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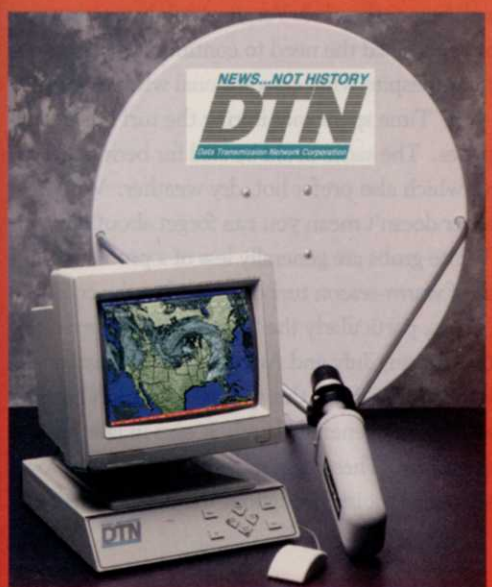

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Warm-season turfgrass insect management: *looking ahead to 1997*

R.L.BRANDENBURG / Turf Entomologist,
N. C. State University

No matter where you are located in the United States and regardless of the turf types you manage, weather plays a significant role in determining which pests you will see, where they occur, and the severity of these infestations. Unusual weather often creates unusual pest problems.

The summer of 1996 was unusually wet over many areas of the southeastern United States; particularly in the Carolinas. One tropical depression and two hurricanes hit North and South Carolina from mid June to mid September plus above normal rainfall occurred every week in between. Short-term we observed significantly higher numbers of twolined spittlebugs, particularly in centipedegrass.

Although white grubs aren't usually a major pest threat in the southeast, be alert for them this season because of a wet 1996 season.

Spittlebug summer

In general, the twolined spittlebug problem has been increasing on warm-season turfgrasses over the past 10 years. This may be due to the increasing population in the South, the increased use of centipedegrass, and extensive plantings of hollies in landscape (a host for spittlebug adults).

Despite this general increase in the abundance of spittlebugs we have seen in recent years, we were not prepared for such high numbers in many areas during 1996. High populations were observed on many species of both cool and warm-season grasses. This phenomenon appeared to be a reflection of a wet, cooler-than-normal summer. Does this mean twolined spittlebugs will be a serious problem in 1997? It's difficult to predict this pest for the summer season. Undoubtedly, higher-than-normal populations of spittlebugs overwintered, but we don't know if this will translate into above-normal populations this summer. Be prepared and scout centipedegrass frequently for this pest.

The southern chinch bug is a pest of St. Augustinegrass particularly in hot, dry weather. Despite rainfall that in some areas was more than twice the normal average, we observed damage from chinch bugs. In fact, we saw some of the heaviest infestations we had observed in the past five years. Was this contrary to our accepted understanding of chinch bug outbreaks? Yes, it certainly was, but it also emphasized the need to continually monitor turfgrass despite what conventional wisdom might tell you. Time spent monitoring the turf helps avoid surprises. The same could be said for bermudagrass mites which also prefer hot, dry weather. Wet weather doesn't mean you can forget about them.

White grubs are generally less of a problem in areas of warm-season turf compared to the cool-season zones, particularly the Northeast. However, wet soil during July and August of 1996 may contribute to more grubs this spring. The adult beetles of white grubs generally lay their eggs in late June through July. These eggs must be laid in moist soil that remains moist throughout the development of

the very small first stage grubs. If the soil is dry the eggs don't hatch or the very small, newly-hatched grubs die.

Many areas in 1996 had enough rainfall to keep the soil moist during this critical period for egg and grub survival. As a result we probably had above average survival of white grubs over a wider area (especially non-irrigated areas) and those above average numbers overwintered to damage turf in the spring. This may well be reflected in the number of moles attracted to turf areas to feed on these grubs. It may also result in more beetles, such as Japanese beetles to feed on certain ornamental plantings during 1997.

New products for 1997

The past few years have been good to those in turfgrass pest management since a number of new products have reached the marketplace and provide us with additional tools for effective control. Some of these products have been what the EPA's Official Pesticide Programs consider to be safer, reduced risk. In fact, during 1996, the EPA noted that more than half of the new active pesticide ingredients registered are so classified and this continues a several year trend.

