



These white pine trees have been completely defoliated by bagworms, a common leaf-feeding pest of many trees and shrubs.

How To Control Pests of Ornamentals

By DR. DONALD L. SCHUDER

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THE PRESENT trend of the American people for suburban living has opened a new field of service, that of insect control of lawns and ornamental plantings.

Several pest control firms in the East and Midwest are already established in this field, and are finding it an excellent source of income in association with their normal household pest control operations. Other companies should investigate the possibilities of expanding into this line of work, while the demand is still growing and there is room for more operators.

Before going into this new business, PCOs and CAs should give some thought to the potential in their areas and the ability of each firm and its employees to take on this new line of endeavor. A change would necessitate knowledge of a new group of insects, new and often larger equipment, and new methods of operations. Most of the actual work is done during the spring and summer months, which are already the busy season for the PCO. Many of the firms in this business have trained personnel who specialize in the care of lawns and ornamental plantings.

In order to understand the scope of this business and the possibilities of success in it, the operators should understand the insects and plants involved, insecticides and equipment needed, and numerous other problems. This article briefly

summarizes some of the pests, and lists methods for their control. The topic is divided into *Sucking Insects*, *Chewing Insects*, *Tree Boring Insects*, *Leafminers*, *Galls*, and *Mites*.

Sucking Insects

This group includes the various aphids, lacebugs, plant bugs, and leafhoppers which weaken plants by sucking out the plant sap. These insects frequently inject into the plant tissues secretions which injure or kill the plant cells.

Aphids or *Plant Lice* — Nearly all ornamental trees and shrubs are subject to injury by aphids. These insects are small, soft-bodied insects which may vary in color from green to shades of red, brown, or black. The insects may attack both aerial and subterranean portions of the plant, but are commonly seen clustered on the new growth or the underside of leaves.

When the population of aphids is heavy, they may cause the twigs and leaves to become curled and twisted, flower buds hardened, and flowers malformed. Aphids secrete a sweet, sticky substance called "honey-dew." The material is attractive to ants and flies and is a nuisance on cars, chairs, tables, and the like which are beneath infested plants. A black, sooty mold may grow on the honey-dew.

Aphids may be controlled during the summertime by applying nicotine sulphate and soap, lindane, malathion, thiodan, or diazinon. The highly poisonous parathion and tetraethyl pyrophosphate (TEPP) are also highly effective against aphids, but are not recommended for use by anyone unfamiliar with handling them. Lindane or BHC is preferred for woolly aphids.

A forceful stream of water from

Last December, *Weeds and Turf* presented its first article on ornamental pest control, written by Dr. L. C. Kuitert of the University of Florida. This article by midwesterner Schuder gives another slant on the important ornamentals market, and offers more control hints for successful contract applicators.

the hose will help to remove sticky honey-dew from plants. Since ants frequently are involved in transporting and tending aphids, it is sometimes helpful to kill the ant colony by treating their nesting areas with chlordane.

Lacebugs — Many trees and shrubs are attacked by species of lacebugs. The insects are about $\frac{1}{8}$ inch in length, dark in color, with transparent, lacy wings. Both the adults and nymphs feed on the underside of leaves. They extract so much plant juice that the leaves become pale and mottled with white splotches. The lower surface of the leaves are spotted with black and brownish dots.

About the last of May, apply lindane, malathion, DDT, or nicotine sulfate. The new systemic insecticide, dimethoate, is also effective. Be sure to treat the underneath side of the leaves. DDT may induce a mite problem and should be combined with a good miticide.

Leafhoppers — Leafhoppers are small, wedge-shaped, active insects which run, hop, or fly when disturbed. These sucking insects are usually yellow or greenish in color, while a few kinds are striped. Leafhoppers feed on the underside of the leaves, causing them to become light in color and marked with small, white dots on the upper surface. Often, the cast skins of the nymphs remain attached to the lower surface of the leaf and may serve as an aid in identifying the cause of the injury. Some species of leafhoppers are known to transmit tree diseases such as phloem necrosis on elm.

