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PLANT DISEASES

Shoot Blights on Juniper and Arborvitae

Over the past 2 weeks, the Plant Clinic has received many samples and/or calls about junipers and arborvitae with shoot blight. The foliage is yellow, pale green, or brown. Sometimes only tips of branches are affected. Other times the injury is on the exposed south or west sides of plants. Sometimes the symptoms have spread over the plant. Always the question is, "What disease is killing my plants?"

Some of the samples have been free of disease but obviously affected by environmental stress. In some areas, drought in 2006 and 2007 has caused root injury; then top decline followed. A few cases were traced to improper planting depth (too deep). Other factors to consider are girdling roots, mechanical root injury, transplant shock, waterlogged soil, rodent feeding on the trunk, and girdling by wires or twine. Look at the pattern of injury for clues to the cause. Most of the listed factors cause a uniform distribution of injury. Injury on the south or west sides of plants may be the result of added stress of heat and wind.

The most common infectious shoot blight of juniper (including red cedar) and arborvitae in Illinois is **Phomopsis blight**. The first symptom is yellow spots at the tips of the youngest growth. Browning and death of new shoots may follow, typically killing 4 to 6 inches of new growth at the tips of stems. A gray band of tissue at the base of the affected shoots contains pinhead-sized fruiting bodies. In warm, moist weather, the spores ooze from these fruiting bodies in tendrils and are splashed to succulent new growth, continuing the cycle of infection. Older plants withstand infection better than young plants. *Phomopsis* can be controlled by removing dead tissue and spraying fungicides to protect new growth. New growth is susceptible when it is still yellowish green. Deep green needles are not susceptible. Registered fungicides are listed by host in the *Illinois Commercial Landscape & Turfgrass Pest Management Handbook* or the *Home, Yard & Garden Pest Guide,* available at https://pubsplus.uiuc.edu/.

Kabatina blight looks much like Phomopsis blight but affects older growth. This fungal disease follows injury such as winter injury or drought stress. Tips of branches show symptoms in early spring, but this is last year's growth. The problem does not spread to new growth as it appears. If new growth is affected, then Phomopsis blight is probably to blame. The two diseases can be discerned by differences in spores. It may be helpful to obtain a positive laboratory diagnosis to plan a useful management scheme. Fungicides are not useful for Kabatina blight. Resistant varieties are available for both Phomopsis blight and Kabatina blight, but not in the same species. For a list of some resistant varieties, consult this summary article in an Iowa State University newsletter: http://www.ipm.iastate.edu/ipm/hortnews/1996/7-26-1996/prefevergrn.html. A more recent listing can be found on pages 204 and 205 of *Diseases of Woody Ornamentals and Trees in Nurseries,* edited by Jones and Benson.

Cercospora blight is a third fungal blight that may occur on junipers and arborvitae. Older needles on lower branches are affected first. Infection may move upward within the tree. Only needles are infected, not the stems. Often the only healthy growth is in tufts at the tips of branches.

For more about Phomopsis blight, consult *Report on Plant Disease,* no. 622, available online at http://www.ag.uiuc.edu/~vista/abstracts/a622.html. *(Nancy Pataky)*

Viral Diseases of Plants

This is a topic that causes much confusion to commercial growers, consultants, and homeowners. As a reminder, viral diseases do not form spores or fruiting bodies as do fungi. They do not produce ooze as do the bacterial pathogens. In fact, they cannot be cultured in a lab because they grow only in living cells. All of these facts make a positive identification of a virus difficult. We rely on symptoms and serological tests to accurately identify virus diseases.

Plant viruses are strands of RNA or DNA. Obviously, these strands are too small to be seen by the naked eye. Viruses are placed into plant tissue by insects or vegetative propagation, or they enter through wounds. Virus particles cannot replicate on their own but cause the live plant cell to replicate more viral particles. They usually become systemic within the host plant. An infected plant may be able to co-exist with the virus, or it may be killed. In any event, the plant cannot be cured of the viral infection.

