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In This Issue:

Vulture damage management

Over the past several years, there has been a significant increase in vulture damage. Two species of vultures occur in West Virginia: turkey vulture *(Cathartes aura)* and black vulture *(Coragyps atratus)*.

The turkey vulture, a historic resident of West Virginia, is a relatively large bird, dark brown to black in color with a red featherless head and pale-colored bill. In flight, it has two-toned underwings with a paler trailing edge of the wing (paler flight feathers). The second vulture species is the black vulture. Black vulture populations were historically uncommon in West Virginia. However, their population has increased, and they now are commonly found throughout the state. Slightly smaller than its red-headed counterpart, the black vulture is uniformly black with a black featherless head (Figure 1). In flight, it can be distinguished by large white patches on the underside of the wings near the wing tips.

Figure 1. The black vulture population has increased, and they are now commonly found throughout West Virginia.

Both species eat carrion and provide a valuable ecological service of carcass removal. Vultures are protected under the Migratory Bird Treaty Act, which makes it illegal to trap, kill, relocate or otherwise handle a vulture or its eggs.

Damage

In certain circumstances, vultures can become a nuisance. Vultures can congregate near domestic or commercial structures resulting in accumulations of feces on trees, lawns, roofs, towers or other structures. They also can use their beaks and talons to cause damage to asphalt roofing shingles and rubber roofing gaskets; upholstery and covers; and other items found outdoors.

Vultures can cause serious damage or death to livestock, including plucking the eyes and tongues of newborn or sick animals, and even disemboweling young livestock. General cuts and bites from vultures also have been reported on livestock and pets.

Management

An integrated wildlife management program is recommended to reduce vulture damage. Remove any food that may attract vultures. Lambing or calving indoors also will reduce possible food attractants. Roost or nest sites may need to be removed to reduce bird numbers.

Harassment tools, such as pyrotechnics, can be used to disperse nuisance vultures. Be persistent in the use of pyrotechnics, because it may take a few days to scare away habituated birds. Check with local law enforcement before initiating any noise-related programs. Dead vultures hung in effigy or used as a scarecrow also can be a very effective technique.

A federal permit can be obtained via USDA/APHIS Wildlife Services and the U.S. Fish and Wildlife Service to lethally manage vultures. If a landowner is currently working with the West Virginia Livestock Protection Program, they are automatically eligible for assistance from USDA/APHIS Wildlife Services. Others can contact Wildlife Services and enter into a cooperative agreement to manage vultures.

Monitoring wireworms before planting potatoes

Wireworms are one of the most problematic pests in potato production. Several wireworm species attack potatoes, but the most common are the Pacific coast wireworm *(Limonius canus)*, the sugarbeet wireworm *(Limonius californicus)* and the dryland wireworm *(Ctenicera pruinina)*. Unlike most pests, wireworms should be monitored before planting because insecticide treatments and other nonchemical methods are not feasible after planting.

Monitoring

Bait traps

Bait traps are the recommended way to monitor wireworms. Baits are placed 4 to 6 inches deep in the soil in the spring when soil temperatures are about 50 F. Bait traps can be made from carrots, packets of untreated corn and/or wheat seed, or ground whole-wheat flour, because they attract wireworms by producing CO_2. The bait material should be presoaked overnight and can be placed directly in the soil, in plant pots (with holes) or porous bags. Bait trap locations should be covered with black or clear plastic bags to warm the adjacent soil.

At least four bait traps should be placed in small fields. If several acres are monitored, at least one trap per acre should be used (at least 24 bait traps for 30 acres). Using more traps will detect damaging populations. Bait traps are placed randomly except for parts of the field with grass. These locations should be monitored separately, because wireworms may be exclusively present in these areas but not in the rest of the field. To count wireworm populations, about 10 to 14 days after setting the bait traps, collect bait and about 4 to 6 inches of the adjacent soil. Sort wireworms by hand or by floating them in a bucket with water.

The average wireworms per bait trap can be calculated by summing all wireworms in all traps divided by the number of bait traps. An average of less than two wireworms per trap indicates that treatment is not required to plant potatoes. Chemical control is recommended when an average of two to four wireworms is found per trap. If an average of more than four wireworms is found per trap, a different crop should be planted.