For control, apply DDT about the middle of June, or whenever the insects are discovered. Be sure to direct the spray to the underside of the foliage where the leafhoppers feed.

Plant bugs — These small, shield-shaped insects are active and run or fly freely when disturbed. Both the adult and nymphal stages have sucking mouthparts. Several species of this group inject toxins into the plant, causing the parts attacked to wither and die. Terminal buds, shoots, and blossoms are commonly affected.

DDT is the best insecticide for controlling plant bugs. The best



Dr. Donald L. Schuder, assistant professor of entomology at Purdue University, Lafayette, Ind., details the role CAs and PCOs can play in treating for pests of ornamentals.

results are usually obtained by spraying early in the morning, because the insects are less active at that time. Preventive measures are important, and include the removal of weeds, trash, and debris.

Scale Insects — Scale insects are serious pests of many ornamental plants, but unlike the other insects which suck sap from the plants, they are inactive during most of their lives. Scale insects are quite small, usually dark in color so that they are difficult to detect. Infested plants appear unhealthy, grow poorly, and the foliage may be small and chlorotic. For ease in identification, scale insects may be grouped into three divisions: (1) armored scales, (2) soft or unarmored scales, and (3) the mealybugs.

Armored Scales

Armored scales are the most common type of scale insect found on trees and shrubs. They secrete a hard, waxy covering over their bodies. The insect feeds and grows beneath this protective covering or scale. The scale may be circular, oblong, or pear-shaped. The armored scales are quite small, varying in size from $\frac{1}{2}$ to $\frac{1}{8}$ inch in length or diameter. A typical life cycle may be illustrated with the gray race of the oystershell scale. These insects overwinter in the egg stage, beneath the female scale of the previous season. These eggs hatch the latter part of May or the first of June. The young scale, called a nymph or crawler, moves about over the host plant until it finds a suitable place to

feed. It then inserts its needle-like mouthparts and draws its liquid food supply from the phloem tissues of the plant. At this time, the insect loses its mobility and goes through a series of five molts, casting off its skin before it reaches maximum size and sexual maturity. The males emerge as winged adults and fly about in search of the females. Eggs are laid underneath the female scale and the cycle is repeated the following season. Other species of scales have multiple generations and the cycle just described may be repeated several times each year. In some species, no males are known and reproduction is parthenogenic.

Species having one generation a year can be controlled by sprays in early June. This group includes Putnam scale, pit-making scale of sweet gum, scurfy scale, and the gray race of oystershell scale.

Species having two generations per year can be controlled by sprays in early June and again in late July. This group includes such common species as the brown race of oystershell scale, pine needle scale, and the juniper scale.

Multiple generation species frequently require sprays at monthly intervals for adequate control. Some of the species included in this group are the San Jose scale, euonymus scale, and the tea scale.

Unarmored Scales

Soft, unarmored, or lecanium scales differ from the armored scales and have their waxy secretion as an integral part of their body. The body shape may be flattened, slightly convex, or hemispherical. They are larger than the armored scales, varying from $\frac{1}{12}$ to $\frac{1}{2}$ inch in length. The eggs are laid beneath the female's body and hatch in one to three weeks. Development is slow and may require almost a year for a single generation. The nymphs of several of the soft scales feed on the leaves during the summer and move back to the twigs in the fall. Most species produce honey-dew.

Some of the unarmored scale species require spraying in June. This group includes: Terrapin scale, hickory lecanium, cottony maple scale, Fletcher's or the taxus lecanium, European elm scale, European fruit lecanium, and

spruce bud scale, among others.

Some of the other unarmored scale insects require spray applications in mid-August. Some common examples are the tulip tree scale, magnolia scale, and oak kermes.

