

OCCURRENCE OF PLANT-PARASITIC NEMATODES ASSOCIATED WITH CROPS OF AGRICULTURAL IMPORTANCE IN TRINIDAD

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ABSTRACT

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A survey, conducted in Trinidad, revealed a total of 20 genera of nematodes associated with a wide range of agricultural crops. Important plant-parasitic nematodes found were: *Meloidogyne incognita* var. *acrita* Chitwood and Oteifa, *M. javanica* (Treub) Chitwood, *Helicotylenchus dihystera* (Cobb) Sher, *H. multicinctus* (Cobb) Golden, *H. pseudorobustus* (Steiner) Golden, *Peltamigratus browni* Khan and Zakiuddin, *P. luci* Sher, *Pratylenchus brachyurus* (Godfrey) Filipjev and Schur. Stek., *P. zaeae* Graham, *Tylenchorhynchus annulatus* (Cassidy) Golden, *Xiphinema elongatum* Schur. Stek. and Teun., *X. insigne* Loos, *X. krugi* Lordello, *X. pachtaicum* (Tulaganov) Kirjanova, *Trichodorus* sp., *Rotylenchulus reniformis* Linford and Oliveira, *Hemicricone-moides mangiferae* Siddiqi, and *Paratylenchus* spp. Nematodes reported for the first time from Trinidad are *Gracilacus* sp., *Helicotylenchus crenacauda* Sher, *H. mangiferae*, *X. pachtaicum*, *X. elongatum*, *X. krugi*, *X. insigne*, and *Boleodorus thylactus* Thorne. Some of the nematode problems, especially those caused by root-knot nematodes, are discussed briefly.

Additional key words: root galling, root decay, stunting, crop failure, *Heterodera* sp.

RESUMEN

Bala, G. 1984. La presencia de nematodos parasíticos asociados con las cosechas de importancia agrícola en Trinidad. *Nematropica* 14:37-45.

Un inventario conducido en Trinidad reveló un total de 20 géneros de nematodos asociados con una extensa distribución de cosechas agrícolas. Los más importantes nematodos parasíticos incluyeron: *Meloidogyne incognita* var. *acrita* Chitwood y Oteifa, *M. javanica* (Treub) Chitwood, *Helicotylenchus dihystera* (Cobb) Sher, *H. multicinctus* (Cobb) Golden, *H. pseudorobustus* (Steiner) Golden, *Peltamigratus browni* Khan y Zakiuddin, *P. luci* Sher, *Pratylenchus brachyurus* (Godfrey) Filipjev y Schur. Stek., *P. zaeae* Graham, *Tylenchorhynchus annulatus* (Cassidy) Golden, *Xiphinema elongatum* Schur. Stek. y Teun., *X. insigne* Loos, *X. krugi* Lordello, *X. pachtaicum* (Tulaganov) Kirjanova, *Trichodorus* sp., *Rotylenchulus reniformis* Linford y Oliveira, *Hemicricone-moides mangiferae* Siddiqi y *Paratylenchus* spp. Los nematodos reportados por primera vez para Trinidad son: *Gracilacus* sp., *Helicotylenchus crenacauda* Sher, *H. mangiferae*, *X. pachtaicum*, *X. elongatum*, *X. krugi*, *X. insigne* y *Boleodorus thylactus* Thorne.

Algunos de los problemas con nematodos, especialmente aquellos causados por los nematodos noduladores de las raíces, son discutidos brevemente.

Palabras claves adicionales: nódulos de las raíces, pudrición de las raíces, enanismo, falla de la cosecha, *Heterodera* sp.

INTRODUCTION

The island of Trinidad is located 15 km northeast of the coast of Venezuela, between 10° and 11° N latitude and has an area of 4528 km². It possesses three mountain ranges: the Northern, Central, and Southern ranges. The Caroni plain lies between the Northern and Central ranges, and is the most extensively cultivated area in the country. The predominantly northeast trade winds help produce a pleasant climate with little seasonal variation; temperatures range from 27 C to 32 C and the rainfall ranges between 1500 mm and 3600 mm. Soil types vary from a rich alluvium in the large valleys, through sands and clays of the lowland areas, to calcareous soils in the Northern range.

Sugarcane (*Saccharum officinarum*) and cocoa (*Theobroma cacao*) are the major export crops. The former is cultivated in large acreages in the lowland areas, whereas the latter is cultivated in mountainous areas. Coffee (*Coffea arabica*) and citrus (*Citrus* spp.) have a small export market; coconuts (*Cocos nucifera*), bananas (*Musa* spp.), rice (*Oryza sativa*), vegetables, and other food crops are grown for local consumption.

