PLANT PARASITIC NEMATODES FROM THE LOWLANDS AND HIGHLANDS OF ECUADOR [NEMATODOS PARASITOS DE PLANTAS EN LA COSTA Y SIERRA DEL ECUADOR]

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ABSTRACT

Soil and root samples of 25 different crops were collected at numerous localities throughout the lowlands and highlands of Ecuador and examined for nematodes. *Radopholus similis* was the most abundant plant parasitic nematode of banana and caused root necrosis, toppling and reduced growth at all sites sampled. High root populations of *Pratylenchus coffeae* caused similar damage to abaca *(Musa textilis). Meloidogyne incognita* and *M. hapla* occurred commonly and were responsible for root galling of tomato, alfalfa, carrot, cucumber, lettuce, tree tomato, babaco and soybean. *Heterodera pallida* and *Ditylenchus dipsaci* were present in large numbers on potato and onions respectively in the highlands. Other nematodes frequently found in roots of many crops were *Pratylenchus neglectus* and *Helicotylenchus* spp.; *Quinisulcius acti* was commonly extracted from soils. Less frequently occurring nematodes included *Pratylenchus penetrans, Criconemoides* spp., *Merlinius* sp., *Tylenchorhynchus* sp., *Hemicriconemoides mangiferae* and *Xiphinema americanum.*

INTRODUCTION

There have been few published records of plant parasitic nematodes from Ecuador, although nematodes have been recognised as a problem in the extensive banana growing areas of El Oro Province in southern Ecuador. The nematode species responsible, and the extent of the damage they cause, are now being investigated, but attempts at control are still in their initial stages. The main pest problem of bananas has been considered to be that of the banana weevil, *Cosmopolites sordidus.*

Eguiguren (2) found many nematode genera associated with a wide range of crops in Imbabura Province, the most frequently occurring plant parasitic genera were *Tylenchorhynchus, Rotylenchus, Meloidogyne, Trichodorus, Criconemoides, Pratylenchus, Xiphinema* and *Belonolaimus.*

Other nematodes that have been reported include *Heterodera* sp. on potato, *Ditylenchus dipsaci* on onions and alfalfa, *Meloidogyne* spp. on tomatoes and beans, and *Rhadinaphelenchus cocophilus* on coconut (3). Esser (4) found *Helicotylenchus microlobus, Meloidogyne* sp., *Trichodorus nanus, Xiphinema macrostylum* and *Radopholus similis* associated with stunted and dying plant of *Musa* x *paradisiaca* from Guayaquil.

At the request of the Instituto Nacional de Investigaciones Agropecuarias a short survey was done in 1974 to establish the importance of nematodes on a variety of crops in Ecuador with particular reference to bananas.

METHODS

A total of 69 banana root samples was collected from 13 plantations in the El Oro Province where decrease in yield had been noticed by the growers in the previous 1 to 3 years. Bananas were also sampled near Boliche and in Los Rios Province. Plant and soil samples were taken from 25 other different crops at many

locations in Los Rios Province, Santa Domingo, Portoviejo, Tungurahua Province and Imbabura Province. Nematodes were extracted from roots by modified maceration and sieving, and from soil by a simplified sieving technique.

RESULTS

A list of the plant parasitic nematodes found is given in Table 1. Non-plant parasitic soil nematodes and those of debatable economic importance (such as members of the Dorylaimida, *Aphelenchoides, Aphelenchus, Tylenchus,* and related genera) although commonly found in most soil samples, are omitted.

All the banana plantations examined in the El Oro District were found to be seriously infested with *Radopholus similis.* Populations ranged from 500 to 103,500 nematodes/100g root in 72% of the root samples. Common disease symptoms were yellowing of the lower leaves, small fruit bunches and stunted growth; and the extent of these appeared to be directly related to the severity of root necrosis and the numbers of *R. similis* extracted from the roots. Leaf yellowing did occur on the less heavily infested plants but was not always obvious and was sometimes related to poor irrigation, poor soils, and possibly, inadequate fertiliser. Serious damage by the banana weevil, *Cosmopolites sordidus*, was only observed at one site and then it was combined with severe root necrosis due to *R. similis.* Bananas from the other 2 areas sampled were also found to be infested with *R. similis.* The other nematodes found in banana roots were *Helicotylenchus dihystera* and *Meloidogyne incognita*, but only in comparatively low numbers.