Mealybugs

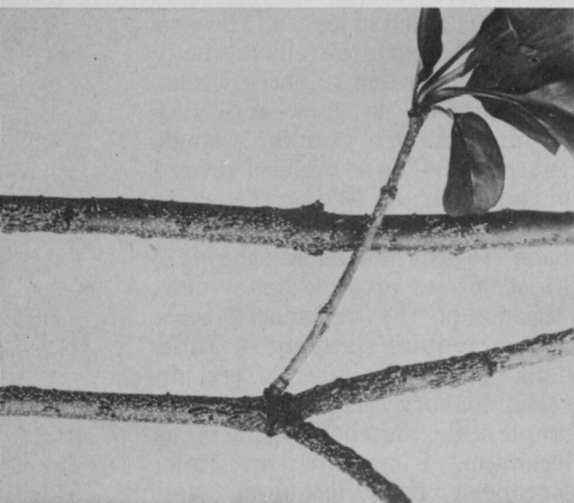
The mealybugs are soft-bodied insects and usually are covered with a powdery, cottony-waxy material. Unlike the scale insects already discussed, the mealybugs have legs and are able to move about throughout their entire life. They vary in size from about $\frac{1}{5}$ to $\frac{1}{3}$ inch in length when full-grown. The female mealybug deposits her eggs in a white, cottony sack. The species noticed on ornamental trees and shrubs produce two or more generations each year. Some common mealybugs are the grape or taxus mealybug and the juniper mealybug.

Control of Scale Insects

The control of scale insects is often difficult because of failure to obtain adequate spray coverage. To be effective, the spray material must come in contact with the insects. Care should be taken to see that the spray is evenly applied to all parts of the plant. The addition of a wetting agent to the spray mix will help wet the insect and insure penetration of the insecticide through the insect's protective covering.

Scale insects may be controlled during both the dormant period and the growing season. During the dormant period, apply dormant oil, lime sulfur, or the dinitro

Oystershell scales have infested these apple-tree twigs. Large insects are the mature females, while the smaller ones are the young, newly settled crawlers.



compounds. When the scale insects occur on oil-susceptible plants, use superior or summer oils. DN and liquid lime sulfur will discolor paint and stone and should be used with caution around home plantings.

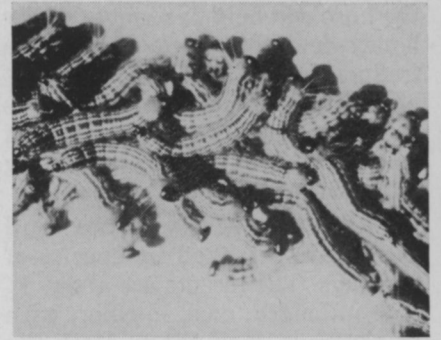
Summer crawler sprays should be timed to coincide with egg-hatch. The most commonly available and effective material for summer application is malathion. The insecticide Sevin has been found to be very effective against many of the lecanium scales. Other insecticides which have been shown to be effective against the scale crawlers are Ethion, Trithion, phosphamidon, Guthion, demeton, phorate, diazinon, chlorthion, and Cygon.

Chewing or Leaf-Feeding Insects

Leaf feeding or chewing insects include those species which consume solid foliage tissue. Members of this group may skeletonize the foliage or entirely defoliate the plant.

The Bagworm — The bagworm is a general feeder and may be found attacking the foliage of both deciduous and evergreen trees and shrubs. The bagworm is so named because the caterpillar spends its life inside a silken, spindle-shaped bag. The bag is usually adorned with bits of twigs and leaves from the host plant and looks so much like a part of the tree that it usually goes unnoticed until extensive damage has been done. The bagworm overwinters in the egg stage inside the old bag. The eggs hatch in late May and early June. The young caterpillars immediately spin bags and continue to enlarge them as they grow. When the bagworm larvae mature in late August and early September, the bags are about 2 inches long. The bags are then attached firmly to twigs or branches and the worms pupate and change into adults. There is only one generation each year.