Soil samples

Soil samples also are used to monitor wireworms. Soil sampling can be ineffective because the distribution of wireworms in the field tends to be patchy and unpredictable. A 6-inch post hole digger and a shaker/sifter can be used to collect the soil samples. Like bait traps, soil samples should be taken in spring when soil temperatures are about 50 F at the 6-inch level or in late summer at the 18-inch level. Thirty soil samples are recommended for a field of 10 acres.

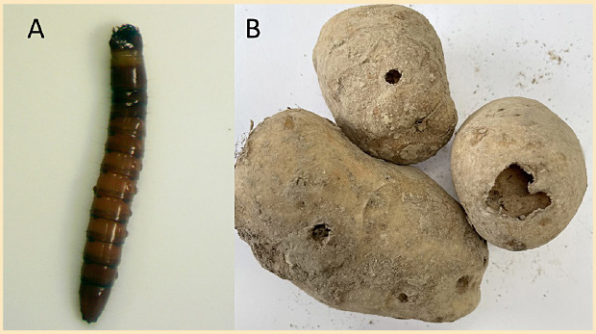

Figure 2. Larva (A) and damage (B) of wireworms. (Photo credits: A – Carlos Quesada; B – Aine Slabaugh)

Insecticide treatment is recommended when one or more wireworms are found. For 22 and 40 acres, 45 and 60 samples are recommended, respectively, and insecticide application is recommended when two or more wireworms are present.

Pheromones traps

Male adults can be monitored by using pheromones traps. This method is mainly used to determine the presence and distribution of population. Lures are available for some invasive species but not for the most problematic species in West Virginia.

Intervention

Cultural control

Crop rotation is the most effective cultural control to keep wireworm populations at low densities. Crop rotation is the practice of planting different crops sequentially on the same plot of land. Also, avoid planting potatoes in fields immediately following clover, grass, pasture or weedy alfalfa, because wireworms are commonly found on these crops. Plowing can effectively reduce wireworm populations; however, the effectiveness of this control method varies with soil temperature and humidity. When soil is hot and dry, plowing is less effective because wireworms are in greater depths.

Chemical control

When insecticides are recommended based on thresholds in bait traps or soil samples, in-furrow applications should be done to a depth of 2 to 4 inches before or at planting. Imidacloprid, thiamethoxam-fludioxodil or Ethoprod are active ingredients used for wireworm control. Many products are commercially available with these active ingredients, but federal laws indicate that the site (crop) of application must be listed on the pesticide label.

Identification and control methods for corn speedwell

If you're wondering about the slender, upright weed with tiny purple flowers that are seemingly everywhere this spring, you are not alone.

Corn speedwell *(Veronica arvensis)*, a winter annual, is a common weed in landscapes, lawns and fallow fields. It belongs to the figwort *(Scrophulariaceae)* family along with other less common weedy speedwells.

Seeds germinate in late summer or fall, or even in early spring. The weed grows rapidly in spring and completes its lifecycle before summer despite its shallow root system (Figure 3).

Identification

Corn speedwell is characterized by oval and pinnate basal leaves with a distinct petiole, arranged oppositely on the stem.

The upper leaves are smaller, alternate and devoid of a petiole. Lower leaves have a round-toothed margin, whereas the upper leaves have fewer serrations with a smooth upper lobe. Both the stem and leaves are hairy (Figure 4).

Figure 3. A corn speedwell plant with a shallow root system. (Photo credit: R. Chandran)

Figure 4. Hairy stem and leaves of corn speedwell with lower leaves showing more serrations compared to upper leaves. (Photo credit: R. Chandran)

There are a few speedwell species that grow in similar habitats.

Corn speedwell is often confused with purslane speedwell *(Veronica peregrina)*. Both have opposite basal leaves and alternate upper leaves; however, the leaves of purslane speedwell are hairless.

Other closely related species are Persian speedwell *(Veronica persica)* and ivyleaf speedwell *(Veronica hederifolia)*. Both of these species have larger leaves than corn speedwell and are more deeply lobed with ivyleaf speedwell having three distinct ivy-shaped lobes.

Another closely related species is creeping speedwell *(Veronica filiformis)*, however, it is a perennial weed.

Controls

As previously mentioned, corn speedwell has two windows for germination: late summer/fall and early spring. Control measures that prevent germination and establishment, such as mulching or application of a pre-emergent herbicide, are effective when appropriately timed.

