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SCREENING FOR ROOT-KNOT NEMATODE (*MELOIDOGYNE INCOGNITA*) (KOFOID AND WHITE) CHITWOOD RESISTANCE IN CERTAIN LINES OF *LYCOPERSICON ESCULENTUM* MILL. FOR TOMATO IMPROVEMENT IN ST. LUCIA

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INTRODUCTION

It is known that root-knot nematodes (*Meloidogyne* spp.) are widespread on vegetable crops throughout the islands in the Eastern Caribbean. However, there are no published records on the economic importance of the disease to crops in the region. Current research work is in progress in order to investigate the extent to which vegetable crop production can be limited by this disease.

In an attempt to evaluate certain selections throughout the region it was found that there was a severe root-knot nematode problem in St. Lucia. As a result, a breeding programme was established at St. Augustine, to develop nematode resistant lines for tomato production in that island. The programme is aimed at incorporating nematode resistance into commercial tomato selections previously evaluated for high yield in St. Lucia.

This report deals with the screening for resistance within lines derived from crosses involving high yield and nematode resistance.

MATERIALS AND METHODS

The tomato lines used in this investigation were:—

Accession Number	*Variety*	
7	Floralou	high yielding lines but
24	Tecumseh	susceptible to root-knot
35	Urbana	nematode
17	Nemared	resistant to root-knot nematode
H 418	17 × 7	
H 417	17 × 24	F_2 hybrids
H 419	17 × 35	

The origin and development of the Nemared tomato is described in Cordner Thomson & Galcotti (1965). The variety was developed from a breeding programme involving the wild South American tomato *Lycopersicon peruvianum* which is resistant to root-knot nematodes and commercial varieties of *Lycopersicon esculentum*.

Dean & Struble (1953) showed that the root-system of *L. peruvianum* and *L. peruvianum* hybrids were invaded by fewer larvae of M. incognita than those of a susceptible commercial variety, Marglobe.

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Two methods were employed:—

1. Varieties were inoculated with a suspeusion of freshly hatched root-knot nematode larvae.
2. Selected resistant hybrid plants were subjected to further screening by growing them in pots containing soil heavily infested with root-knot nematodes.

Inoculum was prepared in the laboratory by incubating egg masses of *M. incognita* obtained from the roots of Patchoi (*Brassica napus var. chinensis*) in water. The water contained 0.05 per cent Aretan to suppress fungal growth.

Tomato seeds were germinated in sterilised sand. Seedlings were then removed at the cotyledon stage, washed thoroughly and placed in rows of 12 between sheets of moist blotting paper supported by panes of glass 6 inches × 4 inches. These units were placed upright in a water bath. When 4–6 young roots were developed on seedlings they were inoculated by placing one inoculum on each root tip. Each drop contained approximately 20 larvae.

After inoculation the units were returned to the water bath for 48 hours. Roots were then washed thoroughly under gently flowing tap water. Samples of 2 plants per unit were immediately fixed in boiling cotton blue in lactophenol. The roots were then squashed and examined microscopically.

The number of larvae in each root tip were counted (Table 1). The inoculated plants were then carefully placed in 4-inch pots filled with sterilised sand, and were given regular application of a complete nutrient solution for 26 days. They were then carefully removed, and the roots were examined under a binocular microscope. Susceptible plants on which root galls had developed are recorded in Table 3.

The 40 plants of each hybrid variety were then planted out in the greenhouse in 6-inch pots containing nematode infested soil. Some susceptible plants were grown as checks. After 18 