For bagworm control when only a few small trees are involved, bagworms can be controlled by hand-picking the bags and burning them. This may be done at any time when the bags are discovered, but is most easily done during the fall and winter, or early spring. Spraying is the most effective method when the trees are large



Yellow-necked caterpillars, which usually feed in colonies on pin oaks, will throw back their heads and curl up the tip of the abdomen as a protective action when they are disturbed.

or numerous. The sprays are most effective when applied in early June, as soon as possible after the eggs hatch. Several insecticides are effective. Malathion is the most widely accepted material. Other materials which have been recommended include diazinon, toxaphene, and lead arsenate. The new insecticide DDVP is suggested for trial by professional sprayers.

Blister Beetles — Blister beetles are active, black, gray, or striped insects which appear suddenly in enormous numbers and strip the foliage from some species of ornamental trees and vines. The beetles are long, cylindrical, and have an unusual appearance because of their long legs. This group of insects usually appears in large numbers during the summer. They are difficult to control. The best control has been obtained by applying 5% granular dieldrin to the soil beneath the trees or vines. The insects are killed when they return to the soil in the cooler parts of the evening and night. Sprays or dusts of cryolite, chlordane, and DDT have also been suggested.

Leaf-feeding Caterpillars — Caterpillars, the immature stage of butterflies and moths, exist in a wide variety of sizes and colors. Some may be covered with hairs and spines, while others are entirely naked. They may feed singly or in large colonies. All species have voracious appetites and consume large quantities of foliage. Most species are easily controlled with DDT sprays. In the case of some of the webworms, it is essential to use high pressure, so that the foliage inside of the web is covered with the insecticide.

Leaf Beetles — "Leaf beetles" is a term applied to several species

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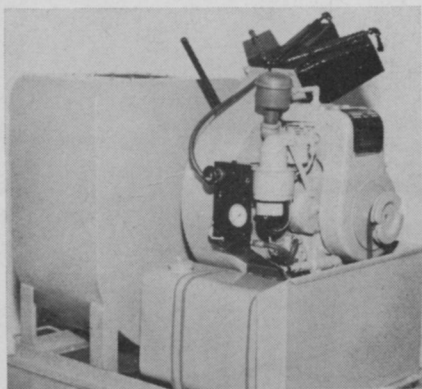
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of hard-shelled beetles of many sizes and colors which feed upon the foliage of shade trees and shrubs. They may eat holes in the leaves, as in the case of flea beetles, or they may devour the foliage completely. Some common examples are the elm leaf beetle and the willow-poplar leaf beetle. Leaf beetles may be controlled by spraying when the leaves are $\frac{3}{4}$ expanded, or whenever the insects are found, with dieldrin or DDT. DDT may cause an increase of mites, so incorporate a miticide in the spray. Lead arsenate is also effective.

Leaf-rollers and Leaf-tyers — The caterpillars included under this heading are described separately because the injury caused by the insects is quite typical, and is seen more frequently than the insects which do the damage. The caterpillars are mostly small, greenish-yellow, and about $\frac{3}{4}$ inch in length when mature. These larvae feed in concealment which they provide for themselves by rolling, folding, or tying leaves together. Control of this group of insects involves early application of the insecticide before the larvae have completed their shelters. The most commonly recommended control is TDE. Arsenical sprays are also of considerable merit. Other newer insecticides which have shown promise in leaf-roller control include Endrin, Phosdrin, Trithion, Sevin, and Guthion.

Sawflies — Many shade and ornamental trees are attacked by colonies of caterpillar-like larvae which strip the plant of its foliage. The larvae have five pairs of prolegs and the adults have transparent wings and a sawlike ovipositor, hence the name. Some species are called slugs, because they superficially resemble small, naked snails. The latter group skeletonize the foliage by eating off the lower surface of the leaf. Sawflies are easily controlled with applications of DDT.

