THE OHIO STATE UNIVERSITY EXTENSION

FACT SHEET

Agriculture and Natural Resources

PP401.08

This is the eighth fact sheet in a series of ten designed to provide an overview of key concepts in plant pathology. Plant pathology is the study of plant disease including the reasons why plants get sick and how to control or manage healthy plants.

Nematode Diseases of Plants

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Overview

A number of genera and species of nematodes are highly damaging to a great range of hosts, including foliage plants, agronomic and vegetable crops, fruit and nut trees, turfgrass, and forest trees. Some of the most damaging nematodes are: Root knot (*Meloidogyne* spp.); Cyst (*Heterodera* and *Globodera* spp.); Root lesion (*Pratylenchus* spp.); Spiral (*Helicotylenchus* spp.); Burrowing (*Radopholus similis*); Bulb and stem (*Ditylenchus dipsaci*); Reniform (*Rotylenchulus reniformis*); Dagger (*Xiphinema* spp.); and Bud and leaf (*Aphelenchoides* spp.).

Morphology

Nematodes are simple, multi-cellular animals—typically containing 1,000 cells or less. They are worm-like in appearance but are taxonomically distinct from earthworms, wireworms, or flatworms. They are bilaterally symmetrical, soft-bodied (no skeleton) non-segmented round worms. Most nematode species that attack plants are microscopic. The basic body plan of a nematode is a "tube within a tube." Most nematodes are not pathogens but rather saprophytes. Some, however, are serious human, animal, and plant pathogens. Those that attack animals or humans do not attack plants and vice versa. Heartworm in dogs and cats and elephantiasis in humans are examples of nematode diseases in animals and people.

Figure 1. Adult root-knot nematode. *(Photo courtesy G. S. Abawi, copyright the American Phytopathological Society)*

Plant parasitic nematodes may attack the roots, stem, foliage, and flowers of plants. All plant parasitic nematodes have piercing mouthparts called ***stylets***. The presence of a stylet is the key diagnostic sign differentiating plant parasitic nematodes from all other types of nematodes. The bacterial-feeding nematode, *Caenorhabditis elegans*, is one of the best-understood animals on earth. It was the first animal to be completely sequenced. The study of *C. elegans* has led to many new insights into animal development, neurobiology, and behavior.

Signs and Symptoms

Typical root symptoms indicating nematode attack are root knots or galls, root lesions, excessive root branching, injured root tips, and stunted root systems. Symptoms on the above-ground plant parts indicating root infection are a slow decline of the entire plant, wilting even with ample soil moisture, foliage yellowing, and fewer and smaller leaves. These are, in fact, the symptoms that would appear in plants deprived of a properly functioning root system. Bulb and stem nematodes produce stem swellings and shortened internodes. Bud and leaf nematodes distort and kill bud and leaf tissue.

Dissemination

Parasitic nematodes are readily spread by any physical means that can move soil particles about—equipment, tools, shoes, birds, insects, dust, wind, and water. In addition, the movement of nematode-infested plants or plant parts will spread the parasites.

Figure 2. Adult lesion nematode. *(Photo courtesy Union Carbide, copyright the American Phytopathological Society)*

Control

Various methods are available to reduce crop losses from nematodes:

1. Genetic Host Resistance

- Plant resistant species and cultivars. For example, in an area with soil heavily infested with the root-knot nematode, plant apricots, cherries, apples, pears, or plums, which are resistant, rather than peaches or nectarines, which are highly susceptible. (A root-knot nematode-resistant peach rootstock called 'Nemaguard' developed by USDA plant breeders is available, thus permitting peach production even on infested soils.) Certain vegetable crops—sweet corn, asparagus, and cabbage—are resistant to root-knot nematodes whereas radishes are susceptible. Resistant ornamentals include the African marigold, azalea, camellia, and oleander. In Long Island, New York, where the golden nematode is a serious problem for potato production, resistant cultivars are available. Similarly, soybean varieties resistant to soybean cyst nematode (*Heterodera glycines*) are also available.

