Extension Leaflet

Control Root-Knot Nematodes in Your Home Garden

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Introduction

Nematodes are tiny, thread-like eelworms (roundworms). Many are free-living saprophytes found in the soil that live and feed on decaying plant and animal matter. Other soil borne nematodes are plant parasites that can slow down plant growth and reduce yield.

Root-knot nematodes are a group of plant parasitic nematodes that live in soil and feed on roots of many vegetable crops. The nematode gets its name because its feeding causes galls (swellings or "knots") to form on the roots of infected plants. Root-knot nematodes are scientifically classified in the genus *Meloidogyne*. There are several species of *Meloidogyne*, but *M. incognita*, also known as southern root-knot nematode, is the most common one in home gardens in Yap.

Some of the crops that may be severely damaged are tomato, pepper, okra, eggplant, watermelon, pumpkin, squash, sweet potato, bean and pea. Root-knot nematodes also feed and multiply on many garden weeds, although they may not injure these plants to any extent.

Fig. 2. Healthy (left) and infected (right) root system

Symptoms

The extent of damage caused by root-knot

Fig.1. Healthy (left) and infected (right) tomato plants

nematodes varies with host, timing of infection, and cultural conditions. Symptoms on affected plants may be evident on plant parts above the ground and below the ground (Figures 1 and 2). Above the ground, plants may appear stunted and discolored and may die when nematode damage is severe. The number, size and quality of fruits and vegetables are usually reduced by nematodes feeding on the plant roots.

However, the presence of root-knot nematodes cannot be diagnosed by aboveground symptoms alone. Such factors as poor drainage, low soil fertility, and other disease causing organisms can produce similar aboveground symptoms. The characteristic galls produced on infected roots and other underground plant parts distinguish root-knot nematode damage from that caused by any other factor. Root-knot nematode feeding stimulates the development of abnormally large cells, resulting in gall formation along the roots. These galls prevent adequate water and nutrient uptake resulting in stunted, unhealthy plants.

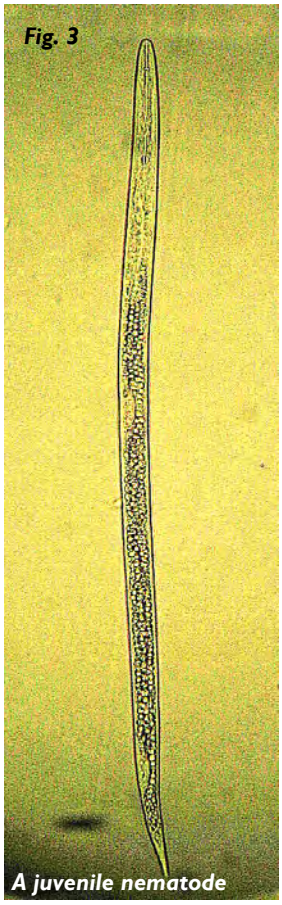
Fig. 3
A juvenile nematode

Pest behavior

A microscope is necessary to see most root-knot nematodes. Their life cycle includes egg, juvenile and adult stages. The male has long, thin, cylindrical shape of a worm but the lip region has a distinct head cap, which includes a labial disc surrounded by lateral and medial lips. Infective second stage juveniles, often free in soil, are usually 0.3 – 0.5 mm long (Figure 3). Mature female is globular in shape, 0.3 to 1.4 mm in size and usually embedded in root tissues which are often swollen or galled (Figure 4). A female root-knot nematode can lay up to 500 eggs at a time, and the root damage results from sheer number of nematodes feeding on roots (Figure 5). After hatching, juveniles move a short distance, locate a favorable plant root and begin feeding. Juveniles feed on the outside and inside of susceptible plant roots (Figure 6).


Female root-knot nematode
Fig. 4


Fig. 6

Whip like larva of root-knot nematode, magnified 500 times, shown here penetrating a tomato root. Once inside, the larva establishes a feeding site, which causes a nutrient-robbing gall.
Photo by William Wergin and Richard Sayre, USDA ARS Photo Unit

Duration of the life cycle and rate of population increase depend upon soil temperature, host suitability and soil type. In one of our field experiments with eggplants, root galls appeared 16 days after transplanting, at about 30°C temperature. About 24 days are required to complete the life cycle, so several generations can develop in

one season. Root-knot nematodes can persist in the soil for several years without feeding on host plants.

