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INTERACTION OF *MELOIDOGYNE INCOGNITA* AND *ROTYLENCHULUS RENIFORMIS* ON SOYBEAN [INTERACCION DE *MELOIDOGYNE INCOGNITA* Y *ROTYLENCHULUS RENIFORMIS* EN LA SOYA]. N. D. Singh, Nematologist, The University of the West Indies, St. Augustine, Trinidad, W.I.

ABSTRACT

In greenhouse experiments, the percentage penetration of "Jupiter" soybean seedlings by *Meloidogyne incognita* or *Rotylenchulus reniformis* was significantly reduced with increasing inoculum levels 10 and 20 days after inoculation. In mixed species infections, significant reduction was found at the higher inoculum levels 20 days after inoculation. *M. incognita* and *R. reniformis*, singly and in combination significantly reduced top and root dry weights of soybean 10 wks after inoculation. Simultaneous inoculation with *M. incognita* inhibited increase of *R. reniformis*, but *M. incognita* was little affected by the presence of *R. reniformis.*

INTRODUCTION

Meloidogyne incognita (Kofoid and White) Chitwood, and *Rotylenchulus reniformis* Linford and Oliveira, are 2 of the predominant nematodes in cultivated fields in the Caribbean (1, 2, 10). They generally occur in poly-specific communities in the same soil and root samples. Greenhouse and laboratory observations have shown that these 2 nematodes are important pathogens of soybean (*Glycine max*). However, little information is available on the interactions between *M. incognita* and *R. reniformis* coinhabiting a particular host. The importance of such studies in nematode population dynamics has already been shown (3, 4, 6, 7, 8, 9, 12).

The objectives of this investigation were to study the population dynamics of coincident *M. incognita* and *R. reniformis* and their effects on growth of soybean.

MATERIALS AND METHODS

Meloidogyne incognita and *Rotylenchulus reniformis* used in this study were obtained from greenhouse stock cultures maintained on tomato and sweet potato plants, respectively.

Test 1. This test was conducted to study the influence of inoculum levels on root penetration and development of *M. incognita* and *R. reniformis*, botn singly and in combination, on "Jupiter" soybean. All seeds were selected for uniformity of size and seed coat, surface sterilized for 10 min in 10% Chlorox, then rinsed twice in distilled water. Soybean seedlings were germinated and grown for 10 days in 10 cm clay pots of soil treated with methyl bromide. Ten replicate pots (one plant per pot) were inoculated with 100, 200, 400, 600, and 1000 larvae of either nematode species per seedling. Other seedlings were also inoculated with a mixture of equal numbers of larvae of both species to give the same population levels. Non-inoculated seedlings were included as controls. The nematodes were pipetted into 2 holes, 2.5 cm deep, near the base of the plant in each pot, covered with soil and watered. After 10 and 20 days, the roots of each plant were washed, stained with lactophenol cotton blue (5) and the nematodes counted.

Test 2. In this test, "Jupiter" seedings (2 per pot) were germinated and grown for 10 days in 80 clay pots (10 cm diam) of soil treated with methyl bromide. The pots were treated as follows: Twenty pots were each inoculated with a 10 ml water suspension containing 980 *M. incognita* larvae; 20 pots were similarly inoculated with 995 *R. reniformis* larvae; 20 pots were similarly inoculated with 980 *M. incognita* larvae plus 995 *R. reniformis* larvae; 20 pots remained non-inoculated as controls.

Equal quantities of 20-20-20 NPK fertilizer were added weekly to each pot. The dry weights of tops and roots in 10 pots of each treatment were recorded after 4 weeks and the remainder recorded 10 weeks after inoculation.

Test 3. Seeds of "Jupiter" soybean were planted in each of 40 clay pots (10 cm diam) of soil treated with methyl bromide and thinned to two seedlings per pot soon after emergence. Eight days after emergence, 10 pots were inoculated with 1000 *M. incognita* larvae; 10 with 1000 *R. reniformis* larvae; 10 with a mixture of 1000 *M. incognita* and 1000 *R. reniformis* larvae; 10 were left as non-inoculated controls. Seventy days after inoculation the nematodes were extracted from 5g root samples from each pot using the Blender technique and counted (5).