Some viral diseases are very host specific, and others are general, over many hosts. Symptoms include stunting, mosaic, ring spots, color breaks, and distortion. Viral diseases are usually easy to distinguish from fungal and bacterial diseases but are often confused with herbicide injury, nutrient stress, and other environmental stress. The pattern of affected plants is often very helpful in distinguishing disease from other causes.

Some examples of viruses on annuals and perennials include geranium yellow net, hosta virus X, iris mosaic, impatiens necrotic spot virus (INSV), tomato spotted wilt virus, *Ajuga* viruses, and cucumber mosaic virus on *Aquilegia*, *Dahlia, Delphinium*.

So how do you diagnose a viral disease on your plants? First review the possibilities for the host in question. Then look in texts or online for pictures of infected plants of the same host. If you think a virus is involved, consult a lab that can test for viruses. The University of Illinois has immunostrip tests for many common plant viruses and can test those at a cost of $12.50 per virus. Standard ELISA (enzyme-linked immunosorbant assay) testing may be the only test available. The cost for ELISA testing is considerably more. Commercial growers are usually the clients who pursue confirmation of plant virus problems.

For more on viral diseases of ornamentals, consult *Report on Plant Disease,* no. 608 (geraniums), 612 (gladiolus), 614 (orchids), 632 (roses), 634(tulip), 654 (iris), and 665 (tomato spotted wilt). These are available at http://www.ag.uiuc.edu/~vista/rpd.html or at your local University of Illinois Extension office. *(Nancy Pataky)*

Hackberry Island Chlorosis Note

There is a disease of hackberry leaves that appears as blocky yellow spots. The spots often have green tissue surrounding them (but not always), so the disease has earned the name of island chlorosis.

The disease has been blamed on a phytoplasma, a virus, and a physiological abnormality; but until lately no one was able to pinpoint the cause. Benham Lockhart, professor of plant pathology at University of Minnesota, has identified a virus responsible for this condition. It is likely that a research report will be available later in the year. We will keep readers posted.

As far as we have been able to determine, the disorder is a curiosity but does not cause significant damage to mature trees. In any event, the symptoms occur on hackberry, are certainly less of an eyesore than witches'-brooms found on hackberry, and can become intense enough to give the entire tree a yellowed appearance. *(Nancy Pataky)*

INSECTS

Emerald Ash Borer

Emerald ash borer (EAB) adults are expected to begin emergence in northern Illinois within the next week. They were observed emerging in Columbus, Ohio, on May 23 by Dave Shetlar, Ohio State University entomologist. At that time, he observed one emerged adult, two current-year emergence holes, one pupa, and six adults in the process of chewing their way out of the tree. The tree was located in a park that was lightly infested with EAB. Phenology observances that he made at the time included Delaware's black locust trees at half bloom, Miss Kim–type lilacs in full bloom to beginning to decline, and Japanese tree lilacs in full bud but no blooms yet.

Several factors should be taken into consideration before applying insecticides to control emerald ash borer. We recommend that preventive treatment of ash trees should not occur more than 15 miles from known infestations. Typically, EAB adults fly about 1/2 mile during their lifespan. In areas where the infestation is still light, which is the case in Illinois, the beetles typically do not fly very far because there are still plenty of live ash trees nearby to infest. As the infestation increases, and most of the ash trees are dying, the beetles fly farther to find new hosts. In these cases, it is thought that they may fly more than 1/2 mile per year. Even so, there is sufficient cushion built into the 15-mile recommendation to cover these variances. With systemic insecticide treatment, there has been 80 to 90% survival of trees with up to 40% dieback, so most trees can still be saved even after EAB is present.

Control of EAB is more effective on smaller trees, those with a trunk diameter of less than 10 inches. Insecticide labels include higher rates for larger trees. It typically takes 2 years for systemic insecticides to move throughout the tree; it may take longer for larger trees.

