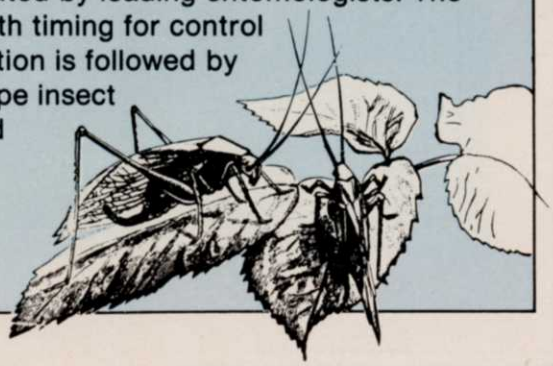
Insect Control Guide

WEEDS TREES & TURF

Turf

by Dr. Harry Niemczyk

The INSECT CONTROL GUIDE will be updated and published each May. For this premier edition, the authors are Dr. Harry Niemczyk, professor of turfgrass entomology, Ohio State University, Wooster, and Dr. R. E. Partyka, director of horticulture, Chemscape, Columbus, Ohio. Photos were contributed by leading entomologists. The Guide was written with timing for control in mind. The turf section is followed by a section on landscape insect control, i.e. trees and ornamentals.



A useful approach to dealing with insect pests of turfgrasses is to consider them as they occur throughout the growing season. While insects are present in the turfgrass environment throughout the year, the key to preventing visible damage from them is knowing the optimal time to apply control measures. These times are keyed to vulnerable periods during the pests life cycle.

Depending on whether the preventive, predictive or curative approach to control is taken, controls for a certain pest may be directed at the different stages of that pest as they occur over the growing season. With the chinchbug, for example, preventive controls may be directed at the overwintering adult in early spring to prevent the laying of eggs, that lead to the damaging summer generation. The curative approach would be to wait until the eggs hatch and then treat for the young (nymphs) during early summer. Whatever the approach, knowing the life cycle of the insect and when the various stages occur, is essential.

The purpose of this guide is to point out some major pests to look out for in 1983 and cover some of the controls that may be used during these times. No endorsement of named products is intended nor is criticism implied for those not mentioned.

LATE WINTER (MARCH)

A. Chinchbug and Bluegrass Billbug - Both of these insects overwinter as adults in the thatch but some move to sheltered sites near buildings or other protected locations. On warm days the insects begin moving about.

When summer damage from chinchbug and/or bluegrass billbug is expected, summer infestations can be prevented with an application of Dursban® (chlorpyrifos) 1 lb AI/Acre (active ingredient/acre) or diazinon 2.5 lb AI/Acre, made as soon as these insects begin to move about. In 1983 this could be as early as the first or second week of March.

B. Grubs — The larvae of this group of pests normally overwinter 6 inches or deeper in the soil. However, during the mild winter of '82-'83, many remained near the surface. This means early grub activity can be expected along with skunks and racoons who will tear up the turf searching for the grubs.

Application of Oftanol® (isofenphos) at 2 lb AI/Acre during March or when frost is gone from the ground, provides control of overwintered grubs as they return to the surface. There is limited confidence that such a treatment will provide adequate control of fall grub infestation. On the other hand, treatment at this time kills overwintering chinchbugs and billbugs and prevents infestation of these insects during the summer.

C. Mole Crickets — The biology of mole crickets varies considerably with the species and is still under study in many areas. Generally, these insects overwinter as adults deep in the soil, however some do overwinter as nymphs. Feeding activity resumes in March. Both adults and nymphs feed at night near the surface on turf roots, organic matter and other insects. During the day mole crickets return to permanent burrows.

In years when feeding of overwintered mole crickets resumes earlier than normal, Oftanol® at 2 lb AI/Acre has been used with some success. Generally, such applications are better made during May.

D. Winter Grain Mite — This dark bodied, red-legged mite actively feeds on grass blades throughout the winter. Symptoms of injury are very similar to those from winter dessication. Damaged areas may also have a gray color appearing as though hit by a late frost.

When unacceptable damage from the winter grain mite is discovered in March, infestations can be readily controlled with a single application of liquid Dursban® 1 lb AI/Acre or diazinon 2.5 lb AI/Acre.

E. Black Turfgrass Ataenius — This golf course pest overwinters as an adult in the soil under debris in roughs or other protected areas. With the mild winter and expectations of a very early spring in 1983, a few may be seen flying about on warm afternoons in early March.

