How to Recognize and Control Major Shade Tree Pests

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Timing of application is one of many critical factors in successful control of shade tree pests, author Hall points out in this detailed analysis of proper techniques.

ANYONE who doubts the enormity of the pest problems which plague contract applicators, arborists, nurserymen, and others with an interest in growing plant life, need only glance at the figures.

Entomologists have actually classified between 600,000 and 1.5 million different species. New insects are discovered every year, and it has been estimated that between 2.5 and 10 million different kinds exist somewhere on the earth.

Shade trees in the nation's parks, yards, and forests serve as a vast target for many of these insects as well as numerous disease pests. This year many thousands of beautiful and useful trees will die due to insect or fungus injury. The purpose of this discussion is to point out how to recognize some of the more severe pests which can create havoc in trees, and to list measures for controlling them effectively.

Many factors influence the life of an insect — weather, host plants, parasites, predators, etc. Sudden rises in the number of insects in a given area may be the result of one or a combination of these factors.

Recently several insects have been noted for such cyclic appearances. Among these are gypsy moths and cankerworms, both of which are expected in large numbers again this year. A heavier than usual population of Linden looper has also been forecast for 1963. Even insects not generally regarded as economically significant will occasionally reach epidemic proportions and become a major problem. Plant diseases, too, tend to run in cycles and, again, a complexity of factors contribute to this. Reasons for these increases are not always apparent and create interesting and challenging studies for the entomologist.

Get the Most from Pesticides

There are many factors which affect the efficiency of insect control via pesticides. Perhaps three of the most important are: (1) Use of the proper chemical for the insect or disease in question; (2) Correct timing. Habits of the pest influence the timing and frequency of the applications; (3) Sufficient pressure with the proper equipment to secure thorough coverage

of the foliage of the infested trees. Knowing where to spray is as important as how to spray.

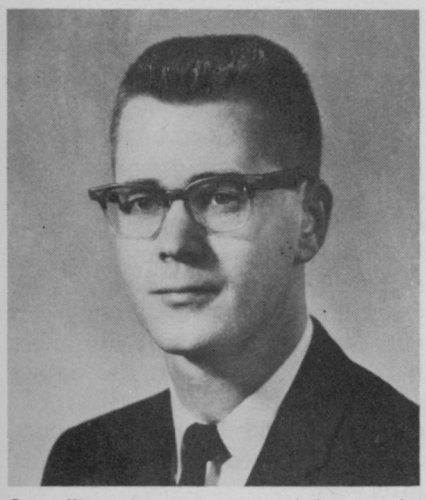
Some further points to consider are:

- Spray coverage should be thorough so no small individual pest will be missed.
- Diseases, in particular, should be controlled by preventive treatments — insects, too, when an infestation is almost certain.
- Keep a record of treatments and schedules used from year to year.
- Always read the pesticide label carefully and fully.

All pesticide formulations available to the CA, arborist, nurseryman, and others, are packed in containers with a label attached. These labels contain information regarding the toxicity of the ingredients, recommended uses, rates and precautions. The label represents an important contribution of the manufacturer in the field of research, and frequently indicates an expenditure in excess of $1,500,000 dollars. It is also the basis upon which USDA registrations for material usage have been obtained. Therefore it should be closely read and followed.

Chief Tree Insects to Beware

Out of the hundreds of insect and disease pests which exist, only a relative few cause significant damage to shade trees. Nevertheless, if left unchecked, one or more of these species can leave behind a costly trail of damage. Following is a brief discussion of some of the more commonly occurring tree pests — how to detect and control them:



Controlling tree pests is a daily task for Franklin R. Hall, arborists' field service representative from Niagara Chemical.

Aphids

One of the more consistent year to year enemies of shade trees is the aphid. There is scarcely a living plant, cultivated or wild, that does not serve as a host for these prolific sucking insects.

Aphids — tiny, soft-bodied pests — fall into two principal groups, according to the type of damage they inflict. One group affects development of young shoots or leaves, while the other produces gall-like swelling on twigs.