RESULTS AND DISCUSSION

Test 1. The percentage of soybean root penetrations between the single species infections of *M. incognita* and *R. reniformis* recovered 10 and 20 days after inoculations was significantly (P=0.05) reduced at the higher inoculum levels (Table 1). There was also a significant reduction (P=0.05) in the percentage penetrations at the higher inoculum levels in the mixed species infections 20 days after inoculation. No significant change was found in the percentage penetration due to the different inoculum levels in the mixed species infections 10 days after inoculation. Kinloch and Allen (7) reported similar results with mixed *Meloidogyne* spp. infections on tomato. They explained that a reduction in percentage penetration was probably caused by the destruction of roots before the maximum level of penetration was reached.

Test 2. No significant reduction was found in top and root dry weights of soybean between the single and mixed species infections 4 weeks after inoculations. *M. incognita* and *R. reniformis*, alone and in combination, significantly (P=0.05) reduced top and roots dry weights of "Jupiter" soybean plants 10 wks after inoculation (Table 2). Pathogenicity of *R. reniformis* on this soybean cultivar has been previously shown (11). These results indicate that, in combination, the effects of each species on top and root growth were competitive.

Table 1. Percentage of root penetration of single and mixed species infections of *Meloidogyne incognita* and *Rotylenchulus reniformis* after 10 and 20 days following inoculation with various inoculum levels (Means of ten replicates).

Species	No. of nematodes applied per pot	10 days % of inoculum in roots	20 days % of inoculum in roots
M. incognita	100	74.1 a [1]	78.1 a
	200	67.4 ab	77.7 a
	400	62.3 ab	64.4 b
	600	57.2 b	62.7 b
	1000	43.3 c	41.2 c
R.reniformis	100	68.7 a	71.7 a
	200	64.2 a	66.4 a
	400	51.6 b	53.8 b
	600	43.4 c	51.6 b
	1000	39.7 c	47.3 b
M. incognita + *R. reniformis*	100	54.2 a	74.3 a
	200	53.7 a	73.7 a
	400	58.6 a	54.2 b
	600	61.4 a	54.7 bc
	1000	49.2 a	52.4 c

(1) Means in columns within species followed by a letter in common do not differ significantly (P > 0.05).

Test 3. Numbers of *R. reniformis* were significantly lower (P=0.01) when soybean roots were simultaneously invaded by *M. incognita* than in its absence (Table 3). This was probably due to nematode-nematode interaction, whereby one species suppressed increase of the other. Similar effects have been recorded with other nematode species on various crops (3, 4, 7, 9, 12). On the other hand, the presence of *R. reniformis* had no significant effect on numbers of the concomitant *M. incognita.*

Johnson and Nusbaum (6) suggested that the mechanism involved in associated interactions of nematode species appeared to involve individual host-nematode responses. They found that *Pratylenchus brachyurus* was suppressed by a tobacco cultivar susceptible to *M. incognita* and enhanced by a resistant one. Gay and Bird (4) also reported that reproduction of *P. brachyurus* was enhanced in cotton cultivars resistant to *M. incognita* and *M. arenaria.* In the present investigations, however, "Jupiter" soybean was equally a good host for both *M. incognita* and *R. reniformis.*

These results do not fit with the above hypothesis. Sikora *et al* (9) also found that although creeping bentgrass was an excellent host for *M. naasi* and *Tylenchorhynchus agri* and a poor host for *P. penetrans, T. agri* inhibited increase of *M. naasi* but neither *T. agri* nor *P. penetrans* was affected in the presence of *M. naasi.* Furthermore, Ross (8) reported that the presence of *M. incognita* suppressed *Heterodera glycines* on soybean in the early growing period but, late in the season numbers of *H. glycines* were greater in plots containing both nematodes than in plots with *H. glycines* alone.

Table 2. Effects of *Meloidogyne incognita* and *Rotylenchulus reniformis*, alone and in combination on growth of "Jupiter" soybean 70 days after inoculation. (Means of ten replicates).

