules, fruiting bodies of the fungus *Coleosporium,* appear on infected needles in the spring and can result in stunting and defoliation in young seedlings. However, the disease is seldom of any importance on older plants, and therefore control measures are not often recommended. Control can be achieved by removing all goldenrod and asters in the area, which serve as alternate hosts for the rust fungus.

The fungus *Botrytis cinerea* may cause a mold or blight on foliage and succulent stems of evergreens under conditions of high humidity. Seedlings and cuttings in the greenhouse are often attacked by this fungus, but *Botrytis* mold on plants in the field is rare and usually occurs only during periods of extremely wet weather. Control has been achieved through the use of copper fungicides, but a new fungicide, Botran, may prove to be much more effective. Weekly spraying of foliage with Botran as soon as *Botrytis* blight appears should give satisfactory control.

Mildew Fungi Are Regular

Mildew fungi appear frequently on the foliage of evergreens, particularly on the broad-leaved plants such as Euonymus and holly. Disease severity, which varies from year to year, depends on weather conditions. In addition to an unattractive appearance, mildew can cause leaf curling, defoliation, and general weakening of infected tissues, resulting in increased dieback due to severe weather conditions. Control measures consist of spraying at 10-day intervals with Karathane, sulfur, or cycloheximide (Acti-dione PM), beginning when mildew first appears on the foliage.

Organisms causing twig and stem diseases on evergreens are often found on plants low in vigor or weakened in some way. Many disease organisms found on stems, such as the canker fungi, are wound-invading parasites which enter the plant through a break or wound and, if the tissues are weakened, cause a localized infection. If stems become girdled by canker or other stem disease organisms, extensive dieback can occur.

Stem infections by disease organisms often result in the formation of dead, sunken areas, called cankers, around the point of invasion, which is usually a wound of some type. In the more destructive canker diseases, the cankers continue to enlarge until girdling of the stem occurs.

A common example is *Cytospora* canker of spruce. Early symptoms appear as browning and defoliation of needles on affected branches. In most cases girdling cankers form, accompanied by the exudation of pitch, and branches die, beginning with those nearest the ground and progressing slowly upward. Control may be achieved by pruning out cankered branches and by maintaining plants in a vigorous growing condition by proper pruning, watering, and fertiliz-

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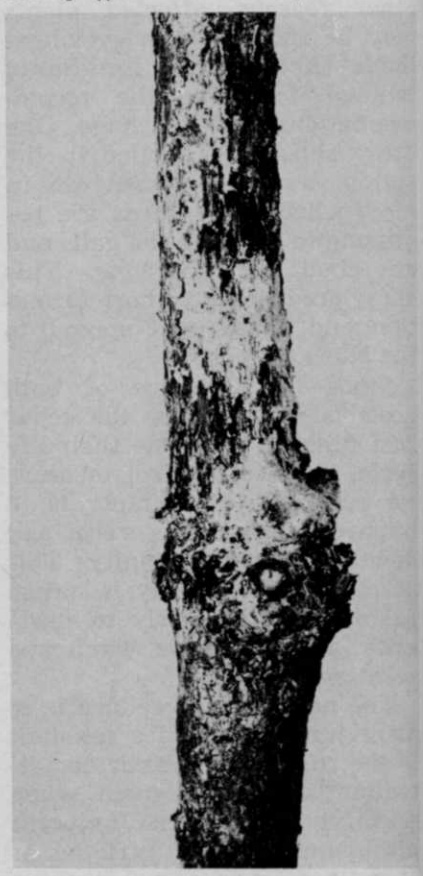
Cytospora canker on Colorado blue spruce showing typical exudation of pitch.



