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Nematodes: The good and the bad

BY BRIAN CLARK

Nematodes are a misunderstood lifeform. Microscopic in size, these small worms are often relegated to insignificance — until the problem becomes too significant to ignore. However, they are frequently missed during plant health diagnostics because their damage above and below ground look similar to fungal and bacterial diseases and soil-related problems.

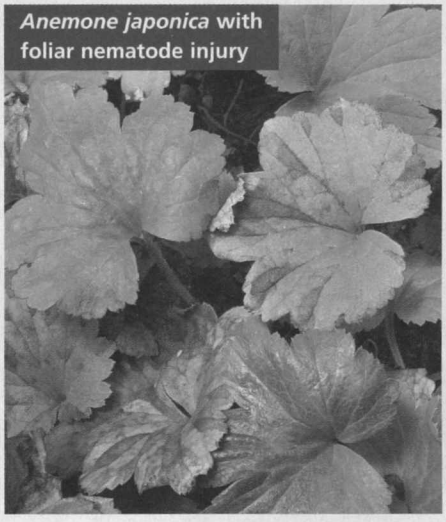
Typically, an affected plant begins to lag behind other uninfected plants and shows signs of overall loss of vigor and chlorosis, which may increase in a circular pattern over time. When all other biological and abiotic factors have been examined and excluded, check for nematodes. Better yet, test for nematodes as part of your IPM program.

When looking for nematodes, the best time to collect soil samples is while completing your soil samples for fertilization in the spring or fall when you can modify your seasonal pest-control program; more importantly, it saves on labor costs. Most state universities have a nematode diagnostic clinic with specific procedures for submitting samples. Check with them or your local extension office for more details.

Dagger and stunt nematodes. Dagger and stunt nematodes cause root stunting, root swelling and even a witch's broom effect on damaged roots. Both types of nematodes feed primarily on the outside of the roots, making them easier to control because nematicides can affect them more directly. However, both dagger and stunt nematodes have a broad host range and will require significant control measures once established in your plots.

Controls for dagger nematodes include using nematicides or rotating in nonhost brassica plants, such as arugula and Braco mustard, for a year or two. Stunt nematodes are also controlled through nematicides. Stunt nematode numbers can be reduced through the use of poor host or nonhost plants, such as wheat, ryegrass, oat and pearl millet.

Both dagger and stunt nematode nonhost systems work well when planting cover crops in open areas as part of a long-term management strategy. Unfortunately, planting these nonhost crops between host plants can increase damage to desirable plants, so plant these nonhosts as a large group in field areas where crops have been removed, but not replanted.

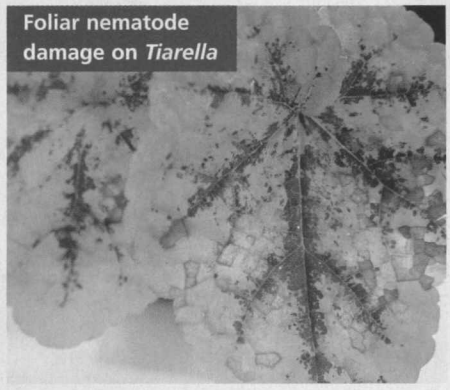


Anemone japonica with foliar nematode injury

Root-knot and root-lesion nematodes. Root-knot nematodes, as their name implies, create a large knot within the root. Unlike dagger and stunt nematodes, root-knot nematodes feed inside the root tissue. After burrowing into the root, they create extra-large cells that swell into a diagnostic "knot." This is done by the nematode releasing a chemical that causes cells to swell, creating cells that are full of easy-to-reach food supplies. This enlarged root reduces the ability of a plant to absorb nutrients and can cause problems. Root-knot nematodes have a broad host range and can survive on weeds within the nursery and landscape.

Controls include nematicides or using nonhost crops, such as marigolds. Nematicides should be used within the rows to reduce costs, but the rows will often succumb to reinfestation over time. Nonhost crops need to be incorporated into a long-term management strategy similar to a program used to control stunt and dagger nematodes. In a landscape setting, marigolds and several other flowers can be incorporated to gain control of root-knot nematode numbers. French marigold cultivars (*Tagetes patula*) have the greatest effect on root-knot nematodes.

Root-lesion nematodes also penetrate roots. They feed and reproduce within the roots of most plants, causing cavities and channels within the root system. These pathways can be exploited by bacterial and fungal pathogens to exacerbate and possibly conceal the damage done by the nematodes themselves.



Foliar nematode damage on *Tiarella*

Control of root-lesion nematodes includes nematicides and using nonhost crops that are similar to those used to control root-knot nematodes. However, because root-lesion nematodes have such a broad host range, selecting nonhost plants may be more difficult.

Foliar nematodes. Foliar nematodes are perhaps the most difficult to diagnose. Their damage looks very similar to numerous fungal and bacterial pathogens that even an experienced landscape manager may have difficulty properly diagnosing. The most commonly attacked plants are *Begonia*, *Iris*, *Hosta* and other lilies, *Anemone japonica* (Japanese anemone), *Polygonatum* (Solomon's seal) and *Trillium*. A complete list can be provided from your local extension office.

Foliar nematodes persist in infested plant material and can spread through vegetative propagation or movement from infested plant material to new plants. Nematodes can crawl on plants through a thin film of water and enter leaves through the stomates. However, foliar nematode damage to leaves is contained between veins because they cannot cross through veins. In parallel-veined leaves, damage is in streaks. In web-veined plants, damage appears splotchy because the nematodes are contained within the borders of the leaf veins.

Control is achieved through hot water baths and good sanitation. Preventing foliar nematodes from entering your nursery can save an immense amount of time and money. Examine stock as it arrives: Look for damaged plants, and either reject or separate them for treatment. Another factor in controlling foliar nematodes is watering techniques that do not wet the leaf surfaces; this denies the pests the water they need to move over the plant surface to infect new plants.

However, all nematodes are not bad. Several are actually beneficial and can work for a grower in a greenhouse or in the field.

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209(12):8-9

Beneficial nematodes. Beneficial nematodes, such as *Steinernema* and *Heterorhabditis*, are bacteria-feeding nematodes that are used in insect control. They range in size and effectiveness. Once the nematodes enter an insect, they escape a protective sheath and release symbiotic bacteria. These bacteria use the insect as its food source, in effect killing the insect from inside within a few days. While bacteria are busy consuming the insect, nematodes are consuming the bacteria and multiplying within the host. When the host is consumed, the nematodes move away from the dead insect and look to infect a new host.

Selection of beneficial nematodes should be based not only on their effectiveness against insect types, but also how they search for their prey. *Steinernema* nematodes are the larger of the two major biocontrol nematode groups. Overall, they are highly effective against nonbeetle insects, such as caterpillars, flies and sawflies. *Heterorhabditis* nematodes are smaller and can easily enter through the plates that guard the spiracles (breathing holes) on white grubs.

Nematodes should also be used based on their foraging strategy. For example, nematodes that ambush their prey can be effective at protecting plants that may be at risk, but are not yet affected. However, when the pest may already be inside the plant, use nematodes that actively search for their prey.

Despite their short shelf life, these beneficial nematodes can be used in a similar manner to conventional pesticides. They can be applied through traditional sprayers (although screens need to be removed), and they have limited persistence in the environment due to the same factors that break down synthetic pesticides, such as sunlight and high temperatures. They can even be used in a tank mix with several conventional pesticides.

Nematodes are an important part of a sustainable IPM program whether they are the pest or part of the control. Be aware of their effects on your ornamental crops, and use that knowledge for a better-grown product.

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