The group which attacks shoots and leaves causes loss of vigor, curling, or growth distortion in trees. They also produce a sticky honeydew substance on which a sooty fungus often develops. Their most frequent victims are birch, linden, larch, maple, oak, elm, and various fruit trees. They overwinter as eggs and become active in the spring.

Gall-producing aphids are particularly partial to balsam fir, Douglas fir, and spruce trees, giving them a ragged appearance and destroying their ornamental value. Resulting galls also interfere with normal twig development and may cause the death of new growth. This type of aphid overwinters as an immature adult form on the twig, and matures in mid-May.

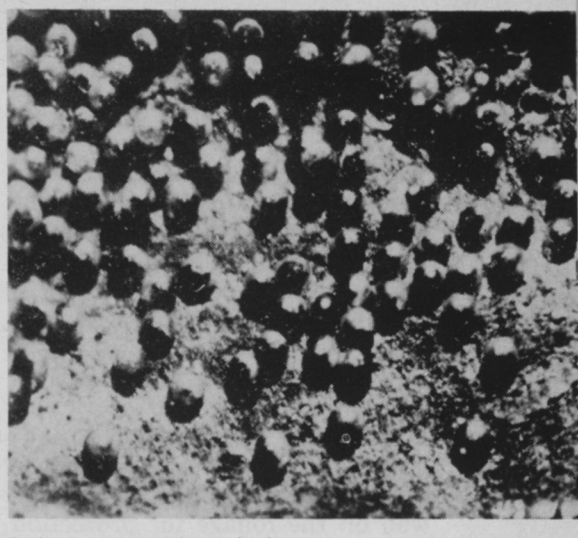
Species which overwinter in the egg stage should be sprayed early in the spring, when buds are expanding. In particular, leaf-curling species should be treated before leaves curl and the pests become less accessible to sprays.

Species which feed on main stems and branches can be sprayed once they become numerous. For gall-producing aphids, control may be effected by spraying in the spring before buds open, or fall.

Periodic inspection, to detect the presence of aphids or their eggs, should be made. Once it is decided that control measures are needed, there are several materials from which to choose. Among those most commonly used are: Thiodan, Sevin, lindane, and malathion.

Cankerworms

Spring and fall cankerworms are common native pests of most deciduous trees. The striped caterpillars (also known as measuring worms, inch worms, or loopers) when fully grown are slightly less than one inch in length. The spring cankerworm larvae vary from red to yellowish green, yellowish brown, or black, while the fall cankerworm larvae range from light green to brownish green.



Red mite eggs on the bark of a tree are a sign of impending trouble; if controlled before they hatch, a major infestation and almost certain leaf damage can be prevented.

Cankerworms destroy the leaves and buds of a great many of the common deciduous trees, but prefer the elm and apple. The caterpillars of both species appear in early May and feed for three weeks or a month. The young caterpillars skeletonize newly developing foliage, and when they are more mature, devour all but the midribs and larger veins. If an infestation is severe, the trees may be completely defoliated. Two or three successive years of severe defoliation can result in death of the tree.

The insecticidal control for both species of cankerworms is the same. Several materials are available. DDT, lead arsenate, methoxychlor, and more recently, Sevin, are most frequently used. If thoroughly applied in the correct proportions and at the proper time, they will give excellent results.

Mites

Brown discoloration of foliage and/or premature leaf drop indicates a likelihood of the presence of mites. These tiny pests are becoming more and more of a problem each year.

There are several kinds of mites. Those frequently found in large

numbers on deciduous trees include the two-spotted mite or common red spider, and the European red mite. On certain conifers, spruce mites are also troublesome. Conditions favoring buildups of all species are: dry periods in midsummer, crowded trees, poor soil conditions, and the absence of natural enemies.

Mites suck juices from the leaves of trees and in severe infestations can cause complete defoliation. Their minute size frequently permits them to be overlooked. Two-spotted mites and spruce mites, however, spin a conspicuous web on the foliage for protection of their young and eggs, and this webbing gives the foliage a readily detectable dusty appearance.

