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Controlling aphids on tomatoes

Aphids are a common insect pest that attack tomatoes grown in greenhouses and in field conditions. They are classified as true insects in the order Hemiptera.

They have soft pear-shaped bodies and come in a range of colors. Depending on the species, aphids can be green, black, red, yellow, brown or gray. They are small in size, ranging from 1/16 to 1/8 inch long. Adult aphids occasionally have wings.

When they are in large groups, it will trigger a response that allows some of the adults to develop wings. They feed on the sap of plants with their piercing-sucking mouthparts.

Cornicles is a common characteristic on aphids, which look like "tailpipes" on the back of their bodies.

Life cycle

Unlike other insects, aphids can produce living young (viviparity) or lay eggs depending on the season.

In the warmer temperatures and optimal greenhouse conditions, aphids most commonly asexually reproduce. When produced asexually, the female aphids give birth to live offspring. During this time, they complete their life cycle in seven to eight days.

In cooler temperatures, aphids reproduce sexually. During sexual reproduction, the offspring develop in an egg. The egg gives more protection from the environment and allows the aphid to overwinter. Once the weather is suitable, they hatch and go through four instar stages before becoming a mature adult.

Species

In West Virginia, the most common species of aphids in tomatoes are the green peach aphid *(Myzus persicae)*, the melon aphid *(Aphis gissyppi)* and the potato aphid *(Macrosiphum euphorbiae)*.

Figure 1. Since aphid populations can quickly increase, it is important to scout plants at least twice weekly when plants are young and growing rapidly. (Photo credit: C. Quesada)

The green peach aphids are yellow to green in summer and vary from pale to dark-green, pink or red in fall. They range in length from 0.06 to 0.09 inches long.

Melon aphids are mottled light and dark green or almost black; however, yellow forms do occur with an average size of 0.06 inches long.

Potato aphids are pink or green and 0.07 to 0.16 inches long.

Plant damage

Aphids can be detected through the signs and symptoms that are presented on the plant. Signs that aphids are

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present include casts that are left behind from molting and the honeydew they secrete. Honeydew is a sugary sticky liquid that can cause the growth of sooty molds.

When aphids are present, there are many different types of symptoms the plant will show. For example, aphids can cause the plant to experience curling and yellowing leaves, as well as stunted growth.

Some species of aphids can inject a toxin into the plant and cause galls to form. They can be found on a very wide range of plants, from trees and shrubs to vegetable crops to annual and perennial plants. The undersides of leaves are frequently infested.

Aphids can be a major vector of viruses. A common virus they spread is called cucumber mosaic virus. When aphids feed on a plant for more than 10 minutes, they have a high likelihood of picking up a persistent virus that can stay with the aphid for at least a week.

When quickly feeding or probing the plant, they can pick up non-persistent viruses. Aphids will remain infected with a non-persistent virus for a short period of time, but when spread they are very hard to control.

Scouting and threshold

Since aphid populations can quickly increase, it is important to scout plants at least twice weekly when plants are young and growing rapidly. Look on the underside of leaves where aphids congregate, and look for any activity.

When sampling for aphids it is important to keep records of the method used. Record the number of leaves with aphids and how many are on each leaf. Be sure to make note of how many aphids have wings and how many natural enemies are in the area.

The economic threshold is 50% of leaves with aphids at any life stage of the plant.

When sampling tomatoes, it is important to check the whole plant when it has up to two true leaves. When the plant has more than two true leaves, check the terminal leaflets of the third or seventh leaf from the top of the tomato plant.

The economic threshold on a plant with up to two true leaves is three to four aphids per a single tomato plant.

Biological control

Natural enemies of aphids are naturally found in tomato field in West Virginia. Some natural enemies of aphids include lady beetles, syrphid fly larvae, lacewings and braconid wasps. Some of these insects are commercially available.

Growers also can encourage natural enemies by planting flowering plants that bloom at different times of the planting season to keep and increase natural enemy populations.