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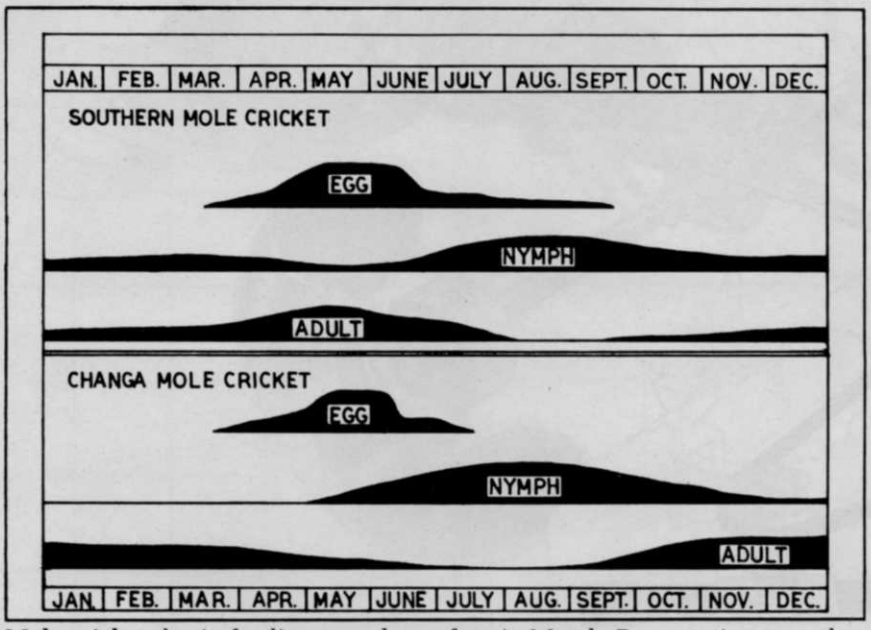

Mole crickets begin feeding near the surface in March. Preventative control would focus on stopping adults before they lay eggs.

Usually this activity begins when crocus starts blooming and intensifies as the bloom of red bud appears.

While an application of Oftanol® in March may be successful in preventing summer infestations of larvae, the probability of successes is increased by waiting until April.

F. Greenbug — The only stage of the greenbug known to overwinter in northern states is the egg. Shiny black eggs deposited the previous fall may be found adhering to grass blades, fallen tree leaves or other debris.

Treatment for greenbug is not appropriate at this time.

G. Sod Webworm — The most common sod webworm species on northern turfgrasses overwinter as larvae in the thatch or upper inch of soil. Feeding does not resume until hibernation (dipause) is broken by early spring warmth.

Treatment for sod webworm is usually not appropriate at this time.

SPRING (APRIL-MAY)

A. Chinchbug and Billbug — As the warm days of May approach, movement of chinchbug and billbug adults increases rapidly. Generally, egg laying begins during May but in 1983 this may occur a month early. Occasionally on warm afternoons, adult billbugs can be seen wandering about on sidewalks.

Generally, application of insecticides to prevent infestations of these two pests (mentioned above) should be completed by the first week in May; before significant number of eggs are laid. This time may vary as much as a week or more depending on the spring.

B. Grubs — Overwintered grubs return to the surface and begin feeding on turfgrass roots in April. Increased activity and damage from moles, skunks and racoons foraging on grubs can also be expected. Feeding by mammals and grubs continues thru May.

A single application of Oftanol® at 2 lb AI/Acre made during April has been successful in controlling overwintered grubs and preventing subsequent infestations during late summer. Application made during May may not provide immediate control, however, prevention of the late summer infestation may be expected.

Infestations of grubs can also be controlled during April or May by spot or general treatment with diazinon 5.5 lb AI/Acre, Turcam® (bendiocarb) 2 lb AI/Acre, Proxol® 8 lb AI/Acre. Golf course superintendents may also use Nematicide/Insecticide (ethoprop) at 10 lb AI/Acre. Irrigation or rainfall should follow such applications, to move the insecticide to the target grub as soon as possible.

Although milky disease products for control of Japanese beetle grubs may be applied anytime there is no frost in the ground. Spring is a good time for such applications because the soil is open and frequent rains help carry the spores deep into the soil. Remember, such products are effective against the Japanese beetle grub only.

C. Mole Crickets — Mature adult mole crickets emerge from the soil in May and engage in mating and dispersal flights. Eggs are laid in chambers hollowed out in the upper 6 inches of soil.

Though some variation in results has been experienced, application of Oftanol® at 2 lb AI/Acre during this time has been generally successful in preventing summer damage. Irrigation following treatment is advisable.

D. Black Turfgrass Ataenius - Adults of the black turfgrass ataenius can be seen flying about in April and are often found in the clipping catchers after early mowing of golf course greens. These adults begin egg laying in early May, or about the time Vanhoutte spiraea first comes into bloom.

Application of Oftanol® during April or May has successfully prevented larval infestations during the summer. Diazinon at 5.5 lb AI/Acre applied to fairways when Vanhoutte spiraea first comes into bloom, kills egg-laying adults and also prevents the development of summer larval infestations.

E. Sod Webworm — Overwintered larvae of the sod webworm

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begin feeding as soon as the grass begins to grow. Usually damage is insignificant, but areas which do not green-up may be infested. Infested areas frequently have probe marks from starlings who feed on the larvae.

When necessary, a wide range of insecticides including diazinon, Dursban®, Proxol® (trichlorfon), Aspon, Sevin® (carbaryl) and others applied at labeled rates may be used to obtain control.

F. Black Cutworms — Moths of the black cutworm begin laying eggs on golf course greens and other turf areas in the spring. These eggs hatch producing larvae that feed on grass blades during the night. While visible damage is uncommon on home lawns, damage can be significant on golf course greens in late May.