Foliage should be inspected periodically to forestall rapid buildup of mites. This can be done by holding a piece of white paper directly under a branch and tapping the foliage sharply. Mites, if present, will drop to the paper.

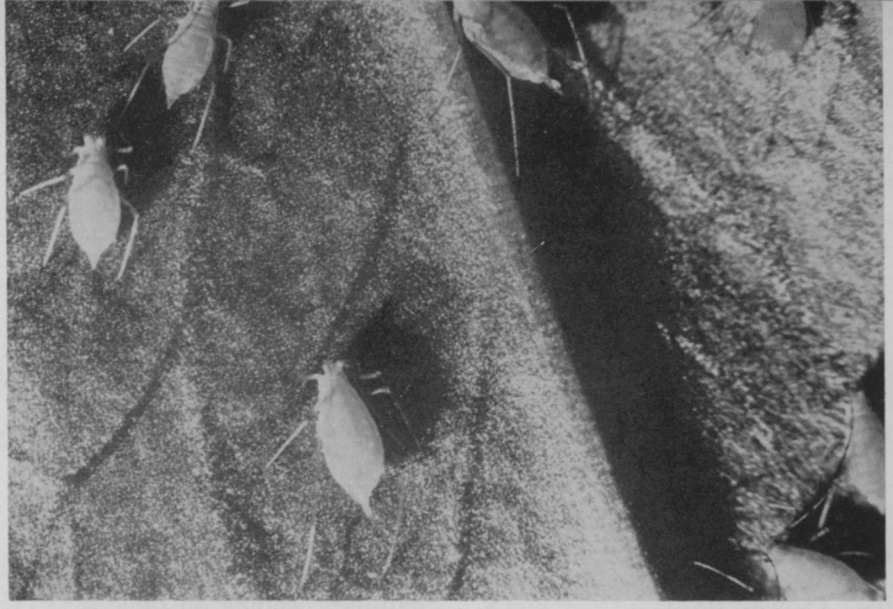
Thorough, early spraying will prevent serious mite infestations. Several effective chemicals are available for control of these pests (see Table I). Recently, new label claims on Ethion .67 Superior 60 Oil E.C. have been accepted by the USDA for control of two-spotted mites and scale on certain ornamentals. The new formulation is regarded as having a high potential for a wide usage as a summer oil.

Gypsy Moth

Oak is probably the preferred host of the gypsy moth. Other tree species favored are poplar, willow, basswood, beech, birch, cherry, larch, maple. The recreational and aesthetic value of park and forest shade trees can be seriously threatened by this pest.

Damage is caused by the larvae, which feed on foliage. When an area is heavily infested, few host species are ignored by the larger larvae. Records kept during many years have shown that oaks are damaged most severely. The trees seldom die unless leaf drop occurs in successive years, but a single defoliation causes considerable loss in normal growth.

Newly hatched larvae usually spin silken threads and swing on these while traveling through the foliage. They can be blown considerable distances by the wind, and frequently carry an infestation over many acres.



Universally troublesome shade tree pests — aphids — are shown here attacking a leaf. This particular variety of aphid causes curling or distortion of leaves and produces a sticky honeydew substance on which fungus can develop.

Gypsy moth larvae are easily recognized by their size and color characteristics. Full grown, the larva is between 1½ to 2½ inches long. The body is dark gray or brown, and clothed with prominent hairs. There are eleven pairs of spots along the back. The five nearest the head are blue, the rest red. When fully grown, they spin a few strands of silk and seek a place to pupate, a period which requires from 1½ to 2 weeks. The males may be seen flying in a zigzag pattern, particularly during warm days. The nonflying females remain on the trees to lay their eggs.

In areas where the insect is known to occur and its abundance is increasing, application of one of several insecticides is an effective control measure. Solutions of DDT and oil have been used successfully in forested areas since 1946. Lead arsenate has merit. Sevin is highly effective for this use and is extremely safe where humans and wild life are involved.