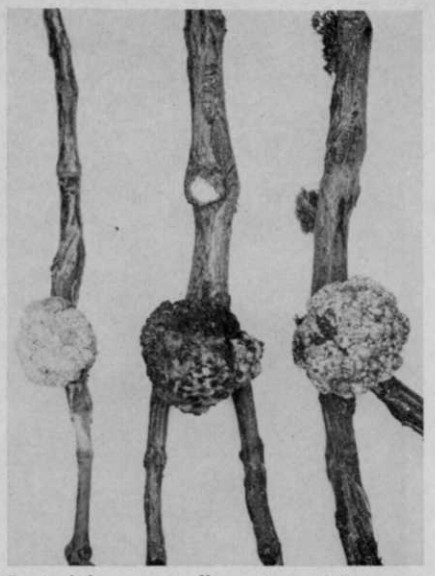
ing. Wounds should be treated with a good wound dressing. Pruning tools should be sterilized between cuts with alcohol, Chlorox, or formaldehyde, and pruning should be done only in dry weather, since spores of the fungus are readily transferred to healthy tissues under moist conditions.

Other canker diseases, such as *Pseudonectria* canker of boxwood and *Nectria* canker of Euonymus and other plants, occasionally occur, usually on weakened plants. Control measures for these and other canker diseases of evergreens are the same as for *Cytospora* canker. Applying organic mercury sprays in the spring to susceptible plants may provide some degree of protection against cankers.

White Pine Blister Rust Is Very Destructive

For many years the most destructive disease of white pine forests and plantings in the United States has been blister rust caused by the fungus *Cronartium ribicola.* Losses from this disease have been so severe that federal funds are regularly appropriated for its control. Fortunately, blister rust is not known to be of consequence in ornamental plantings because of quarantine regulations against plantings of susceptible currants and gooseberries which serve as alternate hosts for the fungus. In addition, blister rust is seldom found on white pines in the southern regions of the Midwest.

Where blister rust does occur, the fungus invades and kills needles on white pines and then moves into the bark of twigs and branches; there it produces swollen cankers which may girdle the stem. Spores produced in these cankers infect the leaves of susceptible currants and gooseberries on which spores are produced that cause further infection of pines. The best control recommendation in ornamental plantings is the removal of dead and dying branches at their point of attachment and the eradication of alternate hosts in the area. In addition, white pines should not be planted in frost pockets or low, swampy areas where conditions of high moisture occur.



Bacterial crown gall on stems of *Euonymus sarcoxie.*

A stem disease which has a wide host range and is familiar to almost everyone who works with woody ornamental plants is bacterial crown gall. The bacteria are soil-borne and enter plants through wounds. Small to large, woody galls form on roots or at the crown of infected plants. Several species of Euonymus such as *E. fortunei* and *E. japonicus* are extremely susceptible to crown gall and are seldom found without galls. Extensive gall formation can cause girdling and death of stems. Galls may become inactive after the first year or they may persist and increase in size each year until the stem is girdled and killed.

To control this disease, all infected material should be removed and burned. Pruning tools should be disinfected to prevent spread of the bacteria. Susceptible varieties should be handled with extreme care to prevent infection of healthy plants through wounds. Whenever possible, infested soil should be planted with species or varieties of ornamentals which are resistant to crown gall.

Shoot tips of pines, firs and spruces, which lack vigor or have been weakened by insects, diseases, adverse weather conditions, drought, or unfavorable planting sites may be attacked by the tip blight fungus, *Diplodia pinea.* Typical symptoms are wilting or drooping and eventual browning and dying of affected shoot tips. Diseased shoots should be pruned off and burned, and affected plants should be kept well watered and fertilized, since vigorous plants are less susceptible to attack. Some protection of susceptible plants can be provided by three spray applications at 2-week intervals with one of the organic mercury fungicides. The first spray should be applied when new growth first appears.

Twig blight, caused by the fungus *Phomopsis juniperovora,* attacks arborvitae and many juniper varieties as well as cypress and false-cypress. The disease fungus invades and kills the bark, and in time cankers form on diseased stems. As the cankers enlarge, affected stems die and needles turn brown. Damage caused by *Phomopsis* blight varies from year to year, but when optimum weather conditions for disease development prevail, as in 1966 in Illinois, the disease may reach epidemic proportions and can result in the loss of many valuable plants.

