

## Foliar Diseases on Greenhouse Tomatoes

Leaf mold, also known as Cladosporium and gray mold or botrytis blight are fungal diseases common on greenhouse tomatoes. Both need high humidity or wet plant surfaces to develop. While these diseases often start on tomato leaves, both can attack the stems, blossoms and fruits.

### Leaf Mold

Leaf mold is caused by the fungus, *Fulvia fulva* and only affects tomatoes. In Connecticut, it is primarily a problem in greenhouses. Leaf mold symptoms typically appear on older leaves first. On the upper leaf surface symptoms appear as a series of randomly spaced, diffuse pale-green or yellowish spots. On the underside of the leaf, the spots appear velvety and tan in color but become darker over time. As the disease progresses, the leaf spots turn yellowish brown and the leaves will begin to curl, wither and drop prematurely. If left unchecked, this disease can kill flowers and cause a black, leathery stem-end rot on fruit. If green fruit are affected, the fruit may develop a lop-sided shape with one normal side and one stunted side that will not ripen normally.



Figure 1 and 2: Leaf Mold Symptoms on Greenhouse Tomatoes. Photos by L. Pundt

Since this disease needs high humidity or wet leaf surfaces, symptoms often first appear in areas of the greenhouse exposed to wet conditions, such as the outside rows when the roll-up sides of the house are left open at night and dew settles on the leaves.

### Botrytis Gray Mold

Gray mold is caused by the fungus *Botrytis cinerea*. Compared to Cladosporium leaf mold, Botrytis gray mold is more ubiquitous, that is the spores are everywhere all the time, especially in greenhouses. Also, unlike Cladosporium leaf mold which is host specific to tomato, Botrytis causes disease in just about any plant species if conditions are right for disease development.

Plants become more susceptible to botrytis as they get older with a denser plant canopy or are injured. This disease causes a loss of leaf area and fruit quality, including losses during storage and shipment. Botrytis symptoms first appear on leaves as light tan or gray spots which tend to run up veins. These spots soon become covered with a dense gray-brown fungal growth and the leaf later collapses and withers. On plant stems, elliptical tan-colored spots may form where an infected leaf meets the stem or where a stem has a wound (for example, following leaf removal). These spots show a series of concentric rings that form cankers on the stem. The cankers can girdle the entire stem and cause wilting of the stem above the canker.



Figure 3: *Botrytis* Blight symptoms in a dense plant canopy. Photo by R. McAvoy

The fungus can either kill the flowers directly or, if fruit is set, botrytis may grow into the developing fruit and cause a soft rot to occur. On fruit, the disease can enter from the top if water tends to puddle on the fruit or from the blossom side if the old flower petal is still attached to the fruit. Dying flower petals are very susceptible. *Botrytis* that enters the fruit by these routes often causes the entire fruit to collapse with spots starting as soft, water-soaked areas with irregular edges. The skin of the fruit usually breaks over the decayed areas but remains intact over the rest of the fruit. A dark gray growth of fungus usually appears over the spot.



Figure 4: *Botrytis* entering tomato fruit and causing a soft rot. Photo by R. McAvoy

Another common symptom on fruit is the so called “Ghost Spot”. Ghost spot is characterized by a small, light colored ring on the surface of the fruit. Ghost spot is caused when a single botrytis spore germinates on the fruit surface, begins to grow but then fails to cause a real infection and dies. The result is the small pale ring spot about 1/8 to 3/16 inch in diameter with a dark speck in the center. Sometimes, dozens of such spots can be found on a single fruit. These spots do not rot and fruit quality is not directly affected but ghost spot rings do not ripen normally and these defects can detract from the final appearance of the ripe fruit, especially if they are numerous.



Figure 5: Ghost spots on tomato fruit. Photo by L. Pundt

## Prevention.

Control of both of these diseases requires keeping the plant surfaces dry and humidity low. Most growers run into problems when they allow dew to form on plants overnight. Extremely high humidity (90% or higher) and wet surfaces favor the rapid development of these diseases. Both of these diseases can be controlled by careful environmental control that prevents high humidity and condensation at night.

At nightfall, vent the humid air out of the greenhouse before the air temperature falls below the dew point and then heat the fresh outside air to maintain a low relative humidity (RH). It is important to do this at dusk since the plant leaves stop pumping water (transpiring) once the sun goes down. That way once the humid air is exhausted and replaced with drier air, the greenhouse will stay dry all night. It is also important to do the vent/heat cycle before the greenhouse air temperature drops below the dew point and water settles onto the leaf surface. Two to three quick vent/heat cycles may be needed to dry the house down.

This technique works because the amount of water that the air holds is related to temperature. At warmer temperatures, the air holds more water. However, once the air temperature drops the RH rapidly increases, and once the RH reaches 100% condensation forms. For instance, a typical end-of-day condition in the greenhouse may be a temperature of 72°F and a RH of 70%. Now, imagine the outside temperature drops at dusk to 55°F and the inside air temperature begins to fall. Once the greenhouse air temperature falls to 61°F, the RH would spike to 100% and condensation would begin to form. If the plants go thru the night wet, disease is likely to occur.

Now consider what happens when you vent and heat at dusk before reaching the dew point temperature. Start by venting the humid air from the greenhouse before it falls to the dew point and replacing it with the outside air that is 55°F. Now, once you heat this air to 62°F, the RH of the air will drop considerably. For instance, even if the outside air was at 95% RH, once you heated the air to 62°F, the RH would have dropped to 75%. For quick calculations of air temperature and RH visit this web link on relative humidity calculation: <http://hyperphysics.phy-astr.gsu.edu/hbase/Kinetic/relhum.html#c4> To use this calculator, all you have to do is enter a temperature value (in either °C or °F) and a value for RH. Next, change the temperature value and see what happens to the RH.

For control of Cladosporium leaf mold, keep temperature at least 60 to 65° F throughout the season. At nightfall, use the heat/vent technique to prevent dew fall on the leaves and to maintain RH below 90%. Avoid wetting leaves with irrigation, and allow leaves to dry before night. Use adequate plant spacing and fans to ensure good air circulation and leaf drying. Remove and destroy all plant debris and disinfect the entire greenhouse after harvest.

For control of Botrytis gray mold, keep relative humidity below 90%. (Temperatures above 70°F will suppress this disease but such high night temperatures are not ideal for greenhouse

tomato). Keep leaves dry by avoiding overhead watering. Keep the air moving at all times by using [horizontal air flow systems](#)

Prune plants by breaking petioles close to the stem; do not leave stubs and prune early on sunny days so that any wounds dry before nightfall.



*Figure 6: Botrytis infection on stubs can then enter the stem. Photo by L. Pundt*

For chemical control, see the latest edition of the *New England Vegetable Management Guide* which is available from the [CAHNR Communications Resource Center](#) or online [here](#).

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