2. Cultural Practices

- Use only nematode-free nursery stock for planting. In most countries, government nursery inspectors will condemn and destroy any nursery stock showing evidence of nematode infestation.
- In nursery operations, use benches raised off the ground and pot plants only into pasteurized soil mixes. Keep containers, bins, benches, and flats clean. Fumigate outdoor growing fields where nursery stock will be grown.
- Rotate crops to control certain nematodes. Rotation is useful for types that have a narrow host range, such as sugar beets attacked by the cyst nematode. Where the crop value is too low to justify large-scale soil fumigation, crop rotation is the only practical method of nematode control.
- Use cover crops that reduce nematode damage. Cover crops can improve soil structure and fertility, decrease soil erosion, be used as animal feed, and suppress weeds, insects, and pathogens. Examples of cover crops that have been shown to suppress nematodes include cowpea, rapeseed, velvet bean, and sudangrass.

3. Chemical Applications

- Treat the soil area with a fumigant before planting. Methyl bromide is often used to reduce the nematode population to levels not harmful to plants. This is a restricted use, highly toxic chemical. Soil mixes for container-grown plants can either be treated with a fumigant or steam-pasteurized at 82 degrees C (180 degrees F) for about 30 minutes. This method is too expensive for field crops other than commercial strawberry fields. The impending loss of methyl bromide may seriously affect the crops where it is used.
- Use nematicides in certain cases. All nematicides are poisonous and must be used carefully, following the directions on the containers exactly. Most such materials will injure or kill plants if applied too close to their root zones. As the number of commercially available nematicides decreases, greater emphasis has been placed on the development of alternative IPM practices.

Figure 3. Aerial view of damage due to soybean cyst nematode. *(Photo courtesy G. L. Tylka, copyright the American Phytopathological Society)*

4. Biological Control

- Although not widely available, scientists have explored the use of antagonistic fungi like *Arthrobotrys dactyloides* to trap and parasitize plant pathogenic nematodes.

5. Government Regulatory Measures

- Avoid importing soil (or plants with soil on their roots) from areas that could be loaded with a dangerous nematode species new to the area. United States plant importation regulations forbid the introduction of plants with soil on their roots from other countries.

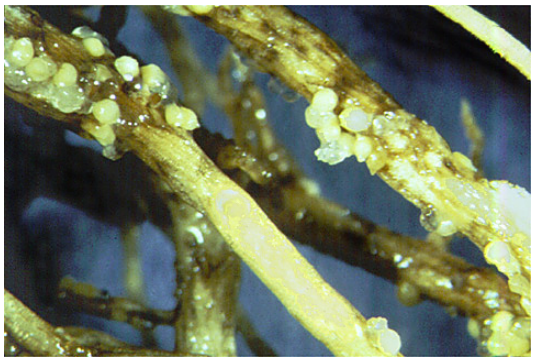

Figure 4. White female soybean cyst nematodes on root surface. *(Photo courtesy R. D. Riggs, copyright the American Phytopathological Society)*

For detailed information on each of the IPM strategies, see the fourth fact sheet in this series, "Keeping Plants Healthy: An Overview of Integrated Plant Health Management" (PP401.04).

Introduction to Plant Disease Series

PP401.01: Plants Get Sick Too! An Introduction to Plant Diseases

PP401.02: Diagnosing Sick Plants

PP401.03: 20 Questions on Plant Diagnosis

PP401.04: Keeping Plants Healthy: An Overview of Integrated Plant Health Management

PP401.05: Viral Diseases of Plants

PP401.06: Bacterial Diseases of Plants

PP401.07: Fungal and Fungal-like Diseases of Plants

PP401.08: Nematode Diseases of Plants

PP401.09: Parasitic Higher Plants

PP401.10: Sanitation and Phytosanitation (SPS): The Importance of SPS in Global Movement of Plant Materials

These fact sheets can be found at OSU Extension's "Ohioline" web site: http://ohioline.osu.edu. Search for "Plant Disease Series" to find these and other plant pathology fact sheets.

Links to Nematode Disease Fact Sheets

Root Knot Nematode: http://ohioline.osu.edu/hyg-fact/3000/3115.html

Soybean Cyst Nematode: http://ohioline.osu.edu/ac-fact/0039.html

Lesion Nematode: http://www.apsnet.org/education/LessonsPlantPath/LesionNema/default.htm

Pine Wilt: http://www.apsnet.org/education/LessonsPlantPath/PineWilt/default.htm

Sting Nematode: http://www.apsnet.org/education/LessonsPlantPath/StingNematode/default.htm