Professional insecticidal control options recommended by the University of Illinois include the following:

- Imidacloprid (Merit, Xytect) applied onto or injected into the soil around the tree annually within 2 feet of the trunk. Do not apply into mulch or other dead organic matter.
- Imidacloprid (Merit, IMA-jet, Imicide, Xytect, Pointer) injected into the tree annually.
- Emamectin benzoate (Tree-age) injected into the tree annually.
- Dinotefuran (Safari) applied in Pentrabark onto the trunk annually.
- Foliar and bark sprays of bifenthrin (Onyx), cyfluthrin (Tempo), permethrin (Astro), or carbaryl (Sevin) in both mid-May and mid-June to control visiting beetles.

There are several factors to consider with the above recommendations. Foliar and bark sprays to control visit-

ing beetles should be used only when a new infestation is located during beetle-flight season. Soil or trunk injections are the preferred method of control. Observe labeled acre rates of insecticide application. Although several states have increased the amount of imidacloprid that can be applied per acre to account for parks and other sites where trees are numerous, the rates have not been increased for Illinois. Where there are many trees per acre, you may need to use more than one insecticide to stay within labeled acre rates.

Soil injections typically take 1 to 2 months to move throughout the tree. Trunk injections are much quicker, taking about 2 weeks to move throughout the tree although it takes 2 years to fully protect the tree. Applications can be made at any time of the year, but they are most effective in the spring. With both soil and trunk injections, transpiration appears to be the driving force in moving the insecticide through the tree. The leaves create much of this transpiration, and they are most active during the first half of the growing season. Although fall application has shown good results, insecticides start breakdown after application. Having several months pass before the insecticide moves effectively through the tree results in reduced efficacy.

Early research indicates that emamectin benzoate provides almost 100% control of EAB larvae for 2 years. Imidacloprid and dinotefuran provide around 90% control for over 1 year. There has been a lot of excitement about emamectin benzoate based on this research, but realize that the other systemics provide a very high level of control as well. It appears that ash trees can tolerate up to 30% infestation of EAB without dieback, so all of the systemics should be effective. Until more research is conducted, we are recommending annual treatments, even with emamectin benzoate.

Realize that soil injections do not injure the tree, as occurs with trunk injections. There is also considerable variability in the size of the holes used with various trunk-injection methods. Arbor-jet is the only company with an emamectin benzoate label, and its imidacloprid application shows the highest control. However, its injection method also creates the largest hole of those recommended. The amount of trunk damage is likely to be less with other injection options that create smaller holes in the trunk. An updated fact sheet containing these and homeowner recommendations, as well as other control information for EAB, can be found at http://www.ipm.uiuc.edu/. *(Phil Nixon)*

May Beetles

Adult May beetles are present throughout the state. These are 1-inch long, stocky beetles that are active at night. Many species occur in Illinois, all in the scarab genus, *Phyllophaga.* As such, they vary in color and somewhat in size, being some shade of brown, from tan through dark chocolate brown. The ones that are out at this time are reddish brown.

These insects emerged from the pupal stage last fall and spent the winter underground as adult beetles. These beetles are sometimes found when you are planting trees or tilling the soil in the fall and spring. As their name indicates, they emerge in May and are quite common, being strongly attracted to lights at night. They spend the day burrowed into the soil of turf areas, emerging at night to feed, mate, and lay eggs.

May beetle adults feed primarily on tree leaves, eating at leaf margins, sometimes to the midvein. Damaged leaves are commonly seen on crabapple, ash, oak, and other broad-leaved trees at this time of year. Damage can be puzzling because no insects are present during the day. They start to show up on the tree foliage at about dusk, and I have found them numerous times feeding in high numbers on the foliage at about 10:30 p.m. They are easily controlled with a spray of carbaryl (Sevin), various pyrethroids, and other labeled insecticides. Typically, most of these beetles are engaged in sex while the female continues to eat the tree foliage. Mated females fly to turf and other areas, burrowing down a couple of inches into the soil to lay their eggs. The larvae are known as true white grubs and have broad feeding habits.