Generally, the insecticides effective against the sod webworm (mentioned above) are also effective against cutworms. The principle of controlling these pests is to apply the insecticide (late in the afternoon) to the grass and allow the cutworm to feed on and come in contact with the treated foliage. Irrigation following liquid application is therefore not advisable.

G. Greenbug - Greenbug eggs begin hatching as early as April but significant infestations do not develop until later in the year. Aphid numbers are too low to detect.

H. Winter Grain Mite — Damage from this mite is often first noted in April when home lawns are receiving spring pesticide and fertilizer applications. By late May, the mites will have laid their eggs and died. Mites do not appear again until the eggs hatch in October.

If treatment is necessary, diazinon or Dursban® will provide control.

SUMMER (JUNE-AUGUST)

A. Chinchbug — Chinchbug eggs begin hatching in May and continue into June when bright red nymphs appear. The number of chinchbugs increases rapidly reaching a peak during July when northern lawns can sustain severe damage. During August the nymphs molt into adults that mate, lay eggs and produce a second generation. Some northern areas have only one generation each year.

A wide range of insecticides such as Dursban®, diazinon, Aspon®, and Sevin® may be used at labeled rates to control existing infestations. Treatments should be applied *before* injury is severe, otherwise, damaged areas may not recover.

B. Billbug — Billbug larvae feed in grass stems during June but move to the plant crowns and roots during July. This feeding causes brown spots that frequently resemble the symptoms of some fungus diseases. During August the larvae burrow deeper into the soil to pupate and transform into adults.

Infestations discovered during this time may be treated with applications of insecticides such as diazinon, Turcam,® Proxol® at rates used to treat existing grub infestations. Irrigation or rain following application is needed for optimal results. If larvae are feeding in the root zone, control may be difficult to achieve. Oftanol® applied during June controls feeding larvae and also provides control of late summer grub infestations.

C. Grubs — By June grubs have stopped feeding and are in the pupal stage 3-4 inches deep in the soil. Beginning in mid-June and continuing through July, the adults of various species emerge and burrow into the soil to lay eggs. Hatching and appearance of young larvae occur during July and August.

Oftanol® applied in June provides control of developing grubs during August as well as chinchbugs and/or billbug larvae present in the turf at the time of application. Existing infestations of grubs found in August may be treated with Proxol®, Turcam®, Oftanol®, diazinon or Nematicide/Insecticide (for golf courses) at standard label rates. At least 0.5 inch of irrigation following treatment maximizes insecticide effectiveness.

D. Mole Crickets — Mole cricket egg laying continues through mid-

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Greenbug damage to bluegrass, but not fescue, under tree canopy.

Turfgrass Insect Identification Quiz

By Dr. Harry D. Niemczyk, Professor of Turfgrass Entomology, Ohio Agricultural Research & Development Center, Wooster, Ohio

Quiz yourself. Answers are on the next page.

A. _____

B. _____

C. _____

D. _____

Photo courtesy Dr. H. Tashiro

E. _____

Photo courtesy Dr. J.A. Reinert

F. _____

G. _____

Photo courtesy Dr. H. Tashiro

H. _____

Photo courtesy Dr. J.A. Reinert

I. _____

J. _____

June. Depending upon location, eggs hatch from early June through August with peak hatch during June.

In areas where damage occurred previously, sprays of Baygon® (propoxur) or Sarolex® (diazinon) or granular Mocap® (ethoprop) at labeled rates have shown effectiveness when applied in early June. Irrigation (½ inch or more) should be applied after treatment. Bait formulations with Baygon®, Dursban®, Malathion or Sevin® have also been effective when applied during late June. Irrigation should not be applied for 3-4 days after application of baits.

E. Black Turfgrass Ataenius — Eggs laid by beetles during May hatch in June and the larvae begin feeding on the turf roots immediately. From late June to mid-July, symptoms of injury include wilting of the turf, in spite of irrigation. In July, larvae move deep into the soil, pupate and emerge as adults. In states such as Ohio, these adults lay eggs during August producing a second generation of larvae capable of damaging turf.

If a preventive program was not applied, existing infestations may be spot or generally treated with Proxol®, Turcam®, diazinon or Nematicide/Insecticide at label rates.

F. Black Cutworm — By June larvae of the black cutworm are large enough to cause visible damage to golf course greens. These larvae pupate in the soil or thatch and emerge as moths that lay eggs on the turf in July. The larvae of this second generation are present on greens in August.

Cutworm larvae can be controlled with a wide range of insecticides such as Dursban®, Proxol®, Aspon®, Sevin®, and others, at labeled rates. Irrigation following liquid applications is generally not advisable.

G. Greenbug — Damaging populations of greenbug can occur from June through August. Populations and incidents of damage frequently varies from area to area, even within a city. Symptoms of injury include turf under the dripline of trees and in open areas having a burnt orange color. When such symptoms are seen, numerous aphids (40 or more) may be seen on a single grass blade. Close examination of damaged turf is necessary because the aphids are small. If left untreated, a heavy infestation can kill the turf.

