Banana Nematodes

Pests and Diseases of American Samoa

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Bananas are the fourth-ranked agricultural crop in the world and first among fruits. Annual sales are about US$2.5 billion. However, this represents only about 10% of the 86 million tons cultivated; the other 90% are consumed by the subsistence farmers who grow them.

Bananas are American Samoa's biggest cash crop, valued at over US$20 million in 1998; there is no export market, all are consumed locally. Most bananas grown commercially are 'Williams' (Cavendish sub-group). The most popular bananas grown on small farms and around houses include 'Pata Samoa' (Bluggoe sub-group), and 'Misi Luki' (Mysore sub-group).

Nematodes are small, worm-like members of the animal kingdom from 0.5-1.0 mm in length (Fig. 1). They are found in almost every habitat, in fresh or salt water, and in soil. Most feed on other microscopic organisms, but some parasitize animals and humans (filariasis), and several hundred species attack plants. Plant-parasitic nematodes have stylets, spear-like mouthparts that pierce cells and allow nematodes to feed on their contents.

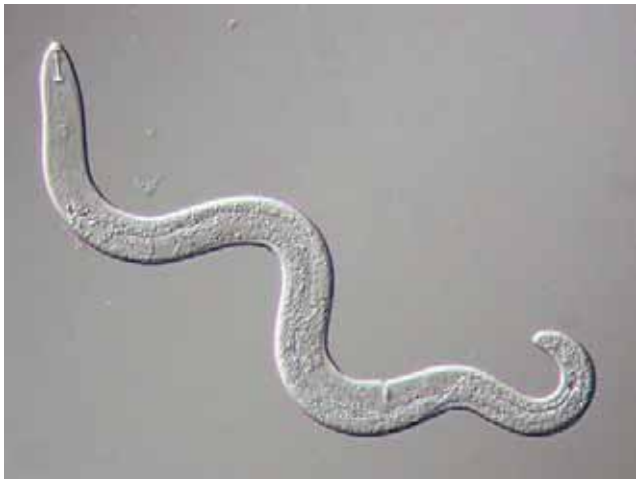

Figure 1. A typical plant-parasitic nematode. Note the spear-like stylet.

Ecology and Damage

Most plant-parasitic nematodes spend all or part of their life in the soil. Some species, however, lay their eggs, hatch into juveniles, molt, and become adults inside the plant's roots. Nematodes move very slowly through the soil but can be spread over long distances by flooding, dirty equipment or shoes, infected roots, and suckers.

Banana nematodes cause yield losses of up to 30-60% in many countries. Roots damaged by nematodes cannot supply plants with needed water and nutrients. This can slow plant growth, lengthen the time to fruiting, reduce bunch weight, and decrease the productive life of the farm. Top-heavy plants may fall over due to the loss of anchoring roots (Fig. 2).

Figure 2. Roots of plant toppled by burrowing nematode. The cortex of most roots has been eaten away leaving the thin, white stele.

Nematode Species

The most common nematodes collected from a 2002-2003 survey of commercial banana farms on Tutuila were spiral and burrowing nematodes (Fig. 3). The average nematode population for the 16 farms was almost 30,000 per 100g of roots, the size of the sample taken from each of 10 plants per farm. Some authors believe yield losses occur at nematode populations over 2,000 per 100g of roots.

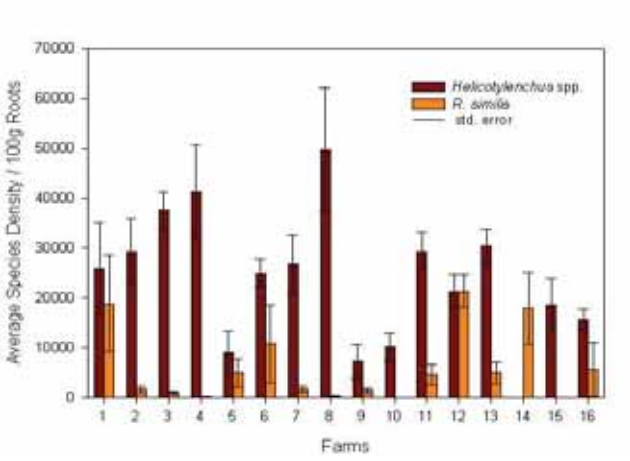

Figure 3. Average number of spiral (*Helicotylenchus*) and burrowing (*R. similis*) nematodes collected per plant (100g roots) from 16 farms growing 'Williams' bananas on Tutuila, American Samoa.