Borers and Boring Insects

The larval stage of some beetles and moths are called borers. Some of these insects work in the terminal shoots, while others work beneath the bark, frequently girdling and killing the tree; still others tunnel in the heartwood, which makes the tree subject to

rots and windthrow. A few species of boring insects are capable of attacking healthy trees, but the majority attack trees and shrubs only after they have been weakened or injured from some other cause, such as transplant shock, drouth, flooding, and dirt fill over the roots. The presence of borers is often not evident until it is too late to save the tree; therefore, preventive measures are of the utmost importance. Spray the



Fall webworm, a common pest of white oaks and other shade and forest trees, is responsible for the heavy webbing on this forest tree.

trunk of transplanted trees with dieldrin, DDT, or lindane prior to wrapping. Be sure to use wettable powder formulations, since oil formulations may injure the bark when the trees are wrapped. Wrap the trunk of the tree with commercial borer wrap, burlap, or even with aluminum foil.

The beetles which act as borers are classified into three groups:

1. **Flat-headed borers** — the sun-loving, metallic-colored wood borers of the family Buprestidae, the larvae of which work in the cambium region.
2. **Round-headed borers** — the long-horned beetles of the family Cerambycidae, the larvae of which bore into solid wood.
3. **The bark beetles** — the shot hole borers of the family Scolytidae and others. The larvae and adults work in the cambium region and are attracted to weakened trees.

The larvae of some of the

common moths also infest the trunk and larger branches of trees. Common examples are the carpenter worm, leopard moth, peach tree borer, and dogwood borer.

Borers may be killed by spraying before the young larvae hatch from the eggs on the bark. The sprays should be applied at monthly intervals during May, June, and July. Direct this spray at the trunk and larger branches. Materials which have been found effective are dieldrin, DDT, lindane, and BHC.

Borer larvae in the cambium beneath the bark may be cut out with a sharp knife. The exposed wood should then be treated with a good wound paint.

Borers in the wood can sometimes be killed if the tunnel is first cleaned out with a piece of wire, and then nicotine sulfate, malathion, or carbon disulfide is injected into the hole. The hole should be sealed with mud, putty, or caulking compound after injection, to confine the fumes.

Leafminers

The category of leafminers contains many different kinds of

insects, the larvae of which feed between the upper and lower leaf surfaces. This feeding may take the form of tunnels which may be either straight, serpentine, or blotch. Some of the more common leafminers are the holly leafminer, arbor vitae leafminer, boxwood leafminer, birch leafminer, locust leafminer, hawthorn leafminer, and the gregarious oak leafminer.

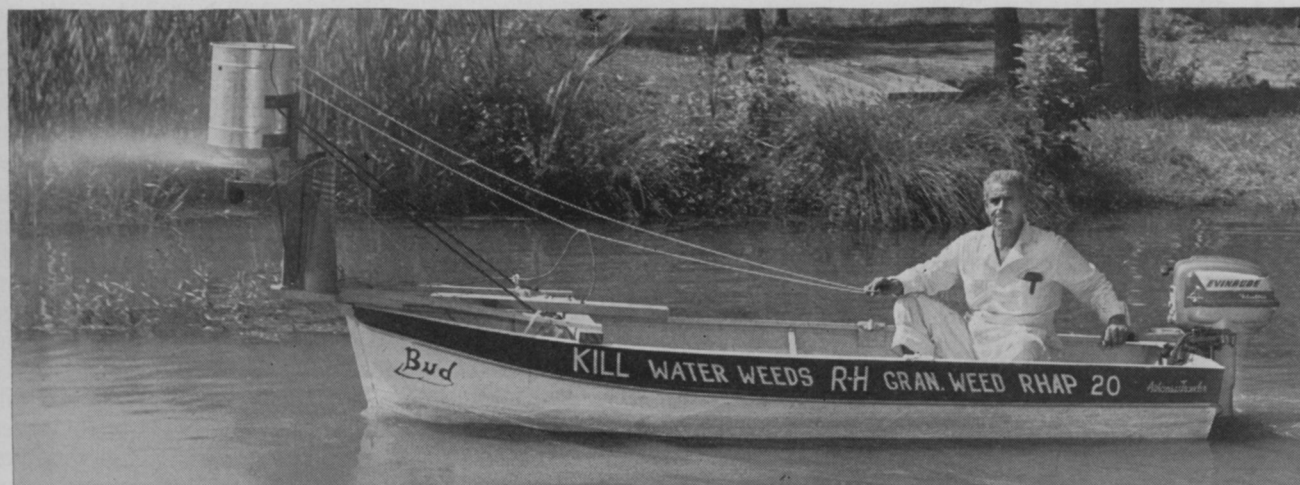
The control of leafminers depends largely upon proper timing of the insecticidal application. If the insecticide is not present on the foliage before the adults lay their eggs, the larvae already inside the leaves may not be killed. The first applications should be made early in May and repeated at monthly intervals for the species which have more than one generation per year. Insecticides commonly suggested for the control of leafminers are DDT, dieldrin, and lindane. Other insecticides which show promise in the control of leafminers are Ethion, Trithion, Cygon, Endothion, malathion, phosphamidon, and Dibrom. Some of the systemic insecticides, such as phorate and