Since fruiting bodies containing spores of the fungus form on cankers during wet weather and provide a source of inoculum for further spread, all diseased twigs and branches should be removed and burned during dry periods. Pruning or shearing equipment should be disinfected periodically to prevent spread of the fungus to healthy tissues. When available, resistant varieties such as Hill's juniper, Keteleer red cedar, and spiny Greek juniper may be planted. Susceptible varieties may be protected against *Phomopsis* blight with five sprays of organic mercury fungicide at 10-day intervals beginning as soon as shoot growth starts in the spring.

Most stem diseases can be prevented or reduced by keeping plants healthy and vigorous. Sterilizing wounds and pruning tools and careful handling of plants to avoid wounding will help prevent the spread of the disease organisms to healthy tissues.

Diseases affecting the roots of

evergreens fortunately do not appear frequently, for once a root disease becomes established, it is usually impossible to save or cure the infected plant. Control measures must be designed to prevent initial infection. Plants subject to root diseases should be handled with care to prevent root wounding. Only resistant species or varieties should be placed in a site which has a history of root infection, since root disease fungi are usually soil-borne and difficult, if not impossible, to eradicate. Under certain conditions soil fungicides can be of value in controlling root diseases.

Root Rot Of Pine Usually Only In Forests

Although considered a disease which is usually confined to forest plantings, root rot of pine caused by the fungus *Fomes annosus* has been found on a wide range of hosts and may eventually appear in ornamental plantings. The disease causes extensive damage in thinned pine plantations, but is rarely a problem in the Midwest on unthinned plantings. The disease fungus enters the host through wounds or cut stumps and spreads readily to adjacent healthy plants through root contacts or grafts. Trees affected by this disease appear suddenly to turn brown and die, although the fungus may have been present in the trees for one or more years before symptoms showed up. In late fall, fruiting bodies or conks of *F. annosus* may appear around the base of diseased trees beneath the duff or leaf litter.

Some control has been achieved in affected pine plantings by treating cut stumps with urea at the time of thinning. This practice promotes the growth of other fungi which colonize cut stumps and are antagonistic to *F. annosus*. If root rot appears in an ornamental planting, it is advisable to treat all wounds on susceptible evergreens with a good wound dressing and to remove all diseased plants and all slash and dead wood from the area.

In recent years the fungus *Phytophthora cinnamomi* has been identified as the cause of wilting and death of several ornamental species, particularly yews and azaleas. In Indiana, where considerable loss of yews in nursery fields has been observed, diseased plants became light green at first, and then dried out and died. In most cases brown streaking was found in the sapwood of the crown and larger roots.

In southern areas of the Midwest where azaleas are grown in the field and in greenhouses where potted azaleas are grown, *Phytophthora* root rot can become a serious problem. The foliage of affected plants becomes sparse and thin and tends to wilt with increasing frequency until permanent wilting and death occur. The wood of diseased plants usually show brown discoloration.

Potted plants may be kept free of *P. cinnamomi* with sterilized soil and disease-free planting stock. In addition, all benches and implements should be kept clean, and tools should be sterilized frequently wherever possible. If *P. cinnamomi* is found, all diseased plants should be destroyed, and all benches and the soil of apparently healthy plants should be drenched immediately at the rate of 2 pounds in 100 gallons of water with a Dexon-Terraclor fungicide mixture. Some control of root rot in the field with Dexon or Dexon-Terraclor has been reported. All diseased plants in the field should be destroyed, root wounding should be kept to a minimum, and only resistant species or varieties of ornamentals should be planted in fields where *P. cinnamomi* is present. Diseased plants cannot be cured by any method now known.