Cultural control

Remove annual and perennial weeds that attract aphids. A couple examples would include sow thistle and mustard. Removing the weeds also can reduce the number of virus cases.

Another cultural control is the inspection of transplants for aphids before planting. Plants infested with aphids should be disposed.

Last, manage nitrogen levels. High levels of nitrogen fertilizers tend to encourage aphid reproduction. Use several, staggered applications of lower concentrations of nitrogen rather than a single high dose. Also, use delayed-release formulations.

Mechanical control

Using row covers can be effective. However, when aphids are already established, row covers can make the infestation worse by keeping out natural enemies. In addition, row covers should be removed during blooming. Reflective mulch like aluminum on paper has been effective in repelling aphids.

Chemical control

Insecticidal soap, horticultural oil, neem and pyrethrin are organic options to control aphids. They kill aphids on contact by physical means (suffocation and disruption of waxes in the exterior cuticle), so thorough coverage is essential for good efficacy. These products also kill beneficial insects in the same way, but there is no residual activity, so natural enemies that arrive post-spray are unharmed.

Beneficial insects are most active during the day, so the best time to spray is early in the morning, late afternoon, or at or after dusk.

Other contact insecticides that are not organic but have a high efficacy to kill aphids are acephate, permethrin, bifenthrin, lambda-cyhalothrin, cyfluthrin and malathion. These products have a high toxicity to beneficial insects, such as predators, parasitoids and pollinators. Systemic insecticides also are effective against aphids. They are applied to the soil and taken up by the plant. When the aphids feed on the plant sap, they will also ingest the insecticide. Imidacloprid and dinotefuran are popular active ingredients of systemic insecticides.

Management of Cercospora leaf spot of Swiss chard, beet and spinach

Cercospora leaf spot is a major disease of Swiss chard and beets. It can also affect spinach and other members of Chenopodiaceae. The disease is caused by the fungal pathogen *Cercospora beticola*. Severe yield and quality loss can occur if no control measure is taken preventatively or at the early stage of disease onset. Severe infection can result in unmarketable leafy greens.

Infection source, survival and disease diagnosis

In an area where these crops have not been grown, the pathogen can be introduced with infected seeds or by wind from nearby production areas. Once the pathogen is established on the host and kills many tissues, the fungus can survive in the infected plant debris from one year to another. In addition, *C. beticola* can form sclerotia (a hard, dark resting body consisting of a mass of hyphal threads of fungus) that can survive longer on plant debris and the soil. *C. beticola* also can survive on weed hosts, such as lambsquarters, pigweed, mallow, bindweed and other members of Chenopodiaceae. Numerous small circular spots of about 1/8 to 3/16 inch in diameter appear on leaves. The centers of the spots are usually gray to tan in color and margins are dark-brown to reddish-purple. As spots enlarge and merge with each other over time, whole or part of the leaves will dry up prematurely. At the centers of the older spots, numerous black hyphal masses known as stroma or sclerotia will form that may be visible with a hand lens. Similar spots formed by bacteria will not have these structures.

Disease spread and conducive environment

Cercospora leaf spot disease development is favored by hot (77 F to 85 F) and humid (90% to 95% RH) weather conditions. Numerous conidia can be formed on lesions that can be spread to nearby plants by wind, rain splash, sprinkled water or insects. Probability of conidial germination and infection is directly related to the leaf wetness hours under moderate to high temperatures. Seven to eight hours of leaf wetness during nighttime can be enough for successful infection of plants by conidia. The disease can move from one plot to another by workers or equipment.

Management

An integrated option that include host resistance, cultural and chemical options may provide good control of the disease.