The spiral nematodes, *Helicotylenchus multicinctus* and *H. dihystera*, are present in American Samoa (Fig. 3). The former is the most common nematode extracted from bananas in the South Pacific. They are robust, with strong stylets (Figs.

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Figure 4. The female spiral nematode, *Helicotylenchus multicinctus*, usually forms a C-shape in a relaxed state.

1, 4). They live partially or completely within roots, feeding on the outer cortical cells. Wounds from their feeding are small, but they create entry points for soil bacteria and fungi that can cause further damage.

Burrowing nematode (*Radopholus similis*) is the most damaging nematode in banana producing countries. It is an endoparasite, completing its entire life cycle within the root and causing decay of the whole root cortex (Fig. 5). *Radopholus similis* is a common cause of banana plants falling over, a condition known as "toppling disease" (Fig. 2). This nematode can also burrow from the roots into the rhizome. The small black spots it creates are sometimes called "blackhead disease".

Figure 5. Reddish-black necrosis of root cortex caused by *R. similis*.

Lesion nematodes (*Pratylenchus*) were not collected from 'Williams' bananas during the survey, but in other countries these endoparasites cause damage to 'Williams' similar to that caused by *R. similis*. Usually found on tea and coffee, *Pratylenchus loosi* was extracted from roots of 'Pata Samoa'. This was a new record for American Samoa, as was *P. gibbicaudatus*, isolated from 'Ducasse'. This is only the second time *P. gibbicaudatus* has been reported on bananas worldwide. The squared tail of this nematode helps distinguish it from other lesion nematodes (Fig. 6). Lesion and burrowing nematodes look similar, with long, narrow bodies and shorter stylets than spiral nematodes.

Root knot nematode, *Meloidogyne* sp. was found on three farms, but root damage was minor.

Figure 6. A lesion nematode, *P. gibbicaudatus*, and its distinctive tail.

Integrated Pest Management: Plants

Plant-parasitic nematodes were present on all banana farms surveyed on Tutuila. Those farms with a high percent of root damage can increase yield by encouraging healthier plants with more vigorous root systems.

Nutrition. Application of a fertilizer high in potassium, 19-19-40 for example, will encourage growth and overall plant health.

Mulching. Covering the soil with banana leaves and other plant material helps moderate soil temperatures, prevent erosion, and gradually add organic matter to soil.

Ratoon control. Limiting the number of plants per rhizome (mat) to 3 or 4 channels more energy and nutrients to the remaining plants.

Propping. Bananas are an unstable, top-heavy plant. When roots have been destroyed by feeding nematodes, plants are more likely to fall over. Fruiting plants should be propped to prevent toppling due to the weight of the bunch or strong winds.

Integrated Pest Management: Nematodes

Exclusion. The best approach is always to keep pests and diseases from becoming established. Most nematodes are spread around American Samoa on infected suckers. Before replanting, the base of suckers can be pared to remove dark spots (infections), then put in hot water (125°F) for 20 minutes. Plants from tissue culture raised in a disease-free nursery are the best option, if available.

Chemical control. Most nematicides pose a threat to groundwater and island habitats. They can also be neutralized over time by soil organisms and tend to be expensive. New products such as DiTera, a fermented fungus preparation, may offer future alternatives.

Resistant varieties. Some new banana hybrids from a breeding program in Honduras (FHIA) are resistant to black leaf streak disease and also have one parent resistant to the burrowing nematode. Planting these hybrids, (eg. FHIA-25), could help reduce nematode populations in American Samoa.

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