Fungi Cause Damping-Off

Several fungi cause damping-off or seedling blights. The most common ones are species of *Fusarium, Pythium, Phytophthora, Rhizoctonia,* and *Botrytis*. These organisms most frequently attack seedlings or cuttings, killing the tissue of roots and stems near the ground line and often causing affected plants to fall over. The standard control procedure for these diseases is soil sterilization, either by steam or fungicidal chemicals. Damping-off and seedling blights are common in seedling and cutting beds but occur only rarely under field conditions.

A fungus which can cause not only seedling blight but also death of young conifers in the field is *Cylindrocladium scoparium*. Spruce and red pine are most commonly affected. Symptoms appear as root rot, discoloration of crown and root tissues, and crown cankers resembling those of heat injury. Since the fungus is soil-borne, sterilization of seedling beds is recommended. Control in the field is more difficult, and resistant species or varieties of conifers should be used where this fungus is present.

Many Types Of Trees Hurt

The fungus *Armilaria melea* attacks a wide range of plants including many deciduous species and a few evergreens such as Douglas fir, pine, rhododendron, and yew. Affected trees are usually stag-headed and are easily blown over or uprooted by high winds because of their rotted roots. Black fungus strands called shoestrings may be found in the duff or soil around diseased trees, and white fungus fans or dark red, rootlike strands are present beneath the bark. Since weakened and injured plants are most susceptible to this disease, such plants should be fertilized and watered to protect them from *Armilaria* infection. No control is known to be effective once infection has taken place.

Wilting, dieback, and decline of a large number of plant species and varieties is caused by the fungus *Verticillium alboatrum*. Although most of the hosts are deciduous, occasionally an evergreen such as *Viburnum lentago* may be seriously damaged. The most obvious symptoms of Verticillium wilt are wilting and dieback, usually occurring over a period of several years. Most plant species infected with this fungus show discoloration in the sapwood. Since the fungus is soil-borne, control measures in the field are difficult. Root wounding should be kept to a minimum to prevent infection, and resistant species should be

planted where Verticillium wilt has become a problem. In some cases diseased plants may recover following fertilization.

Practically all plants, including evergreens, may be damaged by a group of microscopic roundworms known as nematodes. In the past if a plant did not show symptoms of the nematode disease known as root knot, it was thought to be nematode-free. Recent investigations have shown, however, that many species of nematodes other than those causing root knot feed on the roots of ornamental plants and can cause damage. Symptoms of nematode attack may range from almost undetectable stunting to chlorosis; slow decline; increased susceptibility to diseases, insects, and winter injury; and death of affected plants.

The importance of nematodes is increased by the fact that injury or wounds caused by their attack may provide points of entrance for soil-borne disease organisms. In addition, some nematode species have been shown to transmit virus diseases. The true significance of nematodes in the culture of evergreens and other ornamental plants awaits further investigation, but all the facts point to nematodes as a cause of considerable concern to the entire ornamental plant industry. Increasing research in this field is already under way.

In addition to losses caused by disease organisms, many evergreen troubles are caused by adverse weather, nutrient deficiency, mechanical damage, and chemical injury. No standard set of procedures can prevent or control such a variety of troubles; consequently each has its own control recommendations.

Yellowing or chlorosis of evergreens may result from many different causes. Any disease, insect, or mechanical injury may bring about yellowing of foliage, but in most cases other symptoms are also present.

Chlorosis Remedied By N

Chlorosis most frequently results from the lack of an adequate amount of some nutrient, such as nitrogen or iron, in the soil. Nitrogen deficiency usually appears as a general yellowing and stunting of the plant and is easily remedied by the application of a standard high-nitrogen fertilizer.

Iron deficiency, on the other hand, appears as chlorosis or yellowing of interveinal tissues, while veins remain green. Iron deficiency chlorosis is most pronounced on the youngest growth and increases in severity with each new flush of growth. Although iron may be present in a soil, it becomes chemically bound under alkaline conditions, and some species of plants are not able to obtain it from the soil. For example, yews may be dark green and healthy in a soil with a pH rating of 7 or higher, whereas adjacent azaleas in the same soil are highly chlorotic. The ability to obtain iron is genetically controlled and the process is not well understood.