Greenbug infestations may be controlled with liquid treatments of Dursban®, 1 lb AI/Acre or diazinon at 2.5 lb AI/Acre. If reinfestation occurs following treatment with these insecticides, Orthene (acephate) EC at labeled rates has been effective.

FALL (SEPTEMBER-OCTOBER)

A. Chinchbug — In northern areas such as Ohio, the second generation of chinchbug is at peak numbers in September. Nymphs complete their development to adults by late October. Most chinchbugs overwinter in the turf but some move to protected areas before winter.

Generally, infestation levels at this time are not high enough to warrant the use of insecticides. Early fall rains and infection by a parasitic fungus usually provides sufficient suppression.

B. Billbug — During September billbug adults that developed from summer larvae are often seen wandering about on sidewalks, driveways or other paved surfaces. Before winter, these adults seek shelter in thatch, along sidewalk edges, or near the foundation of houses and overwinter there. However, if many, if not most, overwinter in the turf.

C. Grubs — Most species of grubs are in the third of their 3 stages of development and are feeding actively. When soil temperatures decrease in late October the larvae burrow deep into the soil to overwinter. However, during the mild winter of 1982-83, the larvae remained in the top 3 to 6 inches of soil.

Treatments of existing grub infestations can be accomplished as late as early-to mid-September using standard grub insecticides and sufficient (½ inch or more) irrigation. Treatment after this time may or may not kill the grubs before they move deeper into the soil to overwinter. Whenever treatment is applied, the grubs should be in the top one to two inches of soil.

D. Black Turfgrass Ataenius — By September adults of the current generation begin to fly into protected areas, such as golf course roughs, to overwinter. Larvae that have not completed development to adults before frost are killed.

E. Mole Crickets — Mole cricket nymphs develop through the summer and most become adults by fall. However, recent studies in Florida show some egg laying continues throughout the year.

F. Greenbug — Severe infestations of greenbug have been known to occur as late as the first week of December. Areas having a history of infestations should be reexamined when mild temperatures extend late into fall. Heavily infested, turf probably will not survive through winter.

Late fall infestations may be controlled with the same insecticide used to control the pest during the summer.

ANSWERS TO TURF INSECTS

A. masked chafer (adult)
B. hairy chinchbug (nymph)
C. bronzed cutworm (larva)
D. winter grain mite
E. hyperodes weevil (adult)
F. Rhodesgrass scale
G. Japanese beetle (adult)
H. hyperodes beetle (larvae)
I. ground pearls
J. hairy chinchbug (adult)

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Landscape

by Dr. R.E. Partyka

Insect damage to woody ornamental can vary from the subtle insignificant to widespread destruction that eventually results in death of plants. There are many plants included in the ornamental area with a varied assortment of insects on each species. This results in a relatively large number of insect pests that can be destructive to ornamentals. Fortunately, all of these insect pests do not appear at one time or in one year, as many of them are cyclic.

Insect control is dependent on early recognition of the specific insect, its significance in the area, its life cycle or biology, a practical approach to control if needed and materials to use on the pest and their effect on the environment.

Early recognition is important in preventing serious damage to the plant. The majority of the space devoted to this article will dwell on recognition. Once we have established the insect is on a plant, we need to evaluate its potential for severity and what measures will be employed to minimize plant damage.

A second step is to consider its significance. Is it important at this time and what will happen in the future if nothing is done? How does the client view the pest problem? Are holes or webbing so obnoxious that a high degree of control is needed? Also what time of the year does the pest develop?

A late season defoliator may be annoying, but does little harm to a plant that is essentially shutting down for the season. But if this annoys a person who owns the plant, then appropriate suppressive measures must be applied at the proper time.

An early season defoliator may result in foliar devastation but new leaves will form and mid- to late-season appearance will approach that of normal plants.

Continued defoliation each year may be harmful to the plant and results in a second onslaught of problems at some late date. The person diagnosing the problem must understand the consequences of minimal control and the client's feelings toward the problems must be put in perspective.

Life cycles

Life cycles and general biology of the insects are important in determining sensible control strategies. Often times, early control materials can be used in reducing the pest and are safer to the applicator and environment. Treatment at the appropriate stage of development can result in good suppression with a safer material of relatively low toxicity. In some cases, reasonable control can only be obtained at a certain stage in the life cycle of the insect and this becomes critical if one is to obtain satisfactory results.

A practical approach to control needs to be resolved with certain pest problems. The nature of a life cycle and certain predisposing factors that may influence the pest outbreaks need to be considered and evaluated. In some situations, there are no practical means to control because of the advanced nature of the problem at the time. Therefore, removal and starting over again may be the best approach. Again a full understanding between diagnostician and client is important.

Materials to use on a specific pest need to be determined based on research results, climatic conditions, size and age of the pest, plant reactions, equipment capabilities, area where the material is to be used and effects on other forms of life. It should be understood that 100 percent control of a pest is not practical or possible. Shifting a delicate balance where and when it is needed is the prime aim of pest control. Therefore, many other factors need to be considered in maintaining strong healthy plants that are capable of withstanding a degree of insect injury but can recover in a short period of time with minimum visual symptoms and little impact on total plant vigor.