Pesticide applications should take place during the early part of the feeding period — late May or early June, depending upon the climatic factors and locality.

Borers

The significance of borers is their ability to weaken and stunt the growth of trees by making numerous galleries or by girdling the cambium of the trunk and/or main branches of the tree. Their presence can often be detected by a sparse covering of foliage at the top of the tree, wilting of the branches, and/or sap and sawdust coming from holes in trunks and branches. It has been found that old and less vigorous trees are more susceptible to attack by borers.

Borers can be divided into two basic groups: (a) those which have a caterpillar-type larval stage, and (b) those which have a grub-type larval stage. The caterpillar type is most common on ash, oak, and peach, and embraces such destructive insects as the carpenterworm and leopard moth. The grub type is most prevalent on willow, locust, maple, birch, poplar, oak, mountain ash, apple, and others. Among the grub type are "roundheaded borers" and "flatheaded" borers — so named because of the appearance of the body just behind the head of the larva.

Some species bore a gallery into the host tree to serve as a depository for eggs. The length of tunneling done by larvae can vary from a few inches to 4 or 5 feet. Most borers complete their life cycle in a year.

One of the most effective approaches to curbing borers is to enhance vigorous growing conditions. Spraying to control other insects and disease and prompt removal of weakened or dying trees are also advantageous. An effective time to spray for most borer species is when the adults are active and laying eggs. Applications should be repeated once or twice as needed at 2 to 3 week intervals.

DDT is effective in halting most caterpillar and grub-type borers,

Table of Control Measures for Major Shade Tree Pests

Pest	Material & Formulation	Amount per 100 gals. water	Remarks
Aphids	Thiodan 50% W.P. or	1 lb.	Long residual action. Observations indicate that many foliar insects may be well controlled.
	Sevin 50% W.P. or	2 lbs.	Effective against a broad range of insects.
	Lindane 25% W.P. or	1 lb.	Good residual action.
	Malathion 50% W.P.	4 lbs.	Double strength in the fall for gall-producing-type aphids is especially effective.
Cankerworms	DDT 50% W.P. or	2 lbs.	
	DDT 25% E.C. or	1 qt.	Usually, one application as the leaves are unfolding is sufficient for effective control.
	Lead Arsenate or	3-4 lbs.	
	Methoxychlor 50% W.P.	2 lbs.	
Mites	Tedior.® 25% W.P. or	1 lb.	Kills eggs and young mites. Slow kill of adults. Extremely long residual action — 6 to 10 weeks.
	Aramite 15% W.P. or	2 lbs.	Summer use for adults and young mites.
	Ovex 50% W.P. or	Deciduous-1 lb. Evergreen-2 lbs.	Kills eggs primarily.
	Malathion 25% W.P. or	4 lbs.	Use on protective schedule.
	Ethion .67 Superior 60 Oil E.C.	2-3 qts.	Apply when mites first appear.
Gypsy Moth	DDT 50% W.P. or	2 lbs.	
	Lead Arsenate or	3-5 lbs.	Apply as close to egg hatching as possible.
	Sevin 50% W.P.	2 lbs.	
Borer Caterpillar Type	DDT 25% E.C. or	1 gal.	
	DDT 50% W.P.	4 lbs.	Dates of application vary considerably. The insect species and the host to be treated are different. For detailed recommendations consult your pesticide supplier or technical advisor.
Grub Type	Lindane 20% E.C. or	2 qts.	
	DDT 50% W.P.	4 lbs.	
Leaf Miners	Lindane 25% W.P. or	1 lb.	
	Malathion 25% W.P. or	4 lbs.	Materials used against adults may require second application 10 days later. Observation of mining within the leaves is required for efficient timing of larval sprays.
	Sevin 50% W.P. or	2 lbs.	
	DDT 50% W.P.	2 lbs.	
Scale Insects	Superior 70 Second Oil or	2-3 gals.	For Dormant Sprays. (Thorough coverage is necessary)
	Ethion Superior Oil or	2-3 gals.	
	Malathion 25% W.P. Plus	4 lbs.	
	DDT 50% W.P. or	2 lbs.	For Foliar Sprays — directed against the crawler stages.
	Sevin 50% W.P. or	2 lbs.	
	Ethion .67 Superior 60 Oil E.C.	2-3 qts.	Apply when eggs hatch or when summer crawlers first appear.
Elm Leaf Beetle	DDT 25% E.C. or	1 qt.	
	DDT 50% W.P. or	2 lbs.	Where resistance to DDT is suspected, lead arsenate or Sevin are logical choices. Sevin 85W may be substituted where mist blowers are utilized.
	Lead Arsenate or	5-6 lbs.	
	Sevin 50% W.P.	2 lbs.	
European Elm Bark Beetle	DDT 25% E.C. or	8 gals.	**Dormant****
	Methoxychlor 25% E.C.	8 gals.	Hydraulic sprayers — 8-12 gallons of finished spray should be applied per tree.
	DDT 25% E.C. or	**Mist Blower Usage** 12% emulsion	**Dormant** For concentrate sprayers, use 46 gallons of either E.C. to 54 gallons of water. Spray at least 2-5 gallons of finished spray per medium to large tree.
	Methoxychlor 25% E.C.	12% emulsion	
	** If summer applications are needed — DDT (1%) for hydraulics and DDT (6%) for mist blowers may be used.		
Anthracnose	Puratized Agricultural Spray	1 pt.	Spray in early spring before buds swell, and again before the leaves unfold. Follow dormant application with one or two applications at weekly intervals depending upon the rainfall.
	Zineb	2 lbs.	
Powdery Mildew	Kolospray (sulfur)	4 lbs.	Apply midsummer on lilac. Avoid spraying at high temperatures.
Leaf Spot	Puratized Agricultural Spray or	1 pt.	Helpful for leaf spot on walnut, elm, and maple.
	COCS or	4 lbs.	
	Ferbam	1-2 lbs.	Preventive treatments are suggested where severe in past seasons.