Pratylenchus coffeae was extracted in large numbers from roots of abaca (*Musa textilis*) at 3 sites, Estacion Experimental Pichilingue, Quevedo and Santo Domingo. Associated with it was severe damage to the plants in the form of root necrosis, toppling, yellowing of the leaves and stunted growth, all very similar to the symptoms caused by *R. similis* on bananas. Other nematodes, which were occasionally extracted from abaca in low numbers, were *Helicotylenchus* sp., *Meloidogyne* sp. (probably *M. incognita*) and *R. similis.*

Meloidogyne spp. occurred commonly and caused moderate to severe root galling of tomato, alfalfa, carrot, cucumber, lettuce, tree tomato, babaco and soybean. Only 2 species were found, *M. incognita* and *M. hapla,* the former being the most numerous. The majority of tomato crops examined were seriously infested with *M. incognita.* Severe galling was most evident on land which had been repeatedly cropped to tomatoes; in some instances tomatoes had been grown on the same site for 8 consecutive years. Where nematicides had been applied to seedbeds, and tomatoes planted in virgin soils, populations of *M. incognita* were low.

Helicotylenchus spp. (*H. dihystera, H. erythrinae* and 2 other species) were endoparasitic in roots of a number of crops, and were the cause of necrotic lesions in roots of soybean.

Pratylenchus neglectus was a common root endoparasite of crops in the highlands and caused necrosis in roots of lettuce and Swiss chard. *P. penetrans* was associated with root lesions of barley from Imbabura Province.

Abundant cysts and larvae of *Heterodera pallida* were recovered from potatoes in Tungurahua Province. Cysts and larvae that had been collected from 3 other localities, Suelo Huaca, Carchi Province; Chillogallo, Pinchincha Province; and Sabanag, Chimborazo Province, were also identified as *H. pallida.*

Very high numbers of *Ditylenchus dipsaci,* the stem and bulb nematode, were found infesting onion bulbs in Juan Benigno Velva District, Tungurahua. However, the few samples of alfalfa taken from the same area were free of the nematode.

Table 1. Plant Parasitic Nematodes of soil and plant material from Ecuador

CROP	NEMATODES	
	SOIL	**ROOTS**
Abaca *(Musa Textilis)*	(not sampled)	*Helicotylenchus* sp. *Meloidogyne* sp. *Pratylenchus coffeae* *Radopholus similis*
Alfalfa *(Medicago sativa)*	*Criconema* sp. *Meloidogyne* larvae *Pratylenchus neglectus*	*Meloidogyne hapla* *Meloidogyne incognita* *Pratylenchus neglectus*
Avocado *(Persea americana)*	*Criconemoides informis* *Helicotylenchus* sp. *Quinisulcius acti* *Rotylenchus* sp.	– None –
Babaco *(Carica pentagona)*	*Criconemoides informis* *Helicotylenchus dihystera* *Helicotylenchus* sp. *Merlinius* sp.	*Meloidogyne incognita*
Banana *(Musa* AAA Group*)*	(not sampled)	*Helicotylenchus dihystera* *Meloidogyne incognita* *Radopholus similis*
Barley *(Hordeum vulgare)*	*Pratylenchus penetrans* *Quinisulcius acti*	*Pratylenchus penetrans*
Bean *(Phaseolus* sp.*)*	*Merlinius* sp. *Pratylenchus neglectus* *Quinisulcius acti*	*Pratylenchus neglectus*
Beetroot *(Beta vulgaris)*	(not sampled)	*Pratylenchus neglectus*
Cocoa *(Theobroma cacao)*	*Helicotylenchus* sp. *Hemicriconemoides mangiferae* *Paratylenchus microdorus* *Xiphinema americanum*	(not sampled)
Carrot *(Daucus carota)*	*Merlinius* sp. *Pratylenchus neglectus* *Quinisulcius acti*	*Meloidogyne incognita*
Coffee *(Coffea arabica)* *(C. canephora)*	*Xiphinema americanum*	– None –
Cucumber *(Cucumis sativus)*	*Pratylenchus neglectus* *Quinisulcius acti*	*Meloidogyne incognita*
Lettuce *(Lactuca sativa)*	*Merlinius* sp. *Pratylenchus neglectus* *Quinisulcius acti*	*Meloidogyne incognita* *Pratylenchus neglectus*