	Mean dry wt. of tops per plant (g)		Mean dry wt. of roots per plant(g)	
TREATMENT	4 weeks	10 weeks	4 weeks	10 weeks
Control	1.7 a	9.8 a	0.9 a	12.1 a
R. reniformis	1.3 a	5.3 b	0.5 a	6.4 b
M. incognita	1.2 a	4.9 b	0.6 a	5.9 b
R. reniformis + *M. incognita*	0.9 a	4.2 b	0.5 a	5.6 b

Mean in columns followed by a letter in common do not differ significantly (P > 0.05).

Table 3. Mean number of *Meloidogyne incognita* and *Rotylenchulus reniformis* recovered from 5 g samples of "Jupiter" soybean roots 70 days after inoculation, alone and in combination. (Means of ten replicates).

TREATMENT	*M. incognita*	*R. reniformis*
Control	0 b	0 c
M. incognita	190 a	0 c
R. reniformis	0 b	180 a
M. incognita + *R. reniformis*	165 a	60 b

Mean in columns followed by a letter in common do not differ significantly ($P > 0.05$).

Several factors may influence the reproduction of one nematode on a concomitant species (3, 4, 6, 7, 8, 9, 12). More studies are needed in order to obtain adequate information on the factors involved in the complex interactions between hosts and concomitant nematode species.

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RESUMEN

En experimentos del invernadero, el procentaje de la penetración de las plantas de semillero de la soya "Jupiter" por *Meloidogyne incognita* o *Rotylenchulus reniformis* se redujó significanturamente con llanuras aumentandas del inoculante después de 10 y 20 días de la inoculación. En las infecciones de las especies mexcladas se registró una reducción significatura en el porcentaje de la penetración en las llanuras más altas del inoculanta después de 10 días de la inoculación. *M. incognita* y *R. reniformis* separadamente y en combinación redujeron significativamente el peso seco de las copas y de las raicés de la soya después de 10 semanas de la inoculación. La inoculación simultánea con *M. incognita* inhibió la penetración de las raicés por *R. reniformis* pero *M. incognita* se afectó poco en la presencia de *R. reniformis*.

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POTATO SEED-PIECE TREATMENT WITH THE SYSTEMIC NEMATICIDE PHENAMIPHOS FOR CONTROL OF PLANT PARASITIC NEMATODES [TRATAMIENTO DE SEMILLA DE PAPA CON EL NEMATICIDA SISTEMICO PHENAMIPHOS PARA EL CONTROL DE NEMATODOS FITOPARASITOS].

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ABSTRACT

Potato seed-pieces were immersed in emulsions containing the systemic nematicide phenamiphos at concentrations of 0, 1.8, 3.6, 8.9, 17.9, or 35.9 g/L. When treated seed-pieces were planted in soil infested with a variety of plant-parasitic nematodes, there was a reduction in number of pathogens in the soil and in roots of plants produced as compared to controls. Concentrations of nematicide higher than 1.8 g/L were toxic to plants. No plants were produced from seed-pieces immersed in the 2 most concentrated emulsions. The degree of control obtained with the 1.8 g/L emulsion ranged from 67 - 100% depending on the nematode species.

INTRODUCTION

Control of nematodes affecting potatoes has been traditionally accomplished with preplant applications of halogenated hydrocarbons, or more recently, with in-furrow or banded applications of contact or systemic nematicides at planting time (4, 6). Because of the extreme phytotoxicity of halogenated hydrocarbons and some of the contact nematicides (4), the treatment of potato seed-pieces with nematicides has not been considered practical. However, with the introduction of new systemic nematicides, we thought it possible to treat seed-pieces for control of nematodes without injury to the crop. This paper presents results of a study on the feasibility of using phenamiphos for treatment of potato seed-pieces.

MATERIALS AND METHODS

Soil used in the experiment was a Norfolk sandy loam taken from a field that had been under cotton monoculture. The soil was infested with lance (*Hoplolaimus galeatus*), root-knot (*Meloidogyne incognita*), stunt (*Tylenchorhynchus*