What to look for, where, and suppressive measures to use should be checked in your area by contacting the local county extension agent, farm advisor, or the State University. Climate variations and num-

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Fall webworm larvae produce silk to form a web where they feed. One to four generations can take place in the U.S. per year.

ber of generations of a pest are important when providing the service to a client for optimum results and satisfaction.

Pests and control by season

DORMANT PERIOD: This appears to be an ideal time to control insects that survive from season to season in the egg stage or an immature form that can be smothered by the use of a highly refined oil, generally referred to as superior oil and often times called dormant oil. Its mechanism of action is to exclude oxygen to the insect and not damage the plant. However, oils will not control eggs laid in large masses that are engulfed in a protective layer of hair, wax, or other materials or have limited breathing pores.

I. Scales

A. *Armored Scales* — oil controlled or else wait for the crawler stage.

1. Oyster shell — Found on a wide assortment of plants. Characteristic to look like oysters on a branch. Brown and gray scale. Brown has two generations a year which often involves additional sprays in the foliage stage.
2. Cottony Maple Scale — Small immature females on younger wood. Most common on Silver Maple and Linden — One Generation.
3. Obscure Scale on Oak — Often overlooked because it blends in well with the natural bark. Ideally named. One Generation.
4. Pine Needle Scale — Obvious white flecks on needles. More than one generation in many areas makes this scale difficult to control.
5. Euonymus Scale — Obvious white flecks on leaves and not as obvious on the woody tissue. Multiple layers makes control difficult. Multiple generations — female scale resembles oyster shell scale when initially developing.
6. Euonymus Scale (Winged) — A scale on *Euonymus elatus* types that blends in so well with the natural bark that it is often missed and not recognized until segments of the plant dies.
7. White Peach Scale — A very characteristic growth on stone fruit, lilac and privet. Females are circular, white tinged with lemon yellow center, males are elongated and white. Multiple generations in the south.
8. San Jose Scale — At one time a severe pest problem on many plants. It appears to be on the increase in some areas. Multiple generations exists.
9. European Elm Scale — Primarily on elms. Females are oval, reddish brown and surrounded by a white cottony fringe — One Generation.
10. Camellia scale — Females are elongate, oval and dark brown to almost black in color. They somewhat resemble oyster shell scale. Overlapping generations exist.
11. Juniper scale — White round convex females with yellow center on juniper but arborvitae, incense cedar and cyress attacked — One Generation.

B. *Unarmored or Lecanium scales* — oil control is minimal unless applied at critical stage in life cycle. In general major direction of control is toward the crawler stage of the life cycle, with materials such as acephate, bendiocarb, diazinon, malathion and dimethoate.

1. Fletcher Scale — Common on taxus. Sometimes called Taxus Lecanium. Also on arborvitae and juniper — One Generation. Crawlers occur in July, feed on foliage then on bark.
2. European Lecanium — Found on Ash, Oaks, Pine and fruit trees. Crawlers active in June — feed on leaves. One or two generations.
3. Magnolia Scale — One of the largest scales. Crawlers active in late summer or early fall. One Generation. Sooty mold common due to heavy honey dew formation.
4. Globous scale — A scale of minor importance but injurious to prunus species.
5. Tulip Tree scale — Large scale that feeds on the bark. Crawlers active in late summer. One Generation.
6. Wax Scale on Euonymus — Scales with thick heavy covering of white wax over their bodies. Common in warm climates on many plants. May have more than one generation. Highly reproductive. Control in crawler stage best.

II. Eggs in Singles or Single Layers — can be suppressed with superior oils.

1. Fall Canker Worm — Eggs deposited late in the fall and controlled by superior oil. One Generation.
2. Eriophyid Mites (Ash flower gall, Bladder gall mite maple) — Mites or eggs that are found under or around buds where they overwinter. Can be suppressed with superior oils. Pear leaf blister mite, ash flower gall, arborvitae tip dwarf mite, maple bladder gall mite fall in this group. In most cases — One Generation.
3. Aphids — Soft bodied insects that over winter as eggs on specific hosts in northern climate. Oils will help suppress development on treated plants. Rapid build up on other plants often necessitates the need for additional treatments during the growing season.
4. Spider Mites — Species such as spruce spider mite or red mite on apple that overwinter as eggs on the needles or woody tissue can be controlled with oils. This is different from the two spotted mites that over winter as hibernating females in plant duff. Multiple Generations.