To combat iron-deficiency chlorosis, iron-containing com-

pounds may be applied either to the soil or directly to the chlorotic foliage. Foliage treatment may be adequate if the plant is to be transplanted within a year, but this treatment is not long lasting and would have to be repeated, since iron is not translocated from leaves to other parts of the plant or to new growth. In the case of a home or industrial landscape planting of the permanent type, applying iron-containing compounds to the soil will give more lasting results. Iron sulfate may be applied to the soil alone or in combination with sulfur to acidify the soil. In highly alkaline soils, compounds known as chelated iron are usually more effective than other materials. A good way to avoid iron deficiency chlorosis is to check the acidity of the soil and not to plant in alkaline soil varieties known to become chlorotic easily.

With the increasing use of weed killers and pesticides, the improper application of these materials has also increased. Too many people feel that if one pound will do the job, two pounds will do it twice as well; consequently chemical injury occurs frequently. Damage due to excessive or improper use of weed killers, such as 2,4-D; 2,4,5-T; or amino triazol, usually appears as curling and distortion of foliage and succulent shoots, sometimes accompanied by chlorosis, and browning and death of tissues in severe cases. Little can be done to correct the damage on injured plants except to prune out dead material and to keep the plants well watered. Fertilizer applications to injured plants may increase the amount of damage. The best way to avoid injury by weed killers is to use them with caution, try to keep them away from ornamental plants, and above all, follow the manufacturer's recommendations.

Excessive application of fungicides, insecticides, or fertilizers can result in damage to evergreens as well as deciduous species. Foliage burn, dieback, and occasionally death of the plant are typical symptoms. Plants injured by these materials should be pruned and watered. Again the best control is to use any agricultural chemical as recommended by the manufacturer at the rate specified on the package.

Although many people find it hard to believe that mature trees, shrubs, and evergreens are subject to injury during dry periods, such is not the case. The small feeder roots of most plants are succulent and tender and may be injured or killed when soil moisture becomes depleted. Soils differ in their moisture-holding capacity, and root damage may occur more rapidly in sandy soils than in clay or loam soils. Most ornamental plants will be more vigorous and less susceptible to insects, diseases, and winter injury if they are watered periodically during dry periods. The volume of water applied and the frequency of watering should depend on the species and size of the plant, the soil type, and the quality of drainage at the planting site.

Symptoms Are Similar

Oddly enough, the symptoms of drought can result from an excess of water as well as a deficiency of water. Where excess water or poor drainage is a problem, the lack of proper aeration necessary for normal functions of the root system prevents the uptake of water, causing wilting and browning of aerial parts of the plant just as lack of water does. Control in one case involves more frequent watering; and in the other, providing better drainage is the answer.

Many evergreen varieties in the Midwest are injured as a result of unfavorable climatic conditions during the winter. Two main types of injury are common: drying or desiccation of foliage and tissue-kill from a severe drop in temperature.

During the winter when water in the soil and roots of evergreens is frozen and not available to the plants, the loss of moisture from the foliage caused by drying winds frequently results in browning and drying of foliage or small twigs. Desiccation can be prevented by mulching, watering up to the time the ground freezes, and spraying very sensitive varieties with an

antidesiccant. After the injury has occurred, little can be done to correct the damage except to prune or shear all dead materials and fertilize and water to restore vigorous growth.

A more severe type of injury may occur as a result of a rapid and extensive drop in temperature, either in late fall following a period of warm weather and before tissues have matured and hardened, or in early spring following a warm period which has caused tissues to break dormancy or at least to resume metabolic activity. The symptoms of low-temperature injury may be similar to desiccation or they may appear as twig or branch dieback or splitting of bark near the ground line. Another symptom is wilting and death of new shoots during the growing season as a result of stem injury or girdling which occurred during the previous winter.