Last year we saw the introduction of Merit (imidacloprid) for use in grub control in turf and more recently we have seen good success in mole cricket management. This product has been popular not only in its effectiveness, but also due to its acceptable toxicity profile for non-target organisms. Chipco Choice (fipronil) was also introduced into the mole cricket control market available through contracted custom application and has offered a very effective tool for managing this serious pest.

Recently several synthetic pyrethroids have or are being registered for turf insect use and these include Scimitar, Mavrik, Astro, Talstar, and Tempo. Many turfgrass managers appreciate the low use rates and low mammalian toxicity of the products, but they are relatively toxic to fish. Other products such as Cruiser bioinsecticide (entomogenous nematodes) for grub con-

CONTROL OF WARM-SEASON INSECT PESTS

INSECT PEST
Cutworms, armyworms
Hosts
all warm-season grasses
Damage
Generally clip turf off at soil level. Severe infestations may leave large bare areas where turf has been consumed.
Control Practices
*use "soap flush" to detect
*treat late in day
*do not mow and remove clippings for 1-3 days
*entomogenous nematode products available
*may be present from early spring to late fall

INSECT PEST
Fire ants
Hosts
all warm-season grasses
Damage
Create unsightly mounds which may also damage mowing equipment. Painful stings of concern in high traffic areas.
Control Practices
*best controlled in spring and fall when workers are actively foraging for food.
*mound treatments generally most effective, but are labor-intensive
*controls must be continued once program is started (fire ants will return at at higher levels if treatments are stopped)
*do not disturb mounds during treatment
*use baits prior to contact insecticides to allow workers to return bait to mound

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INSECT PEST
Mole crickets
Hosts
prefers bahiagrass and close-cut bermudagrass
Damage
Extensive tunneling is unsightly. Root feeding causes dieback, thin spots.
Control Practices
*use "soap flush" to detect
*treat in June/July as soon as eggs hatch
*follow-up treatments usually necessary
*entomogenous nematode products available
*look for adult activity in March/April to define areas of high risk for egg hatch

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INSECT PEST
Ground Pearls
Hosts
most commonly attacks bermudagrass and centipedegrass
Damage
yellowing and then complete dieback of turf with no new regrowth the following season
Control Practices
*no known effective control measures
*practice good turf management to increase turf tolerance
*irrigate during dry weather

INSECT PEST
Southern chinch bugs
Hosts
all warm-season grasses prefers St. Augustinegrass
Damage
Feeding results in turf becoming yellow and eventually turning reddish-brown.
Control Practices
*avoid over-fertilizing
*manage thatch
*irrigate during dry spells
*apply pesticides with plenty of water
*multiple treatments often necessary

INSECT PEST
Twolined spittlebugs
Hosts
all warm-season grasses
Damage
Results in yellowing of infested turf and severe infestation have noticeable unsightly "spittle masses".
Control Practices
*control adults on ornamentals like hollies
*treat on cloudy days when possible, since spittlebugs are higher up on turf
*begin monitoring in early summer

INSECT PEST
White grubs
Hosts
all warm-season grasses
Damage
Grubs feed on roots and cause drought stress and turf dieback. May attract moles, skunks, etc. which damage turf searching for grubs.
Control Practices
*attracted to low-cut, highly-maintained turf
*dig squares of sod 4-6" deep in late August to detect small grubs
*treatments most effective in late August/early September
*avoid ornamentals attractive to adult stages of Japanese beetles or green June beetles

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INSECT PEST
Bermudagrass mites
Hosts
only bermudagrass
Damage
Initial yellowing of leaf tips, followed by shortening of internodes causing a tufted growth. May die under severe infestations.
Control Practices
*irrigate during dry spells
*proper fertilization helps turf outgrow damage
*Resistant cultivars Floratex, Midiron, and Tifdwarf
*multiple treatments often necessary

trol and Turplex (azadirachtin) are examples of recent introductions of biological materials that help meet a growing demand for such products.