To manage established weeds, light cultivation, such as hoeing or hand-weeding, are effective. Once removed, preventative control measures should be put in place.

In flowerbeds and landscapes, the herbicide Snapshot (trifluralin + isoxaben) is an effective pre-emergent broad-spectrum herbicide. Be sure to only apply it to established plantings, because it can cause injury to new or transplanted plants.

In lawns and other types of turf, specialty herbicides, such as Gallery (isoxaben), applied prior to germination or in conjunction with a broad-spectrum post-emergent herbicide, after germination, such as Turflon (triclopyr), Speedzone (a premix of carfentrazone, 2,4-D, mecoprop, and dicamba) or Q4 (a premix of quinclorac, sulfentrazone, 2,4-D, and dicamba), provides control of speedwells and other broadleaf weeds.

Other cultural practices to maintain a healthy turf by outcompeting pesky weeds include over-seeding (in spring and fall), fertilization (in fall and spring) and maintaining a 3-inch mowing height.

Common abiotic and biotic problems with indoor-grown seedlings and transplants

Growing quality transplants requires good seed, a sterile and well-draining growing medium, proper temperature and moisture conditions, adequate light, and a structure that has built-in capacity to adjust these factors, especially temperature and humidity. However, many small growers start seedlings inside their houses using artificial light or often relying only on the window light. Commercial seedling growers generally use heated high tunnels or greenhouses for the same purpose. But, these indoor growing conditions are not ideal due to the inability to control temperature, humidity and light intensity. Planting medium used for growing seedlings also may not contain optimum fertility or be free from infectious plant pathogens. In addition, various gases can cause injury to seedlings due to their sensitivity at the early stage of development.

Temperature

Temperature can affect germination, seedling vigor and even cause mortality. Not all plants germinate well in the same temperature. For example, warm weather crops, like tomatoes, will germinate better with temperatures in the 70 F range, while cool weather crops, such as cabbage, kale or broccoli, have a much lower germination temperature. During the early spring, plants in non-heated structures can encounter freezing temperatures and show dead areas between the veins of older leaves and on the tips of the youngest leaves. Tomatoes are very susceptible (Figure 5), but plants usually recover with the onset of warmer temperatures. Greenhouses without good heat and air recirculation systems can have high temperatures underneath heaters, causing seedlings in that area to become heat stressed and subsequently attacked by fungi.

Figure 5. Cold injury on tomato leaves (dead areas between the veins) in a high tunnel without supplemental heating. (Photo credit: MM Rahman)

Soluble salt and pH of growing medium

Most people use a potting mix, such as Sun Gro, Miracle-Gro or Pro-Mix, to grow seedlings in plastic plug trays. Some growers use locally available composts or topsoil. Normally, these media contain enough nutrients to support early growth of seedlings. However, some growers mix extra fertilizers, such as Osmocote or some other pre-plant fertilizer, that can increase soluble salt content to such an extent that it can cause injury to seedlings. The symptoms first appear as marginal leaf scorch, stunting and may eventually kill the seedling (Figure 6). If you notice any injury or plant stunting, you should measure pH in addition to soluble salt to make sure pH is between 6 and 7 and electrical conductivity (EC), which is a measure of soluble salt, is not more than 1.7 millimhos per centimeter from a 1 to 2 (substrate to water) dilution ratio. Too high or too low pH also will obstruct nutrient uptake by seedlings. During seedling production, it is better not to use any pre-plant fertilizer. As plants start actively growing, fertilizer can be supplemented based on the need.

Figure 6. Tomato (top) and crucifer (bottom) seedling mortality due to high soluble salt in the growing medium. (Photo credits: MM Rahman)

Humidity

Relative humidity in indoor conditions for vegetative growth of plants should be between 60% to 70%. Humidity below

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Common abiotic and biotic problems – *continued from page 4*

or above that range can affect plant growth. Under very high humidity, indoor-grown tomatoes, crucifers and other plants may show a physiological disorder called edema (Figure 7) that develops when roots take up water faster than it can be used by the plant or transpired through the leaves. Water pressure builds up in the internal cells of the leaves, causing them to burst and leave dead cells that are visible as blisters, primarily on the undersides of leaves. Plants usually recover when transferred to low humidity growing conditions or when humidity is controlled by other means.