III. Eggs in Masses — cannot be suppressed with superior oils. Control directed to larval stage of life cycle.

1. Spring Canker Worm — Eggs deposited on masses on bark early in the spring.

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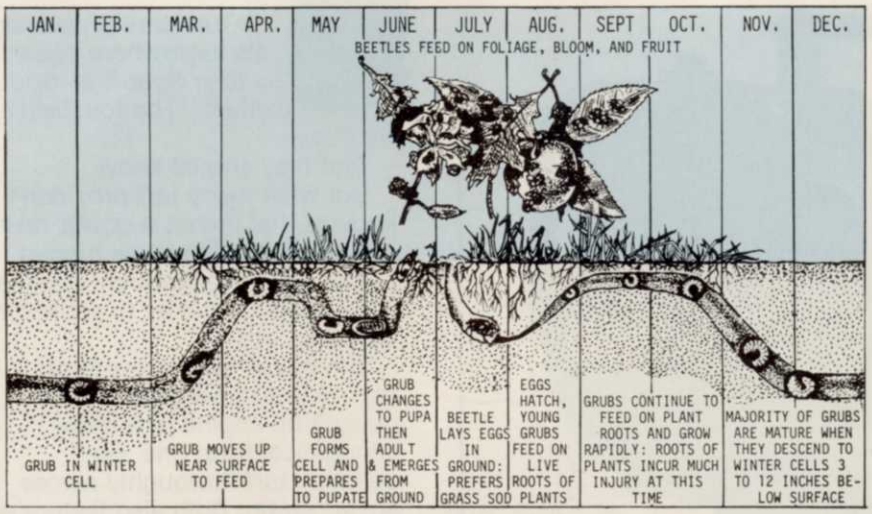
Landscape

2. Gypsy Moth — Masses of eggs in a felt-like media of insect hairs. One Generation.
3. Eastern Tent Caterpillar — Masses of immature embedded in a varnish like material that is resistant to oil pentration. One Generation.
4. Tussock Moth — Masses of eggs cemented to the old cocoon.

Oak Leaf Gall, Oak Flower Gall) — Many are difficult to control because of unknown or complicated life cycles. The ones that form on new growth and related bud tissue can be suppressed to a degree with superior oil when it is used prior to bud break each season. One needs to justify the expense and degree of control obtainable.



Life cycle of the Japanese beetle tells the landscape manager spring soil treatments may reduce summer foliage damage.

IV. Woody Galls — life cycles and timing very important for control.
1. Cooley Gall (Adelgids) — Galls are empty at this stage but the immature are present at base of needles where oils can give a degree of control. But you need to watch for needle color shift with oil. Better to use Sevin, Malathion or Dursban on prime plants, just prior to bud break.
2. Eastern Gall (Adelgids) — Old brown galls are empty at this stage but immature are present at base of needles where oils can give control. Coverage and penetration important. Note Cooley gall controls.
3. Horned Oak Gall — Common on pin oak and other black oaks. Complicated life cycle. Horned oak gall has a two year cycle and oils will give a degree of suppression if used on a regular basis.
4. Miscellaneous Galls (Succulent

V. Bark Dwellers —
1. Pine Bark Aphids — Insects that overwinter on the bark of woody stems. Pine bark aphid is often on white pine but woolly aphids of apple and pear often overwinter in similar manner. High pressure sprays with superior oil will help reduce population but additional insecticides are needed later for best results.
2. Mealy Bugs (Taxus mealy bug) — Oval sluggish insects with short spines on body margins and a covering of a mealy white powder often buried in a mass of cottony fiber at egg laying time. Oil emulsions will aid in control.

SPRING INSECTS: Tender succulent foliage provides an ideal food source for certain insects that hatch with some of first warm weather of spring. This appears to correlate well with plant development and degree day heat-unit accumulation. These spring feeders, when present in large numbers, can cause severe defoliation in a matter of days. The young stages are often unnoticed because of minimal feeding but as they mature the last few days of their life cycle often results in rapid defoliation. At this stage it is almost impossible to obtain control as the insects requires a large volume of pesticide for its mass, often beyond registered dosages, or one cannot treat plants fast enough to obtain control.

I. Foliage Feeder
1. Eastern Tent Caterpillar — Early development when bud breaks on wild cherry, apples, and crabapples. (Note Webbing) Acephate, Bt, Sevin, Malathion, Methoxychlor, Dylox, Dymet for control — One Generation.
2. Spring Canker Worm — Eggs deposited in the spring — Two prolegs — Control Bt, Sevin, Methoxychlor, Acephate, Dymet — One Generation.
3. Fall Canker Worm — Eggs deposited in late fall. Three prolegs. Control same as for Spring Canker Worms or oil. — One Generation.
4. Forest Tent Caterpillar — Similar to Eastern Tent Caterpillar but form silken mat on trunk and branches instead of webs. Note markings on back. One Generation.
5. Gypsy Moth — Voracious feeders on many plants preferring oak but damaging to many other species. Heavy population in NE USA with scattered population outbreaks in other states. When present, proper timing of Sevin, Acephate, BT, Methoxychlor, will give control. Populations vary depending on natural controls — One Generation.
6. Tussock Moth — General feeders of trees and shrubs. White marked common, white tufts of hair. Western Tussock moth a

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Landscape

Canker worm larvae can defoliate entire trees and then swing to nearby trees on strands of silk.

problem in Mt. States. White marked may have several generations. Most materials listed for previous feeders are effective.

7. Yellow Necked Caterpillar — Yellow and black striped caterpillar with prominent yellow spot just back of the head. Feed in groups and raise head and tip of abdomen when disturbed — One Generation generally. Sevin, Acephate effective.

8. Juniper Web Worm — An insect that may cause severe damage before it is recognized — Reddish brown caterpiller overwinters in the frass on branches. Penetrating sprays of Acephate, Diazinon, Sevin, Dymet in early spring or early fall needed for control. One Generation.