and lindane has been recommended for some of the grub types.

Leaf Miners

There are many species of leaf miners — elm, birch, and oak leaf miners, to name but a few. Injury resulting from these pests frequently appears as blotches or blisters on the foliage. Partially or completely mined leaves turn brown and are very noticeable.

Loss of leaves is one end result of attack by the birch leaf miner. This damage is usually confined to newly developing foliage. Beyond the second generation, birch miners generally invoke little damage except for such feeding as is necessary to maintain their population. Repeated leaf losses can cause death or weaken the tree, making it susceptible to attack by other insects or diseases. Hence, treatment to curb infestations before they get out of hand is vital.

In June, the adults deposit their eggs either on the foliage or in the leaf tissue. Once eggs hatch the tiny larvae begin feeding between the upper and lower surfaces of the leaves. Birch leaf miners may have as many as four generations per year; oak leaf miner up to three. Adults of many leaf miners are tiny, two-winged, black midges or flies. The mature birch leaf miner, however, is a small, black, four-winged wasp-like sawfly.

Leaf miners are relatively difficult to curb. Timing is critical. lindane, applied when leaves are expanding and small blisters or mines are just becoming evident, has given a good degree of control.

Larval stages of leaf miners may be curbed by applications of lindane in the latter part of May for the birch leaf miner, and in early June for elm leaf miners. Treatment with malathion is also effective for control of birch leaf miners.

Scale Insects

Because of their small size and general appearance, scale insects are often overlooked until injury has reached advanced stages. This is often the point where it becomes too late to save part or all of the trees attacked.

Scale insects have a tremendous potential for reproduction. Preventive control sprays are advisable in areas where these pests are known to be active from year to year. Treatment with appropriate chemicals should be made on a "planned" schedule, not merely once damage is evident.