Because of prevailing socio-economic factors, consideration has been given to the modernisation and diversification of the agricultural sector. Substantial acreages of the sugarcane lands have been earmarked for food crops and vegetable production. Recently, small acreages within the traditional cocoa-growing areas are now utilised for vegetable production.

Most of the nematological studies conducted in Trinidad have been of a preliminary nature. Phelps et. al. (9) conducted an island-wide survey for the citrus nematode, *Tylenchulus semipenetrans* Cobb, 1913. The nematode was found in 28 estates distributed island-wide. Extensive work on the host-range of *Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, 1949; *M. javanica* (Treub, 1885) Chitwood, 1949; and *M. exigua* Goeldi, 1887, was done by Barnes and Gowen (2). Plant-parasitic nematodes associated with root-crops, sugarcane, papaya (*Carica papaya*), tobacco (*Nicotiana tabaccum*), and sweet pepper (*Capsicum annuum* var. *grossum*), were reported by Brathwaite (4,6), Singh and Farrell (13), and Singh (11,12). An extensive survey for plant-parasitic nematodes was done by Singh (10) who recorded the presence of twenty-three nematode species on a range of crops. Bala (1) reported the importance of *Rotylenchulus reniformis* Linford and Oliveira, 1940, in soybean production.

The purpose of this survey was to assess, qualitatively, plant-parasitic nematode populations and investigate nematode problems on crops of agricultural importance.

MATERIALS AND METHODS

During 1980-82, about 200 soil and 200 root samples were taken from some of the major crop growing areas of north and central Trinidad. The areas included Paramin, La Pastora, Aranguez, Freeport, St. Augustine, El Carmen, Piarco, Centeno, La Reunion, Cumuto, Valencia, and El Reposo.

Nematodes were extracted from soil by a modified Cobb's gravity and sieving technique (14) or direct extraction (5), and by the use of modified Baermann funnels. Root samples were stained and cleared in lactophenol acid-fuchsin or macerated in a blender and placed on paper tissue in a modified Baermann funnel.

RESULTS AND DISCUSSION

The plant-parasitic nematodes found in this survey, along with their hosts, are presented in Table 1. A total of 20 genera and 19 species of nematodes was identified. *Aphelenchus avenae* Bastian, 1865, *Aphelenchoides* spp., and *Tylenchus* spp. were present in a large percentage of samples but these have been omitted.

The plant-parasitic nematodes *Meloidogyne incognita* var. *acrita* Chitwood, 1949, *M. javanica*, *Helicotylenchus dihystra* (Cobb, 1893) Sher, 1961, *H. multicinctus* (Cobb, 1893) Golden, 1956, *H. pseudorobustus* (Steiner, 1914) Golden, 1956 and *Pratylenchus* spp., reported in this survey, are known to be of major importance in decreasing crop production. Other important plant-parasitic nematodes reported here are *Tylenchorhynchus annulatus*, *Xiphinema* spp., *R. reniformis*, *Hemicriconemoides mangiferae* Siddiqi, 1961, *Paratylenchus* spp. and *Peltamigratus* spp.

Meloidogyne spp., *H. dihystra*, *P. zaeae*, *R. reniformis*, *T. annulatus* and *Criconebella onoensis* Luc, 1959, were found to be associated with a wide host range, while chive (*Allium schoenoprasum*), lettuce (*Lactuca sativa*), citrus, melongene (*Solanum melongena*), plantain (*Musa* sp.), sorrel (*Hibiscus sabdariffa*) and tomato (*Lycopersicon esculentum*) were found to harbour several genera of plant-parasitic nematodes.

Of the important plant-parasitic nematodes recorded from Trinidad, *Gracilacus* sp., *Helicotylenchus crenacauda* Sher, 1966, *H. mangiferae*, *Xiphinema pachtaicum* (Tulaganov, 1938) Kirjanova, 1951, *X. elongatum* Schur. Stek. and Teun., 1938, *X. krugi* Lordello, 1955, and *X. insigne* Loos, 1949, are being reported for the first time. *Boleodorus thylactus* Thorne,

Table 1. Plant-parasitic nematodes and related species associated with crops of agricultural importance in Trinidad.

