Meloidogyne mayaguensis reproduction on resistant tomato and pepper.

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Abstract

Meloidogyne mayaguensis is a highly virulent pathogen of many vegetables including broccoli, cabbage, eggplant, pepper, squash, tomato, watermelon, and zucchini. This nematode presents a great of concern due to its ability to reproduce on *Mi*-1 gene resistant tomato, which provides resistance to the major root-knot nematode species, root-knot nematode resistant soybean and sweet potato. Studies were conducted to evaluate the reproduction of a *M. mayaguensis* isolate from Florida on tomato with the *Mi*-1 gene and root-knot nematode resistant pepper genotypes. Four resistant tomato genotypes BHN 543, BHN 585, BHN 586, and Sanibel were compared with the susceptible 'Rutgers' tomato, and four resistant pepper genotypes 'Charleston Bell', lines 9913/2, Sais 97.9001, and Sais 97.9008 were compared with the susceptible 'Keystone Resistant Giant' pepper. *M. incognita* race 4 was used as a control for both tomato and pepper tests. Tomato was tested at 22 and 33 °C in growth chambers, and at 26 ± 1.8 °C in a growth room. *M. mayaguensis* reproduced on all tomato with the *Mi*-1 gene at all temperatures, whereas *M. incognita* reproduced only at 33 °C. Pepper, which was tested at 24 °C, was infected only by *M. mayaguensis*. Egg mass indicies, and the reproduction factor for *M. mayaguensis* were significantly different than those for *M. incognita* race 4 in all resistant tomato and pepper genotypes. *M. mayaguensis* from Florida overcame the *Mi*-1 resistance gene in tomato genotypes, and the *N*-resistance gene on pepper 'Charleston Bell,' and other gene (s) that confers resistance to root-knot nematodes in pepper lines 9913/2, Sais 97.9001, and Sais 97.9008.

Introduction

Populations of *Meloidogyne mayaguensis* from Africa have the capability to overcome root-knot nematode resistant genes in some important crops, such as soybean, sweet potato, and tomato with the *Mi*-1 gene (Fargette, 1987). The resistant genes in these plants confer resistance to *M. arenaria*, *M. incognita* and *M. javanica*. Several single dominant genes from pepper, including *N* (Fery et al., 1998; Thies and Fery, 2000), Me-1 and Me-3 genes (Castagnone-Sereno et al., 2001; Djian-Caporalino et al., 2001) confer resistance to root-knot nematodes and were shown to be stable at high soil temperatures (Djian-Caporalino et al., 2001; Thies et al., unpubl.), whereas tomato genotypes with the *Mi*–1 gene that are currently available on the market are not stable at high soil temperatures, for example above 28 °C (Ammanti et al., 1986; Dropkin, 1969).

Objectives

The objectives were (i) to determine if *M. mayaguensis* from Florida is able to overcome *Mi*-1 resistance gene from tomato; and (ii) to determine if the nematode's reproduction is affected by the N-gene in bell pepper 'Charleston Belle' and other root-knot nematode resistant genes from three additional pepper lines.

Material and Methods

Four tomato genotypes with the *Mi*-1 gene, BHN 543, BHN 585, BHN 586, and 'Sanibel', were compared with the susceptible 'Rutgers' tomato and four root–knot nematode resistant pepper genotypes, *N*-gene 'Charleston Bell', 9913/2, Sais 97.9001, and Sais 97.9008 were compared with the susceptible 'Keystone Resistant Giant' pepper. The pepper lines used in this study are resistant to *M. arenaria*, *M. incognita*, and *M. javanica* (DiVito, pers. comm.). The reproduction of *M. mayaguensis* on tomato was tested at 22 and 33 °C in growth chambers, and at 26 ± 1.8 °C in a growth room, whereas pepper was tested at 24 °C. All plants were inoculated with 2,500 eggs, and a RCBD was used with four and six replications. *M. incognita* race 4 was used as a control.

Results and Discussion

Meloidogyne mayaguensis reproduced on all *Mi*-1 gene tomato genotypes at all temperatures, whereas *M. incognita* reproduced only at 33 °C (Tables 1,2). Similar results were obtained using the *N*-gene pepper 'Charleston Belle', and three root-knot nematode resistant pepper lines at 24 °C (Table 3). Reproductive factor was higher for *M. mayaguensis* than for *M. incognita* race 4 on all resistant tomato plants (Table 1) and pepper genotypes (Table 3). These results show that *M. mayaguensis* from Florida overcomes the *Mi*-1 resistance gene in tomato genotypes Sanibel, BHN 543, BHN 585, BHN 586; *N*-resistant gene from pepper 'Charleston Belle', as well as other root-knot nematode resistant gene(s) from pepper lines 9913/2, Sais 97.9001, and Sais 97.9008.

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Table 1. Reproduction factor of *Meloidogyne mayaguensis* (Mm) and *Meloidogyne incognita* race 4 (Mi4) on *Mi*-1 gene tomato and the susceptible 'Rutgers' tomato at 22 and 33 °C.

Genotype	Reproduction factor[a]			
	22 °C		33 °C	
	Mm	Mi4	Mm	Mi4
BHN 585	7.4 a	0.0 b	8.7 b	3.4 a
BHN 586	15.0 a	0.3 b	9.9 b	4.3 a
'Rutgers'	14.0 a	9.6 a	47.3 a	4.7 a

Means are average of four replicates.
[a]Ratio of the final population density by initial inoculation density.

Table 2. Reproduction factor of *Meloidogyne mayaguensis* and *M. incognita* race 4 on *Mi*-1 gene tomato and the susceptible 'Rutgers' tomato at 26 ± 1.8 °C.

Tomato genotype	Reproduction factor[a]	
	M. mayaguensis	*M. incognita*
'Sanibel'	85.5 b[b]	0.2 b
BHN 543	156.7 a	0.1 b
BHN 585	157.9 a	0.2 b
BHN 586	118.0 ab	0.2 b
'Rutgers'	100.8 b	107.0 a

Means are average of duplicate tests, each with six replicates.
[a]Ratio of the final population density by initial inoculation density .
[b]Means within the same nematode species followed by the same letter do not differ at $P \leq 0.05$.

Table 3. Reproduction factor and egg mass index of *Meloidogyene mayaguensis* (Mm) and *M. incognita* race 4 (Mi4) on root-knot nematode resistant pepper and a susceptible cultivar 'Keystone Resistant Giant' at 24 °C.

Pepper genotypes	Reproduction factor[a]		Egg mass index[b]	
	Mm	Mi4	Mm	Mi4
		Test one		
'Charleston Belle'[b]	79.9 a[c]	0.1 b	5.0 a-	0.0 b
'Keystone Resistant Giant'[b]	34.4 a	81.2 a	5.0 a	4.3 a
		Test two		
Line 9913/2	42.3 a	0.10 b	4.8 a	0.8 b
Sais 97.9001	29.1 a	0.01 b	4.3 a	0.3 b
Sais 97.9008	51.4 a	0.04 b	4.6 a	0.4 b
'Keystone Resistant Giant'	42.6 a	34.80 a	4.2 a	4.0 a

Means are average of duplicate tests, each with four replicates.

[a]Ratio of the final population density by initial inoculation density.

[b]Based on a 0 to 5 scale, with 0 = no egg masses, and 5 = >100 egg masses.

[c]Means within the same nematode species followed by the same letter do not differ at $P \leq 0.05$.