9. Green Stripe Maple Worm - A limited insect on Maple in river bottoms but a major defoliator when present. Two Generations — with the second being most damaging — Sevin, Acephate, Methoxychlor, Dymet.

10. Elm Leaf Beetle — Larvae feed on the lower leaf surface causing them to die and drop prematurely. More than one generation — Sevin, Methoxychlor, Dymet and Acephate for control.

II. Sawflies and Leaf Miners

1. European — Eggs are deposited in needles in late fall. Look for symptoms on needles to determine potential problem. Use Acephate, Methoxychlor, Sevin in early stages. Other conifer sawflies develop during the summer.

2. Birch Leaf Miner — Small black fly-like wasp present when leaves are ½ grown signifies time to apply a protective control. Use Sevin, Diazinon, Acephate, Dimethoate before egg laying. After eggs are deposited, use Acephate or Dimethoate.

3. Arborvitae Leaf Miner — Small green caterpiller with black head that overwinters in mined leaves. Look for holes in Terminal Tissue. Adults are small moths. One Generation. Direct sprays in spring - Acephate

4. Locust Leaf Miner — Many plants skeletonized by adults. Mining occurs on black locust — Two Generations. Limited materials for control. Lindane and Dibrom are listed.

5. Other Sawflies — Skeletonized foliage or consumed foliage. Need to watch for damage as insects are sporadic. Most materials listed will give control.

III. Sucking Insects

1.Aphids — Often present on new growth. Use Malathion, Diazinon, Dymet, Acephate, Bendiocarb. Acephate and Bendiocarb have longer residual but new generations build quickly. Need to watch closely.

2. Spider Mites — Common on evergreens. Need to watch for off-color foliage. Spruce spider mite may be a problem at this time. As weather warms up, two spotted spider mite becomes more common. Kelthane, Malathion, Vendex, Dymet

3. Plant Bugs and Leaf Hopper — Common on honey locust as new growth unfolds. Sevin, Dymet, Diazinon.

4. Lace Bugs — Found on hackberry, oak, Mt. Ash, Sycamore Elm, Azalea. Wings that appear lace-like due to many veins. Can cause much leaf browning. Several Generations — When severe — Use Malathion, Sevin, Acephate, Dymet, Methoxychlor.

IV. Borers

A. *Clear Wing* — Early season emergent holes. Use pheromone traps to detect activity. Protect new wood with Dursban or Lindane.

B. Beetle

1. Bronze Birch Borer — Severely damages white birches — Plant vigor is a factor but protection possible with Bendiocarb or Lindane — Timely application needed.

2. Flat Head & Round Head — Enter in wounded or weakened plant tissue. Little to no control once tissue is invaded. Plant vigor is major control.

V. Scale

1. Oyster shell crawlers — The early crawler stages of euonymus, oyster shell, oak kermes, golden oak and pine needle scale can be active at this time so plants should be carefully watched for activity. Acephate, Sevin, Diazinon, Malathion for control - Multiple Generations.

VI. Shoot & Tip Moths

a. Pine Tip shoot moths

b. Mugo pine shoot moth

Several species of shoot and tip moths needed to be treated for at this time of the year. Timing important and local pests need to be checked. Several materials are suggested including Sevin, Acephate, Dymet, Lindane, Bendiocarb and Dimethoate.

SUMMER INSECTS: These insects feed on mature or near mature foliage. Injury at this time may reduce the amount of sugar or carbohy-

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drates the plant can store up for bud development and winter survival in colder areas of the country. This may leave the plant in a weakened condition making it more suceptible to winter damage or other stress related problems that may eventually lead to the failure of the plant.

I. Foliage Feeders

1. Bag worms - Most common on narrow leaf evergreens but can be found on many other plants when population levels rise. Reasonable control can be obtained with Sevin, Diazinon, Acephate, Malathion, Methoxychlor, Bendiocarb when they are small but Dursban and Acephate are needed when more mature.
2. Japanese Beetles - Early to midsummer favors the first emergence of this colorful but destructive insect. Favored host of prunus, apple, rose, elm and many other plants need to be protected with Sevin, Bendiocarb, Methoxychlor, Diazinon. A long residual is important.
3. Black Vine Weevil — Leaf notching on Taxus, Azalea, Rhododendron and numerous other plants in the landscape suggests weevil feeding. Black vine weevil common but several others may be present. Night feeders — Larval stages feed on roots. Control adults with Acephate, Bendiocarb, Lindane.
4. Imported Willow Leaf Beetle — Most willows attacked by this insect. Several generations. Sevin, Acephate, Methoxychlor — Timing important.

II. Sucking Insects

1. Lace Bugs — Off color and stipple pattern on leaf is common with shiny black fecal residue on under side of leaf. Common on Azalea, Rhododendron, sycamore, Pyracantha. Use Malathion, Acephate, Sevin, Dymet, Dimethoate.
2. Spider Mites — Hot weather will favor the build up of these insects often found on juniper and spruce but many other plants are susceptible. Many regular insecticides give little to no control of spider mites. Other materials must be used such as Dicofol, Dymet, Vendex etc.
3. Aphids — Different species are present during the growing season. Must be alert to build up, especially on new succulent tissue. Use Acephate, Diazinon, Malathion.
4. White Flies — Often found on the under sides of leaves of Azaleas, privet and foundation plants that result in a black sooty mold growing on the honey dew. Difficult to control insect due to life cycle. Acephate, Dymet, Diazinon, Dimethoate, plus others.

