

Radopholus similis

Introduction

The burrowing nematode *Radopholus similis* is found through the tropics and subtropics. In the Caribbean, it is particularly harmful to the *Musa* sp.- Banana and Plantains and the Anthurium industry.

Identity

Authority	: Cobb, (1893) Thorne
Classification	
Kingdom	: Animalia
Phylum	: Nemata
Class	: Secernentea
Order	: Tylenchida
Family	: Pratylenchidae
Genus	: <i>Radopholus</i>
Species	: <i>similis</i>
Synonyms	: <i>Tylenchulus granulosus</i> Cobb, 1893; <i>Tylenchus similis</i> Cobb, 1893; <i>Tylenchus acutocaudatus</i> Zimmerman, 1898; <i>Tylenchus bififormis</i> Cobb, 1909; <i>Tylenchus similis</i> Micoletzky, 1922; <i>Anguillulina similis</i> Goodey, 1932; <i>Tylenchorhynchus similis</i> Filipjev, 1934; <i>Bitylenchus granulosus</i> Filipjev, 1934; <i>Rotylenchus similis</i> Filipjev, 1936; <i>Tetylenchus granulosus</i> Filipjev, 1936.
Common names	: Burrowing nematode; banana nematode; banana root nematode.
Role	: Pest

Signs & Symptoms

On banana and plantain – The nematode invades and feeds in the cortex of roots causing lesions and cavities, and root breakdown. Nematode-infested roots are invaded by secondary organisms, e.g., *Fusarium* sp. The nematode seldom feeds in vascular tissues. Nematode damage to roots results in reddish, elongated flecks parallel to the root axis. The discoloured areas enlarge as the nematodes and progeny feed. The older parts of the lesions turn black and shrink, while the advancing margins remain red (Fig. 6). Continued feeding causes extensive, deep lesions on roots and rhizome. The root systems are reduced, severely damaged and unable to uptake water and nutrients, thus the plants lack vigour, are stunted, and, because of poor anchorage, are prone to toppling under bunch weight or to being blown over even by not so strong winds. Because of toppling or blowdown, growers need to expend money to pay for and set up systems to support plants. *Toppling and/or blowdown and the blackening of corms (blackhead) are the primary symptoms of nematode damage in these crops.* (Fig. 1 & 5). Nematode-infested banana and plantain plantings do not respond well to fertilizer application, irrigation, or other cultural practices. Plantains tend to be more susceptible to nematode damage than bananas. In plantains, production of bunches and bunch sizes (number and size of hands

and fingers) are severely reduced, even in the plant crop, and there is significant loss of plants.

Where there is severe nematode infestation, ratoon crops are hardly produced as there is continued plant loss and significantly reduced suckering, and these are puny. The variability in damage caused to banana crops by *R. similis* can be, to some extent, related to environmental factors such as soil type, amount of organic matter in the soil, etc., and also to differences in aggressiveness of *R. similis* biotypes.

On anthurium – In Jamaica and elsewhere, *R. similis* has consistently been associated with a condition of anthurium plantings called root rot and decline. Whether plantings are started with seedlings, canes or suckers, the initial above-ground symptom observed is retarded growth and development, resulting in stunting. Plants later become unthrifty, leaves and stems appear off-colour, and stems, petioles and inflorescence stalks are spindly. Leaves are smaller than normal and lack lustre. On roots, there is initially a light brown to chocolate-coloured rot in spots, the severity depending on the extent of the nematode infestation. Later, most or all of the root system becomes rotted and steles become exposed as the rotted cortexes disintegrate; the root system eventually is sparse and oftentimes completely rotted. As the decline progresses, leaves become yellow then dry, the oldest first. Bloom production is significantly reduced, and these are mostly of poor quality (small), lack lustre and tend to be prostrate. Affected plants sucker inadequately, may themselves become prostrate, are easily uprooted and some eventually die, often within a year or two of being planted. Affected beds are therefore generally sparse of plants, become weedy and broken down, and need to be replanted earlier than normal. In Jamaica, high numbers of *R. similis* were recovered from water-soaked sections on petioles of anthurium plants (Hutton 1990) (Figs 2 & 3).