This type of injury is common on evergreen varieties which are planted north of their normal range of distribution. Low-temperature injury can be avoided to some extent by selecting plants which have been grown locally for one or more years and by avoiding any practice, such as early fall fertilization, which will tend to delay maturation or hardening of tissues.

Needle drop is quite common on some evergreens, particularly spruce, fir, and hemlock, and to a lesser extent on pines and yews, as a result of climatic shock or adverse growing conditions. Protection of sensitive plants from winter injury by mulching, watering, and selecting protected planting sites are the most practical and effective control measures for this type of injury.

Wounds or breaks of any type on plants provide entrance for disease and insect pests and result in weakened tissues which are more susceptible to attack by parasitic organisms. Even a small wound or scar on the stem of a sensitive plant such as a yew can cause the injured stem to weaken or die. All ornamental plants should be handled with care to prevent mechanical injury, and all wounded branches

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Insect Report

WTT'S compilation of insect problems occurring in turfgrasses, trees, and ornamentals throughout the country.

Turf Insects

A BILLBUG

(Sphenophorous venatus vestitus)

Florida: Adults, probably this species, active at night and causing very light damage to zoyia grass golf greens in Miami, Dade County.

GRASS BUGS

Utah: *Irbisia pacifica* ranges 25-300 per sweep on severely discolored Great Basin wildrye at Beaver Dam, Box Elder County. *Irbisia* sp. badly discolored 200 acres of intermediate wheatgrass at 7,000 feet elevation above Peterson; this area severely damaged in 1966.

A MILLIPED

(Pleuroloma brunnes)

Arkansas: Taken in st. augustinegrass in Desha County. This is same species that has been very heavy in city of Paragould, Greene County.

TWO-LINED SPITTLEBUG

(Prosapia bicincta)

Alabama: First adults noted throughout central and southern areas. Becoming common on lawn and other grasses; no damage reported.

Insects of Ornamentals

BAGWORM

(Thyridopteryx ephemeraeformis)

Oklahoma: Heavy on juniper at Stillwater, Payne County, and Perry, Noble County; moderate in Beckham and Cleveland Counties.

SPIDER MITES

California: *Eurytetranychus buxi* heavy on boxwood hedges generally in Ontario, San Bernardino County. *Tetranychus telarius* medium on boxwood nursery stock in Escondido, San Diego County.

A FLATID PLANTHOPPER

(Anormenis septentrionalis)

Alabama: Numerous nymphs feeding on new growth of azaleas, camellias, dahlias, and many other plants throughout southern, central, and much of northern areas; damage not serious. Growers and homeowners concerned for several weeks in Mobile, Lee, Bibb, Franklin, Winston, and other counties. Mostly adults as far north as Winston County.

ARMORED SCALES

California: *Hemiberlesia lataniae* adults heavy on Japanese maple nursery stock in San Diego, San Diego County. **Florida:** *Pinnaspis aspidistrae* adults severe on 15 percent of 2,000 liriope plants at nursery in Dover, Hillsborough County.

GLOBOSE SCALE

(Lecanium prunastri)

Delaware: Young crawlers on ornamental plum in New Castle County area.

WEEVILS

Maryland: *Apion longirostre* adults heavy on hollyhock at University Park, Prince Georges County. **Rhode Island:** *Brachyrhinus sulcatus* pupating in North Kingstown, Washington County.

Tree Insects

A SHIELD BEARER

(Coptodisca sp.)

Arizona: Larvae severely defoliated many cottonwood trees in Yuma and Maricopa Counties.

BLACK TURPENTINE BEETLE

(Dendroctonus terebrans)

Alabama: Adults and larvae active on isolated pine trees in Lee, Baldwin, and other counties.

ENGRAVER BEETLES

(Ips spp.)

Maine: Numbers and damage of *I. pini* heavy on white pine at Falmouth Foreside, Cumberland County; injured trees transplanted last fall. Heavy sap flow prevents insects from being established. **Nebraska:** Heavy in Nebraska National Forest near Halsey.