III. Scale Insects, Crawler Stages

1. Cottony Maple Scale - Cottony masses on silver maple and others. Wait for all eggs to hatch for best control. Acephate, Diazinon, Sevin, Malathion.
2. Lecanium Scale-Wait for crawler stages to be active for control. Timing important — the materials are listed above.
3. Oyster Shell Scale-Watch for branch dieback or slow leaf development.
4. Pine Needles Scale

IV. Leaf Miners, Skeletonizers

1. Solitary oak leaf miner — Various leaf miners are active at this time. Early recognition and use of a protectant insecticide or use of a systemic material is needed.
2. Leaf Skeletonizer — These insects may be annoying in areas where an oak population exists — Two generations are often found. Similar insects occur on birch and other plants. The larvae that drop from a web and the white cocoons are annoying. Timing is more important than control materials of Sevin or Diazinon.
3. Needle Miners — Needles cut off and webbed together making branches unsightly. Use Sevin or Acephate early in spring and midsummer.

MID-SUMMER TO EARLY-FALL: Chewing insects that feed on foliage at this time of the year are often more unsightly than harmful to the plants. However, if the object is to keep foliage for the fall color change, one must be aware of these late season feeders. Life cycles of certain insects also dictates that control measures be employed at this time for optimum results and satisfied clients.

I. Scale Insects

1. Magnolia Scale — The crawler stage of this scale is active in the latter part of the growing season. Use Sevin, Diazinon, Malathion, Acephate on the crawler stage.
2. Pine Needle Scale — Second generations of this insect that can

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Spider mite damage to one untreated juniper is evident by off-color foliage.

Tree Insect Identification Quiz

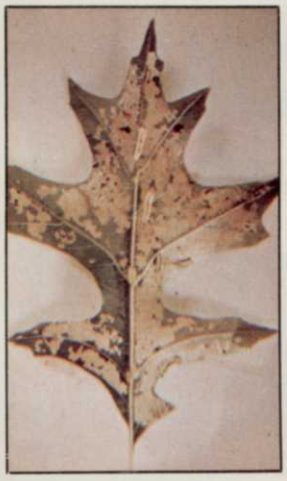
Quiz yourself. Answers are on the next page.

A. _____ B. _____

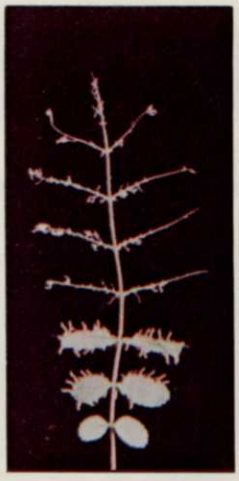
C. _____

G. _____

K. _____ L. _____



D. _____



E. _____

F. _____

H. _____ I. _____ J. _____

M. _____ N. _____

blow in or be carried by other insects and birds or were missed early in the season, can explode and nullify all previous treatment. Use Sevin, Diazinon, Dymet, and Acephate on the crawler stage.
3. Fletcher Scale — Watch for crawler stage at this time of year on prone plants and use Sevin, Malathion, and Acephate.

II. Adelgids
1. Cooley Gall — This adelgid leaves the gall in late summer to start a new life cycle or may return from fir trees if the alternate host of this pest is in the area. Good coverage of the new growth with Diazinon, Sevin or Malathion is important.
2. Eastern Spruce Gall — Similar in nature to the cooley gall, but activity is later so timing is important for the particular area.

III. Leaf Feeders
1. Fall Web Worms — The second generation becomes very obvious at this time of year with extensive webbing of the foliage. Suppression can be obtained with Sevin or Methoxychlor.
2. Japanese Beetle — This colorful insect is destructive on many other plants. Weather conditions play an important role in these numbers. Control with Sevin or Methoxychlor will be dependant on local analysis.
3. Mimosa Webworm — Webbing similar to fall web worm where leaves are pulled together. Several generations, Sevin, Acephate, Diazinon
4. Oak Leaf Skeletonizer — Second Generation on Oak.

IV. Borers
1. Locust Borer — A problem on black locust — Emergency occurs in the fall and egg laying is when golden rod in bloom. Lindane as a trunk protectant where a problem exists.
2. Peach Tree Borer — Mid-late summer treatment may be necessary on valuable plants. Use Lindane or Lorsban.

ANSWERS TO TREE INSECTS

A. aphids
B. eastern tent caterpillar
C. euonymus scale
D. pin oak sawfly
E. mountain ash sawfly
F. dogwood borer (larvae)
G. mimosa webworm
H. willow leaf beetle
I. spruce mite webbing/damage
J. fall webworm
K. gypsy moth (larvae)
L. oystershell scale
M. pine tube moth damage
N. birch lead skeletonizer