On other crops – *R. similis* can cause severe damage to the root system of crops such as ginger, blackpepper, pothos (*Epipremnum aureum*,) etc, resulting in stunting and reduced vigour and production. This nematode was also found to infest leaves and petioles of *Anubias barteri*, an aquatic plant.

Morphology

Female: Body straight to slightly arcuate ventrally; cuticle distinctly annulated. Lateral field with four incisures, not aerolated except towards extremities, arising from near median oesophageal bulb and ending near tail terminus; inner incisures coalescing near middle of tail. Lip region hemispherical, sometimes offset, usually with three to four annules; sclerotization strong; dorsal and ventral arms of framework not wider than submedians; lips six, equal. Anterior cephalids just posterior to labial sclerotization. Spear about 18 μ long, with well developed round basal knobs which are usually indented anteriorly; dorsal knob sometimes appearing larger than subventrals. Median oesophageal bulb well developed, round to oval, valvular apparatus prominent. Oesophageal glands three, in separate lobes, overlapping intestine dorsally and dorso-laterally; dorsal gland anteriormost. Hemizonid three annules long, just anterior to excretory pore which is at or just behind the level of the oesophago-intestinal valve. Vulva prominent, just postequatorial. Reproductive organs paired, opposed, outstretched. Spermathecae spherical, usually packed with small rod-shaped sperm. Ovaries generally with a single row of oocytes. Intestines filled with spherical granules, indistinctly overlapping rectum. Tail somewhat elongate-conoid with a narrow rounded or indented terminus.

Male: Oesophagus and spear degenerate; median bulb and valvular apparatus indistinct, spear without distinct knobs. Lip region elevated, four-lobed, with lateral lip considerably reduced, not strongly sclerotized, with three to five annules posteriorly.

Hemizonid just anterior to excretory pore which is usually two to three body widths behind median oesophageal bulb. Single testis, outstretched anteriorly; spermatocytes in three rows followed by five. Bursa coarsely crenate, enveloping about 2/3rd of tail. Spicules strongly cephalated, 18-22 μ long, with pointed distal ends. Gubernaculum rod-like, protrusible, with distinct sharp, claw-like titillae at distal end. (see: Fig. 4)

Larva: Seven larvae were found to be 315-400 μ in length, with spears 13-14 μ long. Tail tapering to a bluntly rounded terminus; hyaline portion much shorter than in female. Genital primordium near mid-body.

Biology And Ecology

R. similis is a migratory endoparasite spending its adult vermiform life in the roots, but capable of emerging in adverse conditions. At 24-32 C the life cycle took 20-25 days, and 18-20 days at 24-27 C. All larval stages and females are infective. Fertilization is usual but parthenogenesis does occur. Egg hatch occurs in three to seven days. The female produces about two eggs/day. Males do not penetrate intact roots and may not feed. The species survives less than six months in soil free of host roots. At least two *R. similis* biotypes were formerly recognized, similar morphologically but different in host range. The “banana race” could attack banana, but not citrus, while the “citrus race” was pathogenic to both citrus and banana. In 1984, the citrus and banana races were described as sibling species, and the citrus race elevated to *R. citrophilus* (Huettal and Yaegashi, 1988).

Dispersal/ vectors

Radopholus similis is spread locally through root contact, or near contact. However, wide distribution is due to the movement of infected plant material from country to country.

Management

Cultural Control

On banana and plantain – Nematode-free banana and plantain crops can be produced by using clean (uninfested) planting materials (properly pared corms, or micro-propagated plantlets). These are planted in new areas, or in fields, which are free of plant nematodes, having been left fallow for at least six months to ensure the breakdown of infested roots and elimination of the nematode, and which were kept free of weeds that could harbour *R. similis*.