More recently, a new product scheduled for release in 1997 has been receiving a lot of attention. It's a product resulting from a joint venture with Rohm and Haas and American Cyanamid. The new product halofenozide (Mach2) is an insect growth regulator. This product is effective against all stages of grubs and like Merit has a favorable environmental profile.

DowElanco has introduced a new class of insecticides into the turf market with Conserve SC. This product is classified by the manufacturer as being in the Naturalyte class and is derived from a naturally-occurring organism. The EPA has placed Conserve under expediated review for registration as a "Reduced Risk" insect management product. Its activity is primarily limited to caterpillars attacking turf.

A bacterium is also under development that may offer an effective biological control for white grubs. This new strain of *Bacillus thuringiensis* has shown good efficacy in university studies.

As always it will be interesting to see what 1997 brings us in the way of turfgrass insect problems. The good news is that regardless of what the year brings we have a good selection of products to help us manage those situations and new products on the horizon that promise to make it even easier. **LM**

Twolined spittlebugs, if conditions allow, can damage centipede turf. Turfgrass managers in the south should scout for them.

PRODUCTS FOR CONTROL OF WARM-SEASON INSECT PESTS

Southern chinch bug:

bendiocarb (Turcam, Dycarb); ethoprop (Mocap); cyfluthrin (Tempo, Decathlon); permethrin (Astro); diazinon; chlorpyrifos (Dursban); isofenphos (Oftanol); isazofos (Triumph); fonofos (Crusade, Mainstay); lambda-cyhalothrin (Scimitar, Battle); acephate (Orthene); fluvalinate (Mavrik)

Timing: apply as needed during hot, summer months.

Thorough coverage is critical. Irrigate immediately after application of granules. Avoid over-fertilizing.

Leafhopper/twolined spittlebugs:

acephate (Orthene); bendiocarb (Turcam, Dycarb); chlorpyrifos (Dursban); diazinon; carbaryl (Sevin); isazofos (Triumph); fluvalinate (Mavrik).

Timing: begin monitoring and treat damaging populations in early summer.

Cutworms, armyworms:

azadirachtin (Turplex); lambda-cyhalothrin (Scimitar, Battle); acephate (Orthene); carbaryl (Sevin); diazinon; isofenphos (Oftanol); chlorpyrifos (Dursban); fluvalinate (Mavrik); cyfluthrin (Tempo, Decathlon).

Timing: monitoring/treatment may be necessary in early spring-late fall.

Mole crickets:

chlorpyrifos (Dursban bait); propoxur (Baygon bait); carbaryl (Sevin bait); bendiocarb (Turcam, Dycarb); chlorpyrifos (Dursban); isofenphos (Oftanol); fonofos (Crusade, Mainstay); acephate (Orthene); ethoprop (Mocap); fluvalinate (Mavrik, Battle); entomogenous nematodes (Vector MC, others); imidacloprid (Merit).

Timing: soap flushes to monitor egg hatch. Treat nymphs in early summer.

White grub:

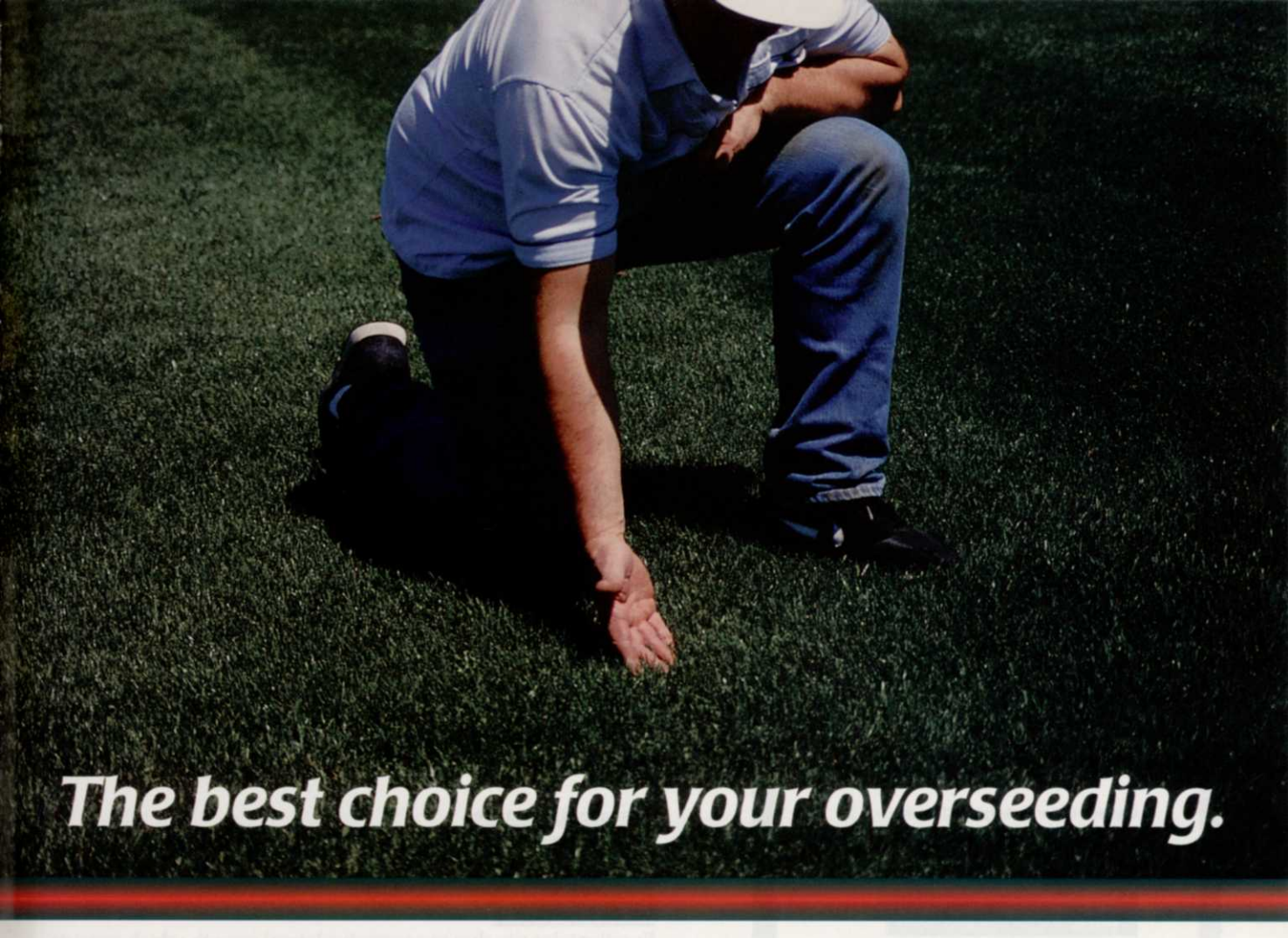
bendiobarb (Turcam, Dycarb); diazinon; isofenphos (Oftanol); isazofos (Triumph); fonofos (Crusade); ethoprop (Mocap); imidacloprid (Merit); entomogenous nematodes (Cruiser) trichlorfon (Proxol, Dylox).

Timing: treat small grubs in late summer and fall for best control.

Ground pearls:

No known effective chemical controls. Follow proper turf management practices and irrigation.

Not all trade names are mentioned, and the ones listed are used as examples. No endorsement of product is intended nor does omission of any product imply criticism.