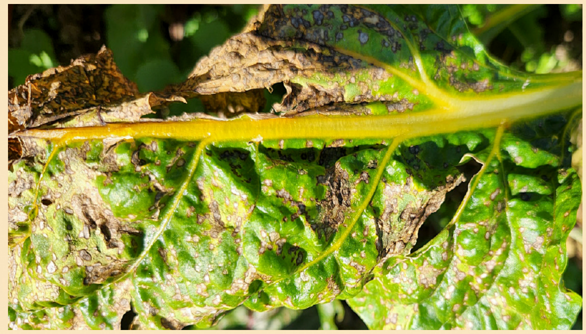

Figure 2. As spots enlarge and merge with each other over time, whole or part of the leaves will dry up prematurely. (Photo credit: M.M. Rahman)

1. Buy disease-free seeds from a reputable company.
2. Remove infected plant debris or deep plow at the end of the season.
3. If full removal of debris is not practical, rotate crops from a different family for up to three years.
4. Use drip or furrow irrigation instead of overhead sprinkler.
5. In case of overhead irrigation, it should only be done before noon to facilitate foliage drying up and minimize leaf wetness at night.
6. Keep field weed free especially those belonging to Chenopodiaceae.
7. Provide enough plant spacing to facilitate quick canopy drying due to sunlight penetration and air movement.
8. There are differences in susceptibility of varieties to Cercospora leaf spot. For example, Swiss chard varieties Ion and Fire Fresh are more resistant than other varieties.
9. Preventative application of fungicides, such as azoxystrobin, Flint or Cabrio, can keep the disease severity low. These FRAC group 11 products should not be used more than twice in a row to prevent resistance development. In case of compromised efficacy due to suspected resistance, tank mixing of products with a copper-based fungicide with the biofungicides Double Nickel (OMRI), LifeGard (OMRI) or Regalia (OMRI) can provide some suppression of the disease. Fungicides from group 11 can also be rotated with products from group 3 (tebuconazole or Tilt) to manage resistance.

Maintaining turfgrass in shady areas to minimize weed competition

Homeowners often find that growing turfgrasses in shady locations can be difficult, which can make them prone to weeds, such as ground ivy *(Glechoma hederacea)*.

When attempting to establish a shade lawn, carefully select the proper type of shade-tolerant turfgrass (species and cultivar) for the location.

Then, implement turf management practices that may help mitigate challenges of shade turf. If needed, modify any areas to make it more favorable for growing turfgrass or try other turf alternatives.

Figure 3. Poor ground cover in shaded lawns can make them prone to weeds such as ground ivy (Glechoma hederacea). (Photo credit: R.S. Chandran)

Shade environments

Shade environments display reduced levels and quality of light reaching ground vegetation, therefore diminishing the intensity and wavelengths of light needed for optimal growth.

As a result, the grass roots tend to grow closer to the soil surface and the leaf cuticles are thinner, making the grass more prone to drought and diseases. Turfgrasses grown in shade have longer, thinner and more succulent leaves compared to those grown under full sun.

Varieties of shade-tolerant grasses

Selecting the proper shade-tolerant variety of turf (species and cultivar) is the most important aspect of successfully growing turf under shade conditions.

Of the cool-season turfgrasses that are adapted in West Virginia, fine fescues are best suited for shady areas. Although they grow quite well in cool, dry shade, they are not recommended for poorly drained soils or in parts of the state where summer temperatures are above 85 F for prolonged periods.

Certain varieties of perennial ryegrass also may be considered for shady areas. Though they will give a good cover early in the season, they are usually severely thinned by the end of the season; annual reseeding helps remediate this condition.

Certain improved Kentucky bluegrass cultivars also have shown varying levels of adaptation to shade, although most cultivars of this grass species require full sunlight.

Mowing

Since the amount of light reaching the turfgrass is reduced under shady conditions, it is important that the grasses absorb as much of the available light as possible. To do this, raise the mowing height to a minimum of three inches, which preserves a greater leaf surface to intercept more light and encourages deeper rooting for water and nutrient absorption.