Chemical Control

Nowadays, the standard recommendations for nematode control in banana or plantain crops is the use of clean planting material (thoroughly pared corms, or micro-propagated plantlets) planted with a nematicide treatment, then plants treated with a nematicide at regular intervals. However, it seems that before long, one will need to find alternatives to these toxic nematicides due to environmental and consumer health considerations, and restrictions placed by banana importing countries. Some authorities were of the view that breeding *R. similis*-resistant banana was not promising. On anthurium – The best option would be to grow nematode-free plants (micro-propagated plantlets are now being used) in nematode-free plots. However, as this is not always possible, since traditional planting materials and beds are usually nematode-infested, beds should be treated with phenamiphos at 10-20 kg a.i./ha two or so months after planting, then every four months

for a year, then every six months. These intervals may be manipulated depending on levels of nematode infestation. These treatments will hold *R. similis* populations in check, and ensure that beds will remain productive for long periods. The point must be made that nematode infestation reduces the life of anthurium plantings such that beds need to be replanted earlier than normal. Replanting anthurium beds is a very costly undertaking

Pest Significance

Radopholus similis is a major pest in the banana and anthurium growing countries of the Caribbean.

Host Notes

This nematode is known to have well over 250 hosts, and is a major pest of banana and plantain, and found virtually every where these crops are grown; it also attacks Anthurium, blackpepper, ginger, tomato pineapple, coffee etc., and has been recorded on sugarcane. Avocado, tea, several ornamentals are also known to be susceptible hosts.

Distribution

R. similis is widespread in tropical and subtropical regions of the world (West Africa, certain countries in Europe, Asia and Africa, Central and South America, the Caribbean and Australia).

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Web Resource -

<http://ucdema.ucdavis.edu/imagemap/nemmap/ENT156HTML/nemas/radopholussimilis>



Fig. 1: Puny, unthrifty plantain toppling under weight of undersized bunch due to severe root damage and loss caused by *Radopholus similis*



Fig. 2: Thirty-month old anthurium plants in bed in foreground have declined and many have died; bed is weedy, dilapidated, unproductive and in need of replanting due to uncontrolled *Radopholus similis* infestation. Plants in adjacent bed still vigorous and highly productive, a result of effective nematode control



Fig. 3: Four month old anthurium; plot to right of stake treated with an effective nematicide at planting. Plot to the left untreated and plants already showing symptoms of “decline” caused by *Radopholus similis*

*RADOPHOLUS
SIMILIS*



Fig. 4: *Radopholus similis* (A.) Female (B.) Male
(After Cobb, 1915)

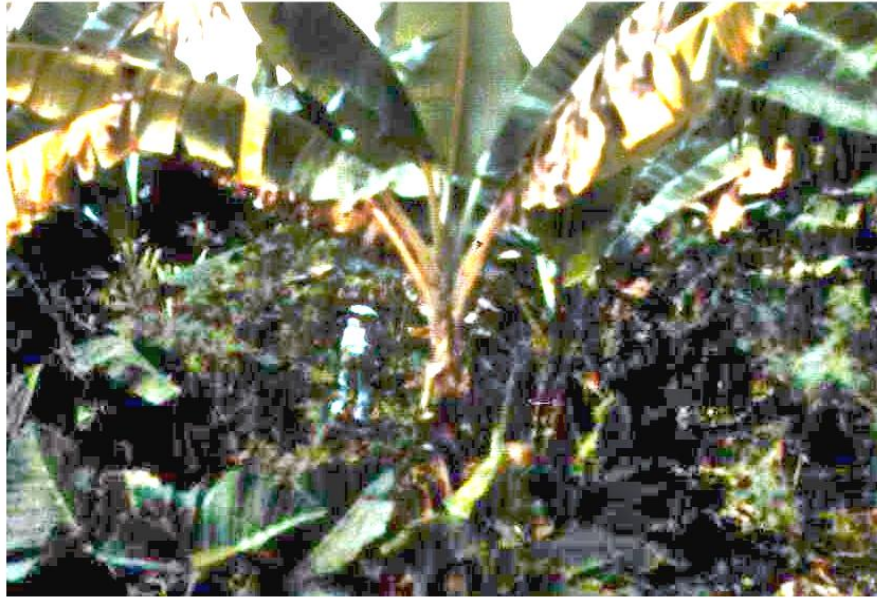


Fig. 5: Plantain showing tropical nutrient deficiency symptoms, a result of root damage caused by several nematodes, including *Radopholus similis*



Fig. 6: “Blackhead” of plantain corm and severe root damage caused by *Radopholus similis*