ELM BORER

(Saperda tridentata)

North Dakota: Heavy larval populations damaged elm at Walhalla, Pembina County; pupae present.

CANKERWORMS

New York: Peak descent from trees at Riverhead, Suffolk County. Numbers medium in Nassau County. **Pennsylvania:** Mainly *Alsophila pometaria* heavily defoliated oak and other hardwoods at Schickshinny, Luzerne County.

TENT CATERPILLARS

(Malacosoma spp.)

Maine: *M. americanum* infestations and damage evident in most areas. **New Hampshire:** Pupating at Durham. **Utah:** *M. disstria* damaged bitterbush, serviceberry, chokecherry and wild rose in ranch area of Blacksmith Fork Canyon, Cache County.

A SPIDER MITE

(Oligonychus milleri)

Missouri: Collected and det., at Columbia, Boone County. Light to heavy on new growth of shortleaf pine.

Compiled from information furnished by the U. S. Department of Agriculture, university staffs, and WTT readers. Turf and tree specialists are urged to send reports of insect problems noted in their areas to: Insect Reports, WEEDS TREES AND TURF, 1900 Euclid Ave., Cleveland, Ohio 44115.

Meeting Dates

Penn State 1967 Field Day, Pennsylvania State University, University Park, Aug. 16-17.

Nursery and Garden Supply Show, Texas Association of Nurserymen Annual Convention, City Auditorium, Austin, Aug. 20-23.

International Shade Tree Conference, 43rd Annual Convention, Marriott Motor Hotel, Philadelphia, Pa., Aug. 27-31.

National Arborists Association Annual Meeting, Marriott Motor Hotel, Philadelphia, Pa., Aug. 27-31.

American Society for Horticultural Science, Annual Meeting, Texas A. & M. University, College Station, Aug. 27-Sept. 1.

Annual Turfgrass Field Days, Virginia Polytechnic Institute, Blacksburg, Va. Noon Sept. 6-Noon Sept. 7.

Annual Turfgrass Short Course, Ala.-Northwest Florida Turfgrass Association, Auburn University, Auburn, Ala., Sept. 7-8.

Lawn and Ornamental Days, Ohio Agricultural Research and Development Center, Wooster, O., Sept. 12-13.

Pacific Northwest Spraymen's Association, Annual Conference, Seattle Center, Seattle, Wash., Sept. 15-16.

Northwest Turfgrass Conference, Annual Meeting, Harrison Hot Springs, British Columbia, Sept. 19-21.

National Agricultural Chemicals Association, Annual Meeting, Holiday Inn, Palm Springs, Calif., Nov. 5-8.

American Society of Agronomy, Annual Meeting, Sheraton-Park and Shoreham Hotels, Washington, D. C., Nov. 5-10.

Texas Fertilizer Association's 1967 Agricultural Exposition, KoKo Inn, Lubbock, Nov. 9-10.

Fertilizer Industry Round Table, 17th Annual Meeting, Hotel Mayflower, Washington, D. C., Nov. 15-17.

Entomological Society of America, Annual Meeting, Hotel New Yorker, N.Y.C., Nov. 27-30.

National Fertilizer Solutions Association, Annual Convention, Denver-Hilton Hotel, Denver, Colo., Nov. 28-30.

National Aerial Applicators Association, Annual Conference, Marriott Hotel, Dallas, Tex., Dec. 3-5.

North Central Weed Control Conference, Civic Auditorium, Fargo, No. Dak., Dec. 5-7.

Ohio Turfgrass Foundation Turfgrass Conference, Sheraton-Cleveland Hotel, Cleveland, O., Dec. 11-13.

Evergreen Diseases

(from page 35)

should be removed and the wounds treated with wound dressing.

