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Lantana:
Diagnosing Lower Leaf Angular Spots

When one observes lower leaf angular spots on lantana, there are three potential causal pathogens: foliar nematodes, bacteria, or downy mildew. Foliar nematodes are easy to self-diagnose by following the steps outlined in this Alert. Foliar Nematode Video Link

When leaves start to develop angular leaf spots, there are three potential casual pathogens: foliar nematodes, bacteria, or downy mildew (see sidebar for discussion of mimics on page 5).

In this situation, the pictured lantana (Fig. 1) received a confirmed diagnosis of foliar nematodes from an experienced pathologist. It contained so many nematodes it surprised him! Usually we think of nematodes as a pathogen that attacks roots, but the *Aphelenchoides* spp. are unique. They feed on leaf tissue in the mesophyll. They do require a film water to move which means that they can be easily spread by splashing water from leaf to leaf. Typically, stomata are the main points of entry into leaves where they feed on leaf tissue in the mesophyll. New nematodes develop from larva which hatch from eggs laid inside the leaf tissue. Dried plant debris also can harbor dormant nematodes allowing them wait for moisture and new plant material to infect. As they feed on leaf tissue, symptoms begin as a patchy yellowing

Figure 1. Angular spots appear on the lower foliage of lantana due to a foliar nematode infestation.
Photo by Brian Whipker

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(Fig. 2) which can develop angular necrosis (Fig. 3) between veins. Plants can be asymptomatic, showing no symptoms, and still contain a population of nematodes.

The host range for foliar nematodes is very large. Bedding plants with reported infections include: ageratum, antirrhinum (snapdragon), argyranthemum, begonia, chrysanthemum, dahlia, ferns, gerbera, gomphrena, helichrysum, hellebore, hosta, lantana, mimulus, pentas, petunia, salvia, solenostemon (coleus), strobilanthes, tithonia, torenia, verbena, and zinnia. (For a complete listing of plants with confirmed infestations by *Aphelenchoides* spp., see L.M. Kohl reference.)

Diagnosis

According to Shurtleff and Averre (2000), foliar nematodes are colorless, microscopic roundworms that are 0.5 to 1.2 mm long. They reside in the mesophyll region of leaves. Leaf veins are natural barriers to their movement which leads to the development of angular necrotic spots between veins.

You can send samples into a diagnostic clinic or check for nematodes yourself with a dissecting or compound microscope, with the capability of magnifying up to 40X.

Figure 2. Initial sign of a foliar nematode infestation is the patchy, angular spots on the lower leaves.
Photo by Brian Whipker

Figure 3. Necrotic spotting develops as the leaf tissue dies.
Photo by Brian Whipker

Proceed with the following steps:

1) Remove a diseased leaf from a plant that contains healthy and necrotic portions.

2) Cut out a small square with a knife or scalpel. Make sure that the sample contains part of the healthy and diseased tissue, as this is where the nematodes would be located.

3) Cut that small square into 1 cm wide strips.

4) Place the cut tissue on a glass slide with 1 – 2 drops of water.

5) Place a cover slip over the tissue.

6) Allow the cut edges to sit in water for at least 5 minutes to allow time for nematodes to migrate out of the leaf tissue.

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7) Place the sample under a dissecting or compound microscope and starting with the lowest magnification, search along the leaf tissue for the 0.5 – 1.2 mm roundworm (Fig. 4).

8) Increase the magnification to search in more detail, starting at the cut edges. *Aphelenchoides* and any other plant-parasitic nematode will have a small needle-like structure called a stylet in the anterior portion.

Management

Take the following steps to manage foliar nematodes:

• Discard infected plant material and soil or soilless media.

• Clean and then disinfest or steam sterilize pots before re-using.

• Quarantine plants that were growing nearest to infected plants.

• Remove plant debris from propagation and production areas.

• Remove weeds from greenhouse floors, benches and pots.

• Avoid overhead irrigation and splashing water on leaf surfaces.

• Increase plant spacing, if possible, to favor air movement and rapid drying.

• Do not handle plants when foliage is wet.

The described cultural practices are the best methods of control along with using clean stock, since there are no effective chemicals that can eliminate foliar nematodes. Scout held-over stock plants and the common “pet” plants that are brought into the greenhouse. When receiving new plant material, inspect, and remove infected product promptly.

Literature Cited

Kohl, L.M., 2008. Population dynamics and dispersal gradient of *Aphelenchoides fragariae* in the woody ornamental Lantana camera. N. Carolina State Univ., Raleigh, MS Thesis. (http://www.lib.ncsu.edu/resolver/1840.16/1457) For host listing, please refer to pages 22-58.

Shurtleff, M.C. and Averre, C.W. 2000. Diagnosing Plant Diseases Caused by Nematodes. APS Press. St. Paul, Minnesota, USA. 187pp.

Figure 4. A foliar nematode emerging from the cut surface of a leaf, under >40X magnification.
Photo by Mike Munster

Mimics

The second problem which results in angular lesions is bacterial leaf spot. (If one counts the number of samples that are submitted to the NCSU Plant Disease and Insect Clinic, bacterial leaf spot problems are more common than foliar nematode samples.) Bacteria such as *Acidovorax*, *Pseudomonas*, and *Xanthomonas* can cause these water soaked, angular lesions which can also develop yellow halos (Fig. 5).

Figure 5. A bacterial infection of alocasia.
Photo by Brian Whipker

Finally, an infection by the downy mildew ifungus also can result in angular yellowing and necrosis. This symptomology is especially true for Buddleia, *Buddleja davidii*) (Fig. 6). Other ornamentals with similar symptomology include rose, veronica, and agastache (Fig. 7).

Figure 6. A downy mildew infection of buddleia.
Photo by Mike Munster

Figure 7. A downy mildew infection of agastache.
Photo by Mike Munster

Greenhouse plants with reported infestations by foliar nematodes (*Aphelenchoides fragariae*) [partial list].

African Violet
Anemone
Anthurium
Argyranthemum
Aster
Azalea
Baptisia
Basil
Begonia
Boston Fern
Bird's Nest Fern
Cactus, Thanksgiving
Calceolaria
Chrysanthemum
Cineraria
Coleus (solenostemon)
Columbine (Aquilegia)
Crossandra
Cyclamen
Dahlia
Delphinium
Foxglove
Geranium
Gerbera
Gloxinia
Gomphrena
Helichrysum
Hellebore
Heuchera
Hibiscus
Hosta
Hydrangea
Impatiens
Indian Rubber Tree
Iris
Lantana
Lilium
Mimulus
Pentas
Petunia
Phlox, Creeping
Primula
Ranunculus
Rudbeckia
Salvia
Snapdragon (antirrhinum)
Strobilanthes
Strawberry
Tithonia
Torenia
Verbena
Zinnia