Cygon, have given long-lasting effects when applied to the soil in mid-April. Use a 5% granular formulation at 1 ounce of actual insecticide per inch of trunk diameter at chest height, or apply one pound of actual toxicant per acre.

Galls

Galls are abnormal growths on leaves or petioles induced by insect attack. The forms of galls vary from the simple to the grotesque and unusual. Each species of insect produces a typical gall formation. Galls are produced by various insects, such as midges, wasps, and aphids. Several different mites also produce galls, of which the hackberry witches' broom and the maple bladder gall are common examples. Oak and hickory trees are the favorite hosts for several hundred different gall insects.

Damage from galls is rarely serious enough to justify chemical control, and since the gall tissue protects the insect inside, sprays applied after the galls have developed are ineffective. When only a few galls occur, they may be



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pruned off and destroyed by burning.

Individual trees which have been heavily attacked by galls in previous seasons may be protected by preventive sprays applied early in the season. Dormant sprays of liquid lime sulfur are effective in preventing attack by Cooley's spruce gall, the eastern spruce gall aphid, ash flower gall, and the maple bladder gall. Where staining by lime sulfur makes its use impractical, delayed dormant sprays (applied just as the buds are swelling) of malathion are equally effective. Similar sprays of malathion and lindane are effective in preventing hickory pouch galls. Several galls, such as the hackberry nipple gall, vein pocket gall, the marginal fold gall of pin oak, honey-locust pod gall, and the gouty oak gall have been successfully prevented by applications of insecticides when leaves are about $\frac{3}{4}$ expanded. The insecticides showing the best results have been dieldrin, Sevin, malathion, lindane, and DDT. Treating the soil beneath infested trees in early spring and in the fall with the above materials is helpful. The aerial and subterranean galls of woolly apple aphids on crabapples have been prevented by monthly application of phorate and demeton. Apply the sprays to the soil, trunk, and foliage.

Mites

Mites are not insects, but are tiny animals closely related to spiders and ticks. They are sometimes called "spider mites" because they spin silken threads over the host plant. Most mites are so small that they can barely be seen with the naked eye. The best way to be sure that mites are the cause of trouble is to hold a white sheet of paper beneath a branch and tap it sharply. If mites are present, they will fall onto the paper and can be seen as tiny specks as they crawl about. These specks, correlated with the typical speckling and webbing, or bronzing, of the foliage, indicate the presence of mites. Evergreens and deciduous trees are both subject to mite attack. Some of the mite species commonly associated with ornamental plants include the two-spotted mite or red spider, the spruce mite, the European red



This pin oak tree has been heavily infested with the marginal fold and pocket galls. Note how the foliage has been twisted and distorted by the infestations.

mite, the honey-locust mite, and privet mite. Any plants sprayed with DDT should be closely watched for mites, since these pests are not killed by DDT but many of their natural enemies are. It is always wise to include a miticide with DDT sprays to prevent mite buildup.

During the past 15 years, a number of new chemicals have been developed for control of mites. These materials, called miticides, do not have any effect on insects. Some insecticides, such as Cygon, phorate, malathion, and parathion, are effective against both mites and insects. Most miticides should be reapplied at periodic intervals throughout the summer.