Injury caused by scale insects can be extensive, manifesting itself in any of four ways: (1) reduction of growth; (2) abnormal growth; (3) death of the host plant; (4) secretion of an unsightly sticky honeydew substance.

Scale insects are members of a large and complex family. For purposes of discussion, they can be divided into three groups. The first is the covered or armored scale insects, which include such pests as oystershell, euonymus, San Jose, and others. At varying intervals, the young of this species crawl out from under the protection of the female's shell or scale. After a short period of activity, they find a favorable location on the host to insert their threadlike mouthparts and feed by sucking the sap. Soon they lose their skins, and, if female, their legs and antennae also. The females combine cast skins with exudations of wax and form them into coverings. After the fourth molt (growth stage), the males soon become minute two-winged insects.

The second type is the naked or soft scale insects. Included here are such common pests as the cottony maple scale and lecanium species. They are usually humped and resemble the shell of a turtle, are not protected by a separate waxy scale or shell, and perhaps most important, frequently move from place to place while feeding and may crawl back to the twigs in the fall of the year.

A third type of insect closely related to the scale group is the mealybug. Types are too numerous to list at length.

For best results in controlling scale insects it is important that correct identification of the species be made. As with many other pests, timing of spray applications for scale insects is critical. This is especially true with the covered scales where the young come out from under the protective female shells and crawl around. The crawler stage is the best time to

control these scales. Time of spray applications can vary from April through September, depending upon the species and number of generations per year. Recommended materials include Ethion Superior Oil or Superior 70 Second Oil for dormant sprays. Sevin, a malathion-DDT combination, or the Ethion .67 Superior 60 Oil E. C. are excellent choices for foliar sprays.

Elm Leaf, Elm Bark Beetles

In recent years many cases of the dreaded Dutch Elm Disease have been traced to the feeding habits of the European elm bark beetle, aided by the widespread and highly destructive elm leaf beetle. It has been found that severe attacks of elm leaf beetles upon the foliage weaken elm trees and make them attractive breeding grounds for elm bark beetles, which we now know are carriers of Dutch Elm Disease.

Large infestations of elm leaf beetles will cause leaves to yellow and fall prematurely. The adult insects are about ¼ inch long. Those found in spring and summer appear quite yellowish with dark stripes along the sides, while in the fall and winter, they are a more uniform olive green.

European elm bark beetles are reddish brown in color with pitchy, red wings, and approximately ⅛ inch long. The rear portion of their bodies appears to have been chopped off abruptly. These pests feed on small twigs, particularly in the crotches of healthy tree branches. The breeding galleries made by the adult female beetles beneath the bark of weakened or dead trees range from 1 to 2 inches long and contain 80 to 140 eggs per adult gallery.

For effective control of the bark beetle a thorough dormant application is required. As a supplementary measure, a spray in mid-July is also advisable.

In curbing leaf beetles, sprays should be applied when leaves are ¾ grown or as soon as feeding is noted (usually late May or early June). A second dosage in midsummer may be needed, particularly if only some of the trees in the area have been sprayed previously.

DDT is suggested as a dormant spray for elm leaf and elm bark beetles. For late spring and summer sprays, DDT, lead arsenate, or Sevin can be used to halt both pests. New work by several research groups indicates that Thiodan® insecticide will probably be labelled for the control of both pests.

Significant Disease Pests

In addition to the many insect pests which threaten shade trees each spring and summer, there are fungus problems to beware as well. A few of the more significant disease pests are cited here to aid in recognition and control.

Anthracnose

Anthracnose is a fungus which overwinters in leaves and cankers and attacks the twigs or leaves of ash, linden, horse chestnut, maple, oak, sycamore, and certain other hardwoods. Oak and sycamore are both attacked by one particular species of this pest, while each of the other varieties is plagued by a different species. Thus, leaf injury to various types of trees differs

slightly in coloring, size, and extent.