Table 1 (cont.)

CROP	NEMATODES	
	SOIL	**ROOTS**
Pea *(Pisum sativum)*	*Criconemoides mutabilis* *Helicotylenchus* sp. *Heterodera* larvae *Merlinius* sp. *Tylenchorhynchus* sp. *Quinisulcius acti*	*Meloidogyne incognita* *Pratylenchus neglectus*
Potato *(Solanum tuberosum)*	*Criconemoides mutabilis* *Heterodera pallida*	*Heterodera pallida*
Oil Palm *(Elaeis guineensis)*	*Helicotylenchus erythrinae* *Helicotylenchus* sp. *Pratylenchus* sp. *Trichodorus monohystera*	*Helicotylenchus erythrinae*
Onion (Garlic) *(Allium cepa* 'Ajo'*)*	*Heterodera* larvae *Merlinius* sp. *Pratylenchus neglectus*	(not sampled) (BULBS and LEAVES)
Onion *(Allium cepa* 'Cebolla'*)*	*Ditylenchus dipsaci* *Pratylenchus neglectus*	*Ditylenchus dipsaci*
Tomato *(Lycopersicon esculentum)*	*Helicotylenchus dihystera* *Quinisulcius acti*	*Meloidogyne incognita*
Tree tomato *(Cyphomandra betacea)*	*Criconemoides mutabilis* *Helicotylenchus dihystera* *Quinisulcius acti*	*Meloidogyne incognita*
Soybean *(Glycine max)*	*Merlinius* sp. *Pratylenchus neglectus* *Quinisulcius acti*	*Helicotylenchus* sp. *Meloidogyne incognita* *Pratylenchus neglectus* *Quinisulcius acti*
Sugar cane *(Saccharum officinarum)*	*Criconemoides mutabilis* *Helicotylenchus dihystera* *Quinisulcius acti* *Tylenchorhynchus* sp. *Xiphinema americanum*	*Helicotylenchus dihystera* *Pratylenchus* sp.
Swiss chard *(Beta vulgaris)*	*Merlinius* sp. *Pratylenchus neglectus* *Quinisulcius acti*	*Meloidogyne incognita* *Pratylenchus neglectus*

Quinisulcius acti, probably a root ectoparasite, was recovered from many soils in relatively large numbers. *Hemicriconemoides mangiferae* was found around cocoa roots together with a species of *Helicotylenchus. Xiphinema americanum* was the only plant parasitic species extracted from coffee soils.

DISCUSSION

Radopholus similis was the major pest of bananas in the areas sampled and its direct control would produce profitable results for the banana industry. *Pratylenchus coffeae* caused similar damage to abaca and, since the nematode can be disseminated on abaca as easily as *R. similis* is on banana seed material, it should be considered when any new plantings of the crop are made especially in previously uncultivated, virgin lands, such as the 'Oriente'. *P. coffeae* has been reported on abaca from other countries in South America, Central America and the Caribbean (6,7). It has been suggested that 2 separate races of *P. coffeae* exist on abaca and plantain (5, 8), and it is only occasionally found on banana (7). In this survey, *P. coffeae* did not occur on banana, and attempts at culturing the abaca isolates on banana were unsuccessful.