Nematode	Crops
<i>Basiria</i> sp. ^z	melongene (<i>Solanum melongena</i> L.); plantain (<i>Musa</i> sp.)
<i>Boleodorus thylactus</i> ^x Thorne, 1941	coffee (<i>Coffea arabica</i> L.)
<i>Coslenchus</i> sp. ^x	cassava (<i>Manihot esculenta</i> Crantz); citrus (<i>Citrus</i> spp.)
<i>Diphtherophora</i> sp. ^x	pomerac (<i>Eugenia malaccensis</i> L.); pommecythere (<i>Spondias cytherea</i> Sonn.); sorrel (<i>Hibiscus sabdariffa</i> L.) ^y
<i>Ditylenchus</i> sp. ^x	cabbage (<i>Brassica oleracea</i> var. <i>capitata</i> L.); citrus; guava (<i>Psidium guajava</i> L.); lettuce (<i>Lactuca sativa</i> L.); pigeon pea (<i>Cajanus cajan</i> [L.] Millsp.); pomerac; tomato (<i>Lycopersicon esculentum</i> Mill.)
<i>Gracilacus</i> sp.	citrus; coffee
<i>Helicotylenchus</i> sp.	hot pepper (<i>Capsicum frutescens</i> L.)
<i>Helicotylenchus crenacauda</i> Sher, 1966	pineapple (<i>Ananas comosus</i> [L.] Merr.)
<i>H. dihystra</i> (Cobb, 1893) Sher, 1961	banana (<i>Musa</i> spp.); cabbage; celery (<i>Apium graveolens</i> L. var. <i>dulce</i> [Mill.] D.C.); chive (<i>Allium</i> <i>schoenoprasum</i> L.); citrus; cowpea (<i>Vigna unguiculata</i> [L.] Walp); cu- cumber (<i>Cucumis sativus</i> L.); guava; lettuce; melongene; papaya (<i>Carica</i> <i>papaya</i> L.); passion fruit (<i>Passiflora</i> <i>edulis</i> Sims.); plantain; sapodilla (<i>Manilkara achras</i> [Mill.] Fosberg); string bean (<i>Phaseolus vulgaris</i> L.); sweet pepper (<i>Capsicum annum</i> var. <i>grossum</i> [L.] Sendt); tomato
<i>H. multicinctus</i> (Cobb, 1893) Golden, 1956	coffee; plantain
<i>H. pseudorobustus</i> (Steiner, 1914) Golden, 1956	banana; cocoa (<i>Theobroma cacao</i> L.); coffee; melongene; papaya; pigeon pea; plantain; string bean

Table 1. Plant-parasitic nematodes and related species associated with crops of agricultural importance in Trinidad (continued).

Nematode	Crops
<i>Hemicriconemoides mangiferae</i> Siddiqi, 1961	cocoa
<i>Heterodera</i> sp. (sensu lato) juveniles	citrus
<i>Macroposthonia</i> sp.	chive
<i>Criconemella onoensis</i> (Luc, 1959) Luc and Raski, 1981	cabbage; cassava; citrus; lettuce; mango (<i>Mangiferae indica</i> L.); pigeon pea; pineapple; plantain; sapodilla; sorrel; tomato
<i>Meloidogyne</i> sp.	banana; chive; cocoa; guava; melongene; passion fruit; plantain; pommecythere; pumpkin (<i>Cucurbita pepo</i> L.); sorrel; string bean
<i>Meloidogyne incognita</i> var. <i>acrita</i> Chitwood and Oteifa, 1952	celery; cucumber; lettuce; tomato
<i>M. javanica</i> (Treub, 1885) Chitwood 1949	okra (<i>Hibiscus esculentum</i> L.)
<i>Paratylenchus</i> spp. ^z	coffee; guava; melongene; sapodilla; tomato
<i>Peltamigratus</i> sp.	plantain
<i>Peltamigratus browni</i> Khan and Zakiuddin, 1969	chive; tomato
<i>P. luci</i> Sher, 1964	chive; melongene
<i>Pratylenchus</i> sp.	banana; cabbage; cantaloupe (<i>Cucumis melo</i> L.); celery; coffee; cucumber; hot pepper; plantain
<i>Pratylenchus brachyurus</i> (Godfrey, 1929) Filipjev and Schur. Stek., 1941	cocoa; guava; melongene; tomato
<i>P. zae</i> Graham, 1951	cassava; chive; coffee; cowpea; lettuce; mango; papaya; pigeon pea; pineapple; pomerac; pommecythere; sorrel; tomato
<i>Pseudhalenchus</i> sp. ^g	cowpea

Table 1. Plant-parasitic nematodes and related species associated with crops of agricultural importance in Trinidad (continued).