Environmental conditions and disease spread

Nematodes are most active in warm weather in moist but well aerated soils in the presence of host plants. They are most abundant in upper foot of soils, but will follow roots several feet deep. In adverse conditions, the eggs can persist in the soil for long periods of time ranging from months to years.

Only males and second-stage larvae of root-knot nematodes are able to move through the soil. This movement is, however, limited to few inches a year and is not significant when compared to other means by which the nematodes can be disseminated. Man is unquestionably most important in spreading the disease. In the garden, nematodes spread by soil-moving implements and shoes during cultivation. Natural means of spread include movement with drainage water during rains.

Disease complexes

Root-knot nematodes often interact with other soil-inhabiting plant pathogens to form disease complexes in which resulting disease is much more severe than components of the complex would cause alone. Root-knot nematodes are known to interact with both *Verticillium* and *Fusarium* fungi, which cause wilt disease of pepper, tomatoes, sweet potatoes and other plants. Disease complex often kill plants, particularly when young.

Control

Nematode management should be multifaceted. Since elimination of nematodes is virtually impossible, the goal is to manage their population, reducing their numbers below damaging levels. Although chemical nematicides have been widely used in commercial agriculture to control nematodes, they are both highly toxic and very expensive. Moreover, nematicides are not suitable for home garden use.

Solarization: Solarization is the use of heat from the sun for killing nematodes in bare soil. This technique involves placing clear plastic on moist, tilled soil and sealing edges with soil, bricks or other materials. Apply the plastic during hot months of the season for at least eight weeks (the longer, the better).

Cultural practices: Select a garden site free of root-knot nematodes, if possible. If land is available rotate the garden to new site each year. If new space is not available, rotate crops so that resistant crops are moved to an area where susceptible ones had grown previously. Rotation with resistant or non-host crops for two or three years generally provides excellent control of root-knot nematodes. Take special care in selecting transplants to ensure they are nematode free. Starting plants directly from true seed also prevents introduction of root-knot nematodes on plant materials since they are not seed borne.

Grow resistant varieties: Certain varieties of common garden crops are resistant to root-knot nematodes. When you buy seeds of crops like tomato, pepper, okra, eggplant bean and pea, read the variety label to see if it says anything about resistance to nematodes. The label may list capital letters VFN. These letters indicate that the variety has resistance to certain diseases: V = *Verticillium* wilt resistant; F = *Fusarium* wilt resistant; and N = root-knot nematode resistant. Resistant plants may not be necessarily immune; some varieties may show sign of infection without being seriously affected.

Soil amendments: The addition of any organic matter to the garden will improve soil health, and will increase microbial activity in general, which will have the benefit of improving plant health. Organic materials such as compost, animal manure (particularly chicken manure) or shredded leaves stimulate soil's microorganisms that are natural predators of nematodes. Green manures (crops grown purposely to be tilled into the soil as fresh organic matter) are particularly helpful.

Water the garden as needed to keep plants healthy and growing especially during the hot summer months. Healthy plants can perform better even in the presence of nematodes than plants that suffer from nutrient deficiencies.

Keeping the soil free of plants (fallow) deprives root-knot nematodes, which, over time reduces their populations. Population of root-knot nematodes can also be reduced significantly in one season by repeated tilling (every 10 days) of the garden soil during the hot, dry summer, to bring the nematodes to the surface to be killed by sun's heat.

In brief…….

- *Root-knot nematodes are plant-parasitic animals*
- *They are microscopic in size*
- *They are one of the most economically damaging plant-parasitic nematodes because of its wide host range and wide-spread distribution*
- *It attacks all major field crops, vegetable crops, ornamentals and legumes*
- *Above ground symptoms of root-knot injury includes stunting, yellowing, wilting, reduced yield, and premature death of plants*
- *Below ground symptoms are swollen or knotted roots (root galls) or a stubby root system.*
- *Root galls vary in size and shape depending on the type of plant, nematode population levels, and species of root-knot nematode present in the soil*
- *Select resistant varieties when available*
- *Plant susceptible crops in containers with a nematode-free soil or growth media; keep the containers off the ground*
- *Sow seedlings for transplanting in clean media in containers kept off the ground*
- *Check the roots of container-grown nursery stock for nematode galls before transplanting*
- *Add large amounts of organic matter to the soil*
- *Keep weeds controlled at all times*
- *Till infested soil to expose root-knot nematodes to weather extremes and predators*
- *Apply good cultural practices (watering, mulching, fertilizing etc.)*
- *Discard infested plants; do not compost them*

For more information, please contact:

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