The potato cyst nematode is a serious pest of potatoes in the high Andes and *Heterodera rostochiensis* has been reported on potato from the northern Provinces of Ecuador (1, 3). Cyst nematodes collected from the field during this survey were identified as *H. pallida.*

Relatively few plant parasitic species were encountered in this short survey. More comprehensive investigations will undoubtedly uncover other nematode problems in Ecuador.

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RESUMEN

Se colectarón y examinarón muestras de suelo y raices de veinticinco diferentes cultivos en numerosas localidades de la Costa y Sierra del Ecuador. *Radopholus similis* fue el nemátodo mas abundante en el cultivo de banano, causando necrosis de la raíz, volcamiento y reducción del crecimiento de las plantas, en todas las areas muestreadas. Altas poblaciones de *Pratylenchus coffeae* causaban danos similares en abaca (*Musa textilis*). *Meloidogyne* spp. (*M. incognita* y *M. hapla*) se observaron con frecuencia y eran responsables de la formación de agallas en las raices de tomate, alfalfa, zanahoria, pepino, lechuga, tomate-de-arbol, babaco y soya. *Heterodera pallida* y *Ditylenchus dipsaci* estuvierón presentes en gran número en papa, y cebolla respectivamente en la Sierra. Otros nemátodos frecuentemente detectados en raices de muchos cultivos fuerón *Pratylenchus neglectus* y *Helicotylenchus* spp.; *Quinisulcius acti* fue comunmente extraido de suelos. Nemátodos encontrados con menor frecuencia fuerón *Pratylenchus penetrans, Criconemoides* spp., *Merlinius* sp., *Tylenchorhynchus* sp., *Hemicriconemoides mangiferae* y *Xiphinema americanum.*

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CONTROL OF *MELOIDOGYNE INCOGNITA* ON *COLEUS BLUMEI* BY DRENCH APPLICATION OF FENSULFOTHION [CONTROL DE *MELOIDOGYNE INCOGNITA* EN *COLEUS BLUMEI* POR MEDIO DE APLICACIONES DE FENSULFOTHION A PLANTAS ESTABLECIDAS]

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ABSTRACT

The average top weight and number of twigs in *Coleus blumei* infected by *Meloidogyne incognita* was considerably increased by drench application of Fensulfothion at 20 lb (ai)/acre. The non-treated plants were chlorotic and the aerial parts were significantly reduced by the nematode infection.

INTRODUCTION

Ornamental plants are being used increasingly to decorate parks, gardens, and homes. The acreage used for the production of these crops is low in comparison with the total land area under cultivation, but monetary returns are high because of the intensive cropping and high crop value (3).

Nematodes are one of the most damaging pests of ornamentals, causing serious production losses worldwide. The most important loss is in planting stock which is not marketable because of nematode damage.

Root-knot nematodes, *Meloidogyne incognita* (Kofoid and White) Chitwood probably are the most serious problem for (decorative) ornamental plants in the temperate and sub-tropical regions. Infecting the roots of these plants, they produce galls which interfere with mineral uptake of the plant and cause considerable growth reduction of the aerial parts. To reduce losses in infected plants, it is usually necessary to apply some method of nematode control, such as hot water or chemical treatment.

Drenches of chemicals applied to different ornamental plants have proven effective in controlling nematodes. Streu *et al.* (4) found that drench applications of Fensulfothion, 16 lb/A in 50 ml of water, reduced *Tylenchorhynchus claytoni* populations in Azalea by 75.5%. They also obtained a reduction of 66% of *Pratylenchus vulnus* population in English boxwood (*Buxus sempervirens*) and an increase in top growth by drenches of Thionozin, 16 lb/A in 200 ml of water (4).

In Puerto Rico, growth of the decorative foliage plant *Coleus blumei* Benth is severely affected by *M. incognita*, but an effective method of control has not been developed. An experiment was conducted to determine if drench application of a nematicide would control this nematode on *C. blumei.*