The larvae feed on dead organic matter, as well as roots. It is common for them to be found in mulched areas, such as flower beds, where they typically cause no serious harm to the plants. They also feed on the roots of vegetables, including carrots, potatoes, and sweet potatoes. This is so common that it is recommended to avoid planting root vegetables for 3 years in new garden areas that were previously in turf. They also feed heavily on turfgrass roots, causing turf to wilt and turn brown, with the turf being easily pulled back like a carpet due to the loss of roots.

Life cycles are quite varied, with this genus containing the 3-year white grub, named for the length of its life cycle; species with 3-year life cycle commonly take 4 or more years to complete their life cycles under adverse food or climate conditions. However, there are species that have 1- and 2-year life cycles.

One common *Phyllophaga* species in southern Illinois has a 1-year life cycle and emerges as an adult at this time of year. Unlike most in the genus, the adult is tan and only about 1/2 inch long. Landscapers and other turf professionals see these beetles and think that the masked chafers have emerged early. Masked chafer adult beetles are named for their black face, which this true white grub species does not have.

Eggs hatch 2 to 3 weeks after the beetles die off. Due to the adult beetles' feeding on tree foliage, the adults are present for 3 to 4 weeks. The eggs hatch into white

grubs that feed through the balance of the summer and are easily controlled in this first year with insecticides used to control annual white grub species, such as Japanese beetle and masked chafers. In the 3-year life cycle, larvae descend deeper into the soil to overwinter, rise to feed during the next growing season, descend into the soil to spend a second winter, and rise to feed during their third spring. They pupate and emerge as adults underground during this third growing season.

These second- and third-year true white grubs are commonly encountered by turf professionals as large individuals at times when Japanese beetle and masked chafer grubs should not be present or should still be small. It is important in these cases to check the raster pattern of the grub for identification. True white grub larvae have two parallel rows of thick hairs, or setae, on the underside of the last abdominal segment. They also tend to grow larger, with third-year larvae approaching 1-1/2 inches in length.

True white grubs tend to survive better in drier soil conditions than do Japanese beetle and masked chafer grubs. For that reason, they frequently appear in nonirrigated turf that is commonly not treated for the annual-life-cycle grub species. Turf damage tends to be spotty because, although May beetle grubs can be found in small numbers in many turf areas, damaging numbers are uncommon. When turf damage does occur, the grubs are typically too large for effective control by typical grub insecticides. Insecticidal nematodes, particularly *Heterorhabditis bacteriophora,* provide the most effective control. *(Phil Nixon)*

White Grubs

We have had several reports from turfgrass professionals about large white grubs being found in turf. May beetles, Japanese beetle, and masked chafers all overwinter deeper in the soil as larvae. These white grubs migrate upward when the temperature in the turfgrass root zone rises to 50°F. Japanese beetle and masked chafer grubs pupate in early to mid-June, so their feeding will cease soon. True white grub larvae in their second year will continue to feed through the growing season.

These large white grubs are difficult to control with typical white grub insecticides such as imidacloprid (Merit), halofenozide (Mach 2), and trichlorfon (Dylox). Of the three, trichlorfon is likely to provide the best control; but 30% or less control is typical rather than the 95% control that these three insecticides typically provide on young grubs in late summer. *Heterorhabditis bacteriophora* and other cruising nematodes should provide about 60% control on these older grubs. The nematodes need to applied within a couple of days of arrival, applied in late afternoon to wet turf, and watered into the turf before the turf dries.

Generally, the number of overwintered Japanese beetle or masked chafer white grubs is below or just above the 10 to 12 grubs per foot square typically necessary to cause turf damage. If the grub numbers are marginal for grub damage, generally the best option is to increase irrigation to keep the turf growing roots faster than the grubs can eat them for the few weeks before these grubs pupate—rather than making an insecticide application. *(Phil Nixon)*

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