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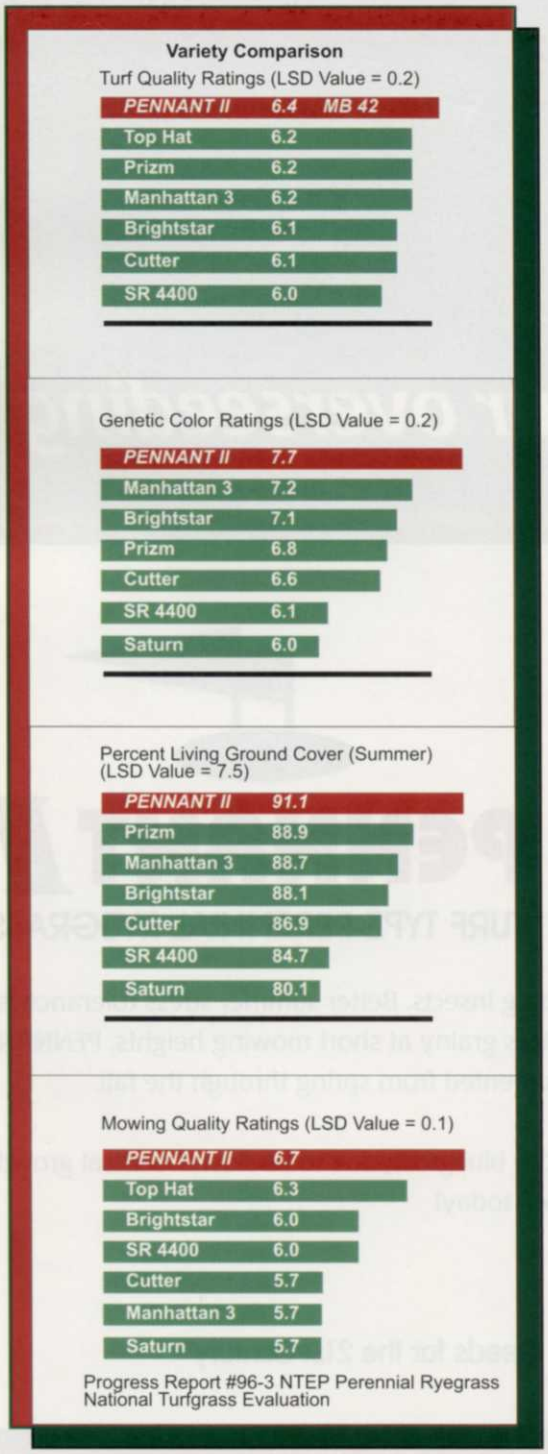

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Insect control in landscape ornamentals

by TIMOTHY ABBEY

As trees, shrubs, turfgrass and flowers are pushing forth new growth, insect activity is starting to increase due to the warmer temperatures and longer days.

To keep pace with these persistent pests, it is best to lay out an efficient and effective battle plan before they reach crisis levels.

Many of you may be familiar with Integrated Pest Management, and the steps needed for its successful implementation. IPM is a decision-making process that uses biological, chemical, cultural, physical and regulatory tactics to manage disease, insect, weed and other pest problems. IPM includes both the production and maintenance of ornamental plants in a way that minimizes risks to human health, society and the environment.

Since the focus of this article is specific pests, and not IPM, I will only present four main components. Individual modifications can be made to an IPM program based on personnel, pest problems and specific site locations.

1) Properly identify the plants, pests and miscellaneous creatures found in the landscape.

2) Establish a routine monitoring/scouting plan that enables you to track potential pest populations over time so that they do not explode.

3) Once a pest has reached a level that requires attention, a decision must be made regarding how to control it. This involves using one or a combination of the options mentioned previously.

Maintaining plant health, through proper cultural practices (plant selection, fertilization, irrigation, pruning, etc.), reduces the chance of most pest problems. For example, more landscape plants are killed from mower and weed-wacker injury than from any insect.

4) Evaluate individual pest management decisions and the overall effectiveness of the yearly IPM program. Hopefully, this introduction to IPM sparks the interest of people not using it. It is not intended as an in-depth exploration. □

'Least wanted' insects

The key insect pests featured in this article were selected based on: their routine occurrence in the northeast each year; a wide host plant range; or their ability to cause serious plant damage. Depending on your specific landscape locations and their respective plant composition, other insects may cause more headaches. The following pests are grouped according to how they feed on plant material.

Piercing-sucking group

Though mites are not insects, the following two mites are common landscape pests. The **spruce spider mite** (*Oligonychus ununguis*) is found on conifers such as arborvitae, hemlock, juniper, pine and spruce. Adults have a dark-green to almost black body with a tan area directly behind the head. Their activity peaks during the cooler seasons (spring and fall) in the northeast. Immature stages have six legs as compared to the eight legs of adults. Spruce spider mites overwinter as red-colored eggs, and there can be several generations each year.

To monitor for this pest, tap tree or shrub foliage onto a white sheet of paper. If mites are present, they will stand out against the white background. They are about the size of the period at the end of this sentence. A 10X to 20X handlens makes observing mites easier. These mites often produce webbing but by the time it's apparent, there may already be plant damage.