Fertilizer

The application nitrogen fertilizer is extremely important in shade turf, as high rates of nitrogen will encourage succulent tissues susceptible to disease and traffic injury. Nitrogen also encourages shoot growth at the expense of root development. For fine fescues, 1.5 to 2 pounds of actual nitrogen per 1,000 square feet may be applied per year. Only the minimum rates should be applied to cool-season grasses during hot summer months. If trees have to be fertilized, consider placing the fertilizer below the root zone of the grass. This will minimize the possibility of excessive succulent tissue and shoot growth in the turfgrass.

Watering

Shade turfgrass requires a carefully managed watering regimen. Frequent, light sprinklings (especially in the evening) should be avoided since these can result in shallow-rooted grasses. Instead, employ deep irrigation as it allows the surface of the soil and the turfgrass to remain wet longer. Schedule watering in the mornings to allow moisture to evaporate from leaf and soil surfaces. Turfgrasses grown in the shade should be checked regularly for the presence of fungus or disease so that fungicides may be applied promptly, if necessary.

Factors influencing fruit set: Effect of cold temperatures on tree fruit crops

Many ecological and physiological factors play a major role in determining the crop output.

Once the fruit trees have satisfied their chill requirement or exposure to the cumulative cold temperatures, the only thing keeping them dormant is the ambient temperature.

Once the warm or hot spells start occurring, they cause trees to "wake up" and start converting carbohydrates stored in tissues and having more water in cells and intercellular spaces.

Those physiological processes accelerate phenology, or bud development.

Whether you subscribe to climate change or not, the growing season seems to start earlier every year.

This year, we are three weeks ahead of last year in terms of bud development.

Any sudden, significant temperature drop (teens or low 20s) at the time of advanced bud development (swollen buds to pink or even bloom) leads to often severe freeze damage and consequent crop loss.

Bloom period has its own challenges related to cooler temperatures.

We might go through the spring without any frost injury, only to encounter trouble during bloom.

Most peach and tart cherries are self-fruitful, and some apple cultivars (e.g., Golden Delicious, Wealthy, Granny Smith, Grimes Golden, Gala) are at least partially self-fruitful.

The others require cross-pollination and are depending on pollinators' activity.

During cold, cloudy weather pollinators may not be active.

Bees, for one, are not active if the temperature is not above 55 F.

The other important factor is the time it takes for pollen tube to travel through the style before the fertilization takes place.

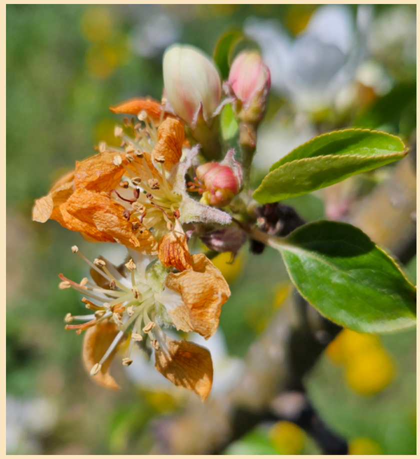

Figure 4. Frost burned petioles, stigmas amid anthers. (Photo credit: M. Danilovich)

There is a so-called effective pollination period, or period during which fertilization can be affected.

The ovule is receptive for a week (seven days) and it takes five days for the pollen tube to penetrate and reach the ovule, which means the effective pollination period is only two days.

So, if we have a rainy, cloudy and chilly period of three days since the flower opened, that means that we have only four days of "effective pollination period" left.

If the pollen is transferred on the fourth day since the flower opened, in effect, there would be no time for the pollen tube to reach the ovule while it was still receptive, and there would be no fertilization, even considering the fact that the cool weather prolongs ovule viability, but at the same time, slows down the pollen tube growth.

Additional factors influencing the fruit set include having the cross-pollinating cultivar flower at the same time, placement of the cross-pollinating cultivar, overall tree health, vigor, age, pruning, mineral nutrition and the rootstock it is on.

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