Nematode	Crops
<i>Rotylenchulus reniformis</i> Linford and Oliveira, 1940	cabbage; cantaloupe; celery; chive; coffee; cowpea; cucumber; lettuce; mango; melongene; passion fruit; hot pepper; pigeon pea; plantain; sorrel; tomato
<i>Trichodorus</i> sp. <i>Tylenchorhynchus</i> <i>annulatus</i> (Cassidy, 1930) Golden, 1971	chive; cocoa; melongene; tomato banana; cabbage; cassava; celery; chive; citrus; cowpea; lettuce; mango; pigeon pea; plantain; sapodilla; sorrel
<i>Xiphinema</i> sp. <i>X. elongatum</i> Schur. Stek. and Teun., 1938	cowpea; tomato sorrel
<i>X. insigne</i> Loos, 1949	citrus
<i>X. krugi</i> Lordello, 1959	sorrel
<i>X. pachtaicum</i> (Tulaganov, 1938) Kirjanova, 1951	chive

*Probably fungal feeders or food preference unknown.

†Cultivated for the commercial production of a beverage.

‡Includes two species which may probably be *P. serricaudatus* Raski, 1975 and *P. veruculatus* Wu, 1962.

1941, is also being reported for the first time. Further work is necessary for the accurate identification of a *Paratylenchus* sp. close to *P. veruculatus* Wu, 1962, and one close to *P. serricaudatus* Raski, 1975.

Meloidogyne spp., reported as occurring on 16 crops in this survey, are probably the most important plant-parasitic nematodes associated with vegetable crops in Trinidad. They have been observed to cause severe damage to crops, resulting in substantial losses in yield and in some instances total crop failure. At La Pastora, high population levels of *M. incognita* var. *acrita* in tomato fields resulted in severe root galling, chlorosis, stunting, and reduced yield; and during the wet season at St. Augustine, young plants showed root galling, root decay, and stunting which led to total crop failure. Severe galling of roots was observed in string beans and okra at Valencia, in cucumbers and pumpkins at

Centeno, and in most instances, the plants exhibited chlorosis, stunting, and reduced yield.

In some crops, root-knot nematodes are found in association with other pathogens such as *Pseudomonas solanacearum* E.R. Smith, *Sclerotium rolfsii* Saccardo, and *Fusarium* spp. In celery, for instance, root-knot species and *Fusarium* spp. were commonly found to be associated with a condition known locally as "heart-rot," in which decay of the stem, wilt, and eventual collapse of the entire shoot system occur.

At Freeport, on a farmer's holding, a substantial number of melongene plants exhibited chlorosis, stunting, and reduced fruit size. In addition, many plants exhibited "toppling," and when the root systems were examined they were found to be "stubby" with the feeder roots showing severe damage. Analysis of soil samples revealed that the damage to the root system was caused by plant-parasitic nematodes; soil population density was 6120 per L soil and comprised *Meloidogyne* sp. (juveniles), *Pratylenchus* sp., *R. reniformis*, *Helicotylenchus* sp., and *Trichodorus* sp., occurring at 800, 800, 920, 3200, and 400 per L soil, respectively. Of these nematodes, *Trichodorus* sp., is likely to cause the kind of damage that would result in a "stubby" root system.

The spiral nematodes, *Helicotylenchus* spp., were the most widely distributed nematodes reported in this survey. Of significance was the detection of *H. multicinctus* in soil taken from plantain. This nematode has been reported to cause banana decline in Israel, Cuba, and the Windward Islands (3,7).

Juveniles of a *Heterodera* sp. were recovered from the rhizosphere of *Citrus* spp. at St. Augustine and further work is necessary on the identification, pathogenicity, and host-range of this species. Farrel (8) reported the occurrence of *Heterodera graminis* Stynes, 1971, on bamboo-grass (*Paspalum fasciculatum* Wild.) in a museum plot at the field station of the University of the West Indies, St. Augustine, where he recovered cysts containing viable eggs, juveniles, and white mature females.

As a result of this survey, research has been initiated to investigate suspected disease complexes involving plant-parasitic nematodes in tomato and celery. It is suggested that the nematode problems of citrus, plantain, melongene, sorrel, and chive also be investigated, as these crops were found to harbour numerous genera of important plant-parasitic nematodes.

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