Figure 7. Tomato leaves in an indoor growing condition showing a blister-like appearance due to edema. (Photo credits: MM Rahman)

Toxic gas injury

Injury due to a faulty heating system and the generation of toxic gases also may occur when starting seedling production indoors. If exhaust from a methane or propane heating system is obstructed or an incomplete combustion of gas occurs, ethylene gas can be formed causing injury to tomatoes, even at a low concentration (≥ 0.1 parts per million). Symptoms include stunted growth, pronounced downward curling or twisting of the leaves and shoots (epinasty), and a thickened stem (Figure 8). Ornamentals, such as baby's breath euphorbia and Mexican heather, also are very sensitive to ethylene.

Light and moisture

Light is generally not required for seed germination, except for a few species of plants with fine seeds that need to be planted shallow. However, a fluorescent or LED lamp with photosynthetically active radiation is the best choice to ensure that post-germination seedlings get the quality, intensity and duration of light they need. A timer can be attached to the light source to ensure the light stays on for an appropriate number of hours. Without adequate light, seedlings will be leggy, or etiolated, and will not establish well. Water only when needed – check moisture by feeling medium by hand or by when the soil has pulled away from the wall of the pot. Excess watering and a lack of adequate drainage will deprive the plant's root system from air and also enhance fungal growth. Damping off can be prevented by using clean containers and a sterile, well-draining potting mix, and by following good cultural practices. If containers are reused, they should be surface sterilized by dipping them in a 10% bleach solution for 30 minutes, followed by thorough drying.

Figure 8. Ethylene injury on a tomato seedling inside a greenhouse caused by a faulty heating system. (Photo credit: Angela Medeiras, UMass)

Acclimation and hardening off

Indoor-grown plants are not ready for harsh conditions in the field. Cucumber transplants grown indoors can get extensive sunburn if taken directly to the field. Put plants outside for five to seven days prior to planting, gradually increasing the daily sunlight exposure hours.

Broad mite injury on pepper

Greenhouse-grown pepper seedlings can have substantial injury from broad mites. The primary symptom is curling and distortion (Figure 9) of leaves that can easily be confused with growth regulator-type herbicide injury. These mites are very tiny and may require a very high magnifying lens to see. Most of them can be found on the lower side of the leaves or on the stems.

Figure 9. Broad mite injury on a pepper seedling (left), plant in the field at pre-bloom stage (center), and a broad mite under 50-times magnification (right). (Photo credits: fromseedtotable.blogspot.com and growingproduce.com)

Adding trees to your landscape

When considering landscaping for your home, add color and shapes that complement the exterior of your house. This will add to your home's curb appeal while adding to the value of your property.

When to plant

If planting container-grown or balled-and-burlapped trees, they can be planted throughout the season, except in the instance of a very hot, dry season. Plant trees in the fall to take advantage of strong root development during the fall months. While the above ground portion of a tree stops growing and goes into dormancy, roots will grow and develop throughout the fall (and possibly winter), as long as the ground does not freeze.

Planting considerations

Before planting there are some things to consider: type of soil and the soil's drainage properties. Trees and shrubs must be planted at the proper depth in order to thrive. In well-drained soils, plant trees and shrubs as deep as the height of the root ball. However, West Virginia has predominantly clay soils notorious for poor drainage (Figure 10), which is the leading cause of many landscape problems such as poor root development, lack of anchoring, overall weakness and lack of performance due to root asphyxia and/or collar rots (Figure 11).

Figure 10. Soil with poor drainage. (Photo credit: M. Danilovich)

Figure 11. Asphyxia-dead root due to lack of oxygen. (Photo credit: M. Danilovich)

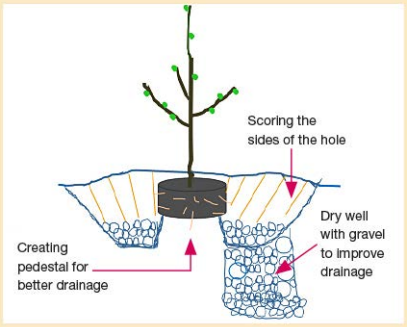

Figure 12. Improve drainage by creating a pedestal and dry well. (Graphic credit: M. Danilovich)

In a situation like this, the best approach is to create a raised bed about 12 inches above the existing grade to prevent roots from drowning.