Mite feeding first causes discoloration to both the top and bottom of a needle. They

Birch leafminer damage

use their mouth parts to rupture individual plant cells in order to feed on the contents. This pin-point type damage is called stippling. Later, after more feeding, damage areas coalesce giving each needle a brownish, gray color. Heavy feeding activity can lead to needle drop and affect overall plant health.

Treatments for spruce spider mites may not be necessary unless more than ten mites are discovered at each limb jarring.

Twospotted spider mites

(*Tetranychus urticae*) are green-colored with a dark spot on either side of the back. They feed on numerous hosts including roses, viburnum, *Buddleia*, euonymus, flowering fruits and assorted vegetables. Unlike spruce spider mites, twospotted mites prefer hot, dry summer conditions. These environmental factors promote rapid development leading to numerous generations a year. They overwinter as orange-colored females in leaf debris or soil crevices.

Monitor for this pest beginning in early June when populations are low. Twospotted spider mites favor the underside of leaves, but noticeable discoloration appears on the top. Pull back plant material to see active mites and shed skins which look like white specks. Also, remove individual leaves and count the mites. Use a handlens. Early detection allows you to follow their populations over time. This ensures that treatments are applied at the best time.

Black vine weevil notching this rhododendrum, one of the pest's favorite foods.

Early feeding damage appears as stippling, but can quickly lead to bleached out leaves. Large populations will cause leaf drop and produce webbing. The webs permit quick movement to adjacent plants, or individual web strands can catch wind currents and disperse mites.

Naturally occurring predatory mites often keep populations in check. If plants are treated with selective miticides, which have less of an impact on predators, twospotted spider mites may never be a major concern. Again target the underside of the leaves.

Individual **lace bug** (Family: *Tingidae*) species feed on specific host plants such as azalea, cotoneaster, rhododendron and sycamore to name a few. The adults are ⅛- to ¼ inch with white, lacy wings held flat over the back. Though similar in general body shape, the immature stages (nymphs) are black with spines. Lace bugs that feed on evergreen hosts overwinter as eggs, while those that feed on deciduous plants overwinter as adults. There are two or more generations per year.

As the adults and nymphs feed on the underside of leaves, they cause discoloration to the upper surface. Plants, such as azalea and *Pieris japonica*, that are under attack in full sun suffer the greatest.

For this pest examine the underside of leaves on susceptible hosts. If done by early June, the populations should be small and have caused little visible damage. When observing the bottoms of the leaves, look for the presence of dark fecal spots stuck to the leaf surface. The waste products of lace bugs distinguishes the damage from the similar feeding of mites or leafhoppers.

Unfortunately, natural predators and parasites do not provide sufficient control of lace bugs. If spray treatments are necessary with a contact insecticide or horticultural oil, direct the spray at the leaf undersides. Systemic insecticides, chemicals absorbed by the plant and then ingested by piercing-sucking insects, work well with thorough coverage to any of the leaf surfaces.

There are too many species of **aphids** (Family: *Aphididae*) to discuss individually, so they are presented here as one general group. Aphids are approximately 1/16- to ¼-inch in length. Body color can range from green to orange to black. Some aphids produce a white wax-like material to cover themselves. Wings can be present or absent depending on the aphid species or the time of year. Plant hosts include assorted weeds, shrubs and trees. Certain aphids use a primary host plant early in the growing season and feed on an alternate host in the summer. Winters are spent in the egg stage. Several generations can occur each year.

Twospotted spider mite damage on over 50 percent of leaves

Aphids prefer to feed on young, succulent growth particularly on the underside of leaves. Focus monitoring in these locations. Another sign of aphid feeding is the waste product of aphids, a sticky substance called honeydew. This can often be found on plants, sidewalks, cars, etc. located below heavy populations. Also, sooty mold, a dark-colored fungus, grows on the honeydew turning surfaces an unsightly black.

Plant damage appears as discolored and distorted leaves. Severity depends on aphid numbers and the host plant. A number of naturally-occuring predators and parasites affect aphid populations. These include adult and larval ladybeetles, green lacewing larvae, flower fly larvae and tiny wasp parasites. Often these insects do such a thorough job that no other control is necessary.