Two principal types of injury are usually distinguishable. One is early leaf blight which results in the complete killing of young leaves during April or May. This type of injury varies from partial to complete defoliation of tender leaves and is similar to frost injury in appearance. It is most common on sycamore. The second type of injury shows up later in the season as irregular brown areas adjacent to and surrounding diseased spots on midribs and lateral veins of mature leaves. This type rarely causes serious defoliation, but the fungus may spread through the twigs into younger branches, producing cankers which in turn can cause twig and branch dieback.

As with many other tree pests, successful control by spraying depends on the frequency and the thoroughness of application. A suggested schedule follows:

(1) Just before the buds start to swell in the early spring.
(2) When the buds are breaking and before the leaves unfold.
(3) One or two applications at weekly intervals depending upon the amount of rainfall.

The following treatment is suggested in curbing anthracnose: Puratized Agricultural Spray (a mercury compound spray) — 1 pint per 100 gallons of water applied in the dormant stage followed by 2 treatments of Zineb (2 pounds per 100 gallons of water).

Powdery Mildew

Extensively distributed and occurring on a wide variety of plants, the powdery mildews have distinguishing characteristics which enable specialists to identify them. The powdery mildews are important in this country on maple, oak, alder, elm, poplar, and willow.

The damage caused by this disease is usually slight except when young trees are attacked. The powdery mildews are usually confined to the upper or lower surfaces of leaves, forming a white superficial growth visible to the naked eye. Occasionally, when conditions are right, and the infestation is severe, the mildews will progress onto fruits and twigs of the host. In addition to covering the surface of the leaf, the mildews also produce a sucking organ which penetrates the cells of the host to withdraw food. The spores of the developing mildews are readily carried by the wind and spread the fungus widely during summer months. The fungus overwinters in the black fruiting bodies found on fallen leaves, ruptures in the spring, discharging the spores which are carried by air currents to infest new foliage.

The powdery mildews definitely create an unsightly condition on the leaves of the host trees, but they may be checked during the growing season by use of a sulfur dust or spray at weekly intervals. Burning the fallen leaves in autumn is also quite helpful in a small or confined area.

Citywide programs for controlling shade tree pests are frequently handled by CAs. Spraying shown above is part of a Japanese beetle control program in Sacramento, Calif.

Leaf Spots

Leaf spots on trees can be caused by insects, toxic gases, bacteria, and fungi. Leaf diseases such as this can be important when defoliation results or when the infestation is so severe that most all the leaves are involved and cannot function normally. Defoliation for several successive years *may* bring about the death of hardwoods. Species of trees commonly infested by the leaf spot fungi include: elm, chestnut, oak, red maple, hickory, ash, locust, and sycamore.

Characteristic of leaf spot is the formation of dead areas in the leaf. Size and shape of the area can vary from small to large and round to irregular. The deadened tissue varies in color from yellowish to all shades of brown and black. Some of the dead areas frequently fall out, leaving holes (sometimes called "shot hole").

The spread of the leaf spot fungi is basically the same with all species. They overwinter in the old fallen leaves, develop and spread to the newly developing leaves in the spring. Wet seasons favor increased infestations of leaf spot.

Recommendations for control include the burning of fallen leaves in the fall. Dead and cankered twigs should be pruned out before the buds break in the spring. If infestations are severe, spraying with ferban or COCS (copper oxychloride-sulfate) is helpful. Puratized Agricultural Spray (mercury compound) is also useful in the control of leaf spot of walnut, elm, and maple.

Subsoil Problems Blight Lawns

Dead spots on lawns or patches that yellow during dry weather may be an indication of subsoil problems, according to Vaughn H. Holyoke, assistant crops specialist with the Cooperative Extension Service, University of Maine, Orono.

Pockets in subsoil, 4″ to 8″ below the top, can collect water in fall and winter, causing winterkilling, Holyoke explains.

"These areas can be the starting point of a severe weed problem, as well," Holyoke adds. In established lawns, turf renovation is the only solution to subsoil problems, so be sure to watch out for it when establishing new lawns, Holyoke warns.