Another approach would be to create a pedestal and a dry well (if needed) next to the planting hole (Figure 12). The pedestal should be 8 to 10 inches above the bottom of the hole. Soil below the root ball should not be disturbed – instead dig around it to prevent soil from settling down and pulling the root ball down. Place the root ball on the pedestal and fill the bottom around it with gravel. In soils with very poor drainage, the pedestal might not be enough and a dry well may need to be added.

Container-grown trees

Trees grown in containers should be removed from them and placed directly into the hole. Any dead or damaged roots need to be pruned and any girdling roots must be cut, so they do not strangle the tree. The best way to do this is to make four cuts through the root ball, about 1 to 2 inches deep, to prevent any potential circular root motion (Figure 13).

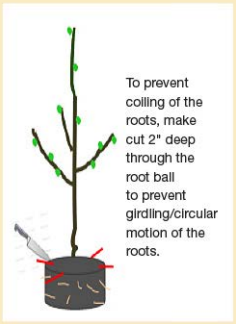

Figure 13. Cut through the root ball to prevent coiling and girdling root. (Graphic credit: M. Danilovich)

Balled-and-burlapped trees

If trees come balled and burlapped, remove the twines and as much of the burlap as possible. After positioning a ball in the hole, roll down the burlap and cut away. If needed, lean the ball on one side to cut material away as much as possible. If the burlap is of natural, organic material, it will eventually decompose; however, if left on, it will restrict root growth and act as a wick pulling the moisture away from the roots causing them to dry out and die (Figure 14). Plastic burlap, on the other hand, will not break down and decompose. It will act as a pot and continue to significantly restrict roots from growing, which will cause them to coil, girdle and eventually kill the tree.

Figure 14. Balled-and-burlapped tree declining due to twines and burlap not being removed. (Photo credit: M. Danilovich)

Controlling fungus gnats with beneficial nematodes

Nematodes are worm-like microscopic organisms that live in the soil with more than 15,000 other known species.

Most of us know about the bad nematodes; however, only a handful of species attack the outside surfaces of plants and burrow in causing damage. Other nematodes live inside the plant for a portion of their lives but cause damage seen on the outside.

Like with any pest, damage from these nematodes makes the plants more susceptible to bacterial and fungal pathogens. Unfortunately, it isn't easy to identify if the initial damage is from nematodes or some other issue, like poor fertility or a disease.

Beneficial nematodes

Despite what many believe, not all nematodes are bad – some help break down organic matter in the soil and others help control pests, like grubs, fleas, cutworms and root maggots.

Four years ago, I learned about beneficial nematodes from an insectary. The insectary staff suggested applying beneficial nematodes to the potting media used in our greenhouse for tomato breeding.

Even though I was hesitant, I was willing to try anything to get rid of the fungus gnats we had every year.

Fungus gnat control

In my experience, fungus gnats did not cause damage to our plants but rather were an annoyance when we pruned or harvested.

The insectary suggested we work with the beneficial nematode, *Steinernema feltiae*, which works against fungus gnat larvae and western flower thrips pupae in the soil.

Just like with any other beneficial insect, you need to match the best beneficial insect to use with the target pest(s).

Following the instructions on the package, the nematodes were stored in the refrigerator until we were ready to use them. Then, a pump sprayer was used to apply them to the potting media.

Despite what many believe, not all nematodes are bad – some help break down organic matter in the soil and others help control pests, like grubs, fleas, cutworms and root maggots.

We removed the filter or screen in the sprayer so the nematodes would not be impeded, and we aerated the mix to keep the nematodes suspended during application. There is not a restricted entry interval or the possibility that the pests you are targeting will develop resistance.

To my amazement, the fungus gnats were gone that season.

Beneficial nematodes have been applied for four years now in the greenhouse with no fungus gnats having been seen. The product costs less than $50 to cover 2,880 square feet of greenhouse space, and application of beneficial nematodes have become part of our annual IPM plan.

For more information, visit Biological Control: Using Beneficial Nematodes *(https://ag.umass.edu/greenhouse-floriculture/fact-sheets/biological-control-using-beneficial-nematodes)* and Insect Pathogenic Nematodes *(http://greenhouseipm.org/biocontrol-agent/insect-pathogenic-nematodes/)*.

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