Also, horticultural oil can be a valuable management tool.

Chewing pests - leafminers and borers

Another common pest in the landscape is the **birch leafminer** (*Fenusa pusilla*). Its favorite hosts include gray birch, *Betula populifolia*, and paper birch, *B. papyrifera*. The adult birch leafminer is a small (⅛ inch), black wasp called a sawfly. Adults emerge in the spring with females laying eggs in leaves that are at half-size. The green-colored larvae feed inside the leaf. A second generation of adults will emerge in late June or early July, but it is not as severe the first. In some parts of the northeast, there is a third generation. The leafminer spends the winter in the soil as a larva inside a cocoon.

The larvae feed inside the leaves between the upper and lower epidermal layers causing small mines. Over time, these mines expand and run together forming noticeable brown blotches on the leaves. A heavy infestation can give a tree an overall brown cast. If heavy populations continue over several consecutive years, and if the tree is subjected to other environmental stress, the overall health of the tree declines. The tree is now more susceptible to attack from another pest, the bronze birch borer.

In order to optimize tree protection, reduce the first generation of birch leafminers. The adults are found around or on trees when the leaves are expanding. Place yellow sticky-card traps in birches to monitor for adult activity. The early-stage mites can be seen by holding a leaf up towards the sun. They appear as small pin-point discolorations.

One option for control is to replace susceptible species of birch with ones more resistant to this pest. These include *Betula davurica*, *B. costata*, *B. maximowiczana* and *B. schmitii*. Also, remove adventitious tree growth which only serves to attract leafminer adults. At this time, there are no other effective non-chemical controls. Chemical controls can target adults and larvae. Apply contact insecticides when adults are first detected on sticky cards or by visual inspection. The larvae can be killed with systemic insecticide applications when mines are first observed. Systemic products containing imidacloprid can be applied to the soil as a preventative larval treatment before adult activity begins. This type of preventative application doesn't follow IPM guidelines, and should be used when the birch leafminer is known to be a problem.

Chewing pests - leaf feeders (adults) root feeders (larvae)

Black vine weevils (*Otiorhynchus sulcatus*) damage many landscape plants. Adults and larvae primarily feed on azalea, rhododendron and taxus, but they also attack other evergreen plants. The adults are a black beetle approximately ½ inch in length. A handlens reveals the small yellowish spots found on the back. Weevils do not fly. They move to new landscape areas by walking or on infested nursery stock. The immature stages (larvae) are small, white, legless grubs that live in the soil feeding on roots. There is one generation of black vine weevils each year. Most overwintering as grubs.

The grubs consume small roots and girdle larger ones. This causes tremendous damage that kills the plant. The foliage of plants that have suffered heavy root damage will turn yellow. The adults chew C-shaped notches in leaves.

Adult black vine weevils hide in debris or soil crevices at the base of the plant during the day and do not move onto plants to fed until dusk. Scout in late May/early June for the first indication of leaf notching. Pit-fall traps, consisting of plastic cups inserted into holes in the ground, can be placed to catch the wandering adults. Another option is to take a piece of burlap, fold it into pleats, and then wrap around the base of the plant in question. The weevils use the folds as a daytime shelter and can be detected by unfolding the burlap. Larval detection can only be accomplished by exposing the root zone.

Control must be more effective than with some of the previously mentioned insects. First, before installing any new plant material, examine the root ball for larvae and the soil surface for adults. The best method for black vine weevil management is to not introduce them into a planting bed. Also, do not use an excessive amount of mulch which increases the protective areas favored by the adults. Second, place barriers of aluminum flashing or plastic into the soil around uninfected areas to protect them from surrounding trouble spots. Since the adult weevils can only walk and not fly into the area, this reduces the chance of further infestations. Due to the feeding depth of the larvae, and the screening-effect of the foliar canopy, insecticide soil drenches are ineffective for grub control. Entomopathogenic nematodes (microscopic, soil-dwelling worms that attack certain insects) are an option for larval control in certain situations. No predators or parasites control the adults. The best approach is to treat the foliage with an insecticide, preferably at dusk, so that the chemical residue is fresh when the weevils crawl up to feed.