Some of the newer, more effective miticides include Kelthane, Dimite, Chlorobenzilate, Eradex, and Aramite. Tedion and Ovotran, primarily ovicides, are most effective when applied before mite populations become abundant.

This discussion will probably make many CAs and PCOs hesitate to tackle the job of controlling insect pests for their customers because it might appear as though there are too many insect pests with which they would have to become acquainted. However, many operators are already very well acquainted with several of these pests. For example, many already control the boxelder bug, the elm leaf beetle, and the

hackberry psyllid when these insects leave their plant hosts and invade homes in the fall of the year. Actually, these insects are easiest to control by attacking the insects while they are still on the host plant; therefore, many PCOs have already entered the field of ornamental insect control. Since pest control operators have found this endeavor profitable, it is only logical to help the customer by controlling their other ornamental insect pests while the equipment and materials are at the scene.

Successful control of insect pests depends upon thorough coverage, whether they are indoors or out-of-doors on trees and shrubs. In order to get adequate coverage out-of-doors, the small one- and two-gallon sprayers, commonly used by the PCO servicemen, will have to be replaced with larger power equipment. The type of sprayer selected will depend upon the extent to which one is going to engage in the care of trees and shrubs. Small trees, 35 feet in height, may be adequately covered with some of the small sprayers used in termite work; however, tall trees such as the American elm, oaks, etc., require hydraulic rigs, or even the new air blast sprayers and mist blowers.

When sprays are applied to a wide variety of plant materials under varied conditions, plant injury is always a hazard. Two plant sensitivities are worthy of

particular attention at this time. Cannaert junipers are browned by applications of malathion, and DDT sprays will defoliate Amur river privet. A compilation of known phytotoxicities was published in *Pest Control* magazine in June 1960, and should be consulted for more specific details.

Those investigating the possibilities of entering the field of ornamental insect control should be interested in selected references. The four references listed below will provide the basic information

needed to provide ornamental insect pest control services for customers' outdoor problems.

Suggested References

Anonymous. 1956. Lawn Insects, How to Control Them. USDA Home and Garden Bulletin No. 35. Superintendent of Documents, Washington, D.C.

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Westcott, Cynthia. 1956. The Gardener's Bug Book. Doubleday and Company, Inc., Garden City, N. Y.

Be Cautious Near Power Lines

"CAs must learn to live with the hazards of electricity," John M. Ferguson, extension agricultural engineer at Kansas State University, Manhattan, points out. "Just using good judgment and not taking any chances will help."

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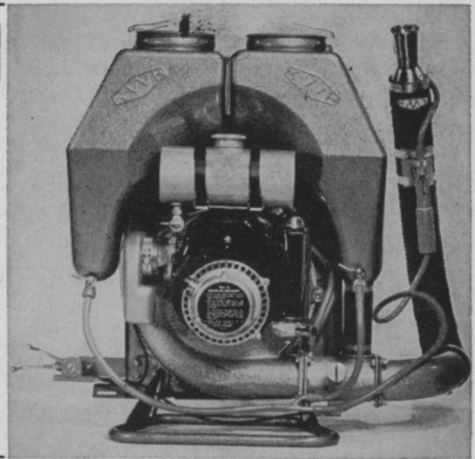
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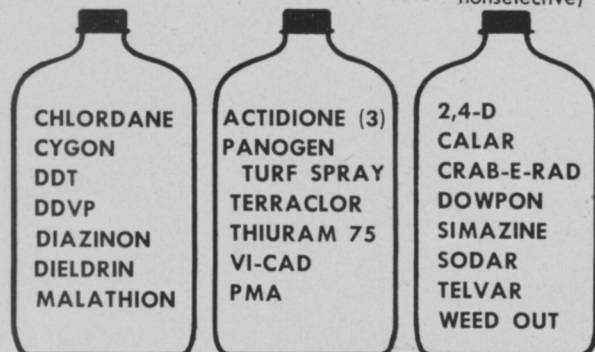


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