Ice storms which cause thick deposits of ice to form on branches occur occasionally in the Midwest. The ice itself does not usually cause damage, but the extra weight can result in twig or branch breakage. Fortunately, ice damage is rare for little can be done to prevent it. Ice injury should be treated like any mechanical injury on evergreens. Injured plants should be pruned, watered, and fertilized; and wounds should be painted with wound dressing.

In addition to the diseases and other types of damage already mentioned, there are many troubles of evergreens for which the causes are unknown; and other problems are continually arising. Evergreen diseases have not received the attention that diseases of other plants have had; and much research is needed to solve not only the new problems which arise, but also some of the problems which have been with us for many years.

Aquatic Vegetation Control

(from page 18)

at commercial use of water hyacinths have had little success to date, he reported.

Officers elected for the new year by the Society which met June 18-21 are: Robert D. Blackburn, research botanist for the Crops Research Division, USDA, Fort Lauderdale, Fla., president; James Gorman, who served this past year as president, vice-president; Paul R. Cohee, technical sales representative for Hercules Incorporated, Orlando, Fla., secretary-treasurer; and Dr. Lyle Weldon, research agronomist, Crops Research Division, USDA, Fort Lauderdale, Fla., reelected as editor. Dierctors for the coming year are: Frank Wilson, Polk County Mosquito Control Unit, Eaton Park, Fla.; Dr. F. W. Zur Burg, University of Southwestern Louisiana, Lafayette, La.; and Fred W. John, Southern Florida Conservancy District, Belle Glade, Fla.

Trimmings

Greenskeeper Knows His Turf. A stolen golf green at Teigmouth, Eng., turned up as a new lawn at the home of Ivan Hitchcock who, incidentally, is now serving 3 years probation for the theft. Greenskeeper Edward Yeo said he had no trouble spotting his green because there was no other turf in the area like it.

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Elm Blight On Run. *Kansas City lost 13,200 elms from Dutch elm disease in 1963 which was 10% of the city's elm population. The city then hired Frank Vaydik, Detroit forester, who started a 3-pronged program in which diseased trees were removed as quickly as possible, dead or dying branches trimmed, and the 100,000 elms of the city sprayed yearly. Result was a loss of only 4578 trees in '64, 3744 in '65 and only 2912 last year, cutting losses to less than 3%. At the same time 7000 new trees are being planted each year to replace former elm loss.*

* * *

Irrigation Protects Against Hot and Cold Weather. Researchers now tell us irrigation can protect crops from frost damage. Seems that in the freezing process, water releases heat. A pound of water gives off 144 BTU's of heat. The increased moisture in the air serves as a blanket and reduces the amount of heat given off by the crop through radiation. Crops can be protected down to 20° temperatures by irrigating. During hot weather, light irrigation can be used to cool crops when temperatures are above 85° F. And all the time we thought irrigation just guaranteed the proper transpiration rate.

* * *

Big Business. Virginia Tech researchers at Blacksburg point out that weed control accounts for heavy spending throughout the state. They estimate that weed losses cost citizens $14 million in lawns and $11 million in industrial sites and rights-of-way every year.

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"Grass" Contract to Monsanto. We hear that Monsanto Chemical Company was just awarded a $174,468 contract to install synthetic grass on the Memorial High School Stadium football field at Seattle, Wash. Monsanto's bid was accepted over a lower bid of $162,000 by virtue of a 5-year guarantee. Gate receipts plus stadium parking and rental fees will finance the installation. At the price, it has to be superior to Kentucky blue.

* * *

Customer Credit. J. R. Stiffler of Borden Chemical offered his company's dealers a bit of timely advice in a recent newsletter. He urged them to arrange for customers to charge for purchases in order to increase sales. Stiffler says a number of dealers don't like the idea of the collection fee, but he feels that customers understand that the merchant has to be reimbursed by a direct charge or markup. Stiffler points to bank credit cards as a popular type aimed at practically every type of business. Seems to us it might be a good step for the service segments of the vegetation control industry.