Aphids. Note the shed skins.

The next insect pest is one that is all too familiar. **Japanese beetles** (*Popillia japonica*) are oval-shaped with copper-colored wing covers and small white tufts of hair around the sides. The adults feed on 300 species of plants. A few favorites are roses, Japanese and Norway maples, flowering crabapples and cherry. Adult activity is at its peak on the warmest, sunniest days. These beetles group, usually in large numbers, to feed and mate. The grubs are white, C-shaped with six legs. They feed on the roots of turfgrass. Japanese beetles have only

one generation a year and overwinter as grubs in the soil.

Unlike black vine weevils, the feeding damage of adult Japanese beetles can be extreme. They strip away leaf material leaving behind only leaf veins. Roses and other flowers can be destroyed. Turf dies and turns brown as the grubs consume the roots. Larval feeding can strip away turf roots so that areas can be rolled up like a carpet.

Watch for the first adults to emerge in late June or early July. They may be active until late August. The only way to be sure that grubs are responsible for turf damage, and not other insects, disease or drought dormancy, is to use a knife or shovel to cut back the turf and search in the soil. The commonly available adult traps can be used to monitor for early adult emergence. However, there are two important drawbacks to consider. The attractant that pulls in the adults is a combination of a pheromone and floral scent. Pheromones are chemicals given off by insects to induce specific behaviors in other individuals of the same species. The pheromone used here is a mating pheromone that will attract males. The floral scent will draw in both males and females. Not all of the beetles brought to the area will enter the trap. Thus, since both the males and females feed on plant material, serious damage can be done to any surrounding host plants. The other problem is that both sexes have now been conveniently brought together to mate. This increases the chance that the female will deposit eggs in the turfgrass near the trap.

There are several options for managing both the adults and grubs. If new plants are going into the landscape, less susceptible adult hosts can be installed. Adults can also be hand-picked and destroyed if the population is small. Crows and skunks dig up turf areas as they search for grubs. The wasps *Tiphia vernalis* and *T. popilliavora* will parasitize grubs. The fly *Istocheta aldrichi* will parasitize adult beetles. None of these should be relied on to sufficiently control the populations. Their effectiveness and distribution is limited.

The entomopathogenic nematode species *Heterorhabditis bacteriophora* and *Steinernema feltiae* can be purchased commercially and applied for grub control. Once applied to the turf area, the nematodes search for and then enter grubs. They multiply inside and then burst out to search for more beetle larvae. Though nematodes are effective, follow labelled application steps carefully. Focus Insecticide treatments on late summer and early fall grub populations. Depending on turf conditions, treatments may not be necessary unless there are more than eight grubs per square foot.

Feeding Japanese beetles cause much damage to many plants.

In some sections of the northeast, **Oriental beetles** (*Exomala orientalis*) have not yet reached the status of the Japanese beetle, but their damage is on the rise. The adults are smaller than adult Japanese beetles and are a mottled tan and brown.

Grubs are white, C-shaped and have six legs. There is one generation a year with grubs as the overwintering stage. The adults cause some feeding damage on flowering shrubs and perennials. The larvae feed on turfgrass roots and on the roots of ornamental plants.

Unlike the Japanese beetle, adult feeding damage is minimal. Since the grubs feed on roots other than just turfgrass, they can affect more host plants than Japanese beetles. Often these two species, and other beetle grubs such as European and masked chafers and Asiatic garden beetles, can be found feeding together.

Scout for adults starting in mid-June and continuing into August. Adults are most active during warm days, but can also be found near lights at night. Management efforts should focus on the late summer and early fall grub populations. Use nematodes or contact insecticides. As with the nematodes, there are some points to consider when using insecticides. Some of the chemical products bind to organic matter like thatch or excessive mulch. If this material is plentiful, there is little chemical penetration into the root zone, and thus grub reduction is poor. Also, after exposure to some of the insecticides, it may take over a week for the grubs to die. Proper follow-up evaluation of treatments is essential to the success of IPM. If the turf is healthy, treatments may not be required unless there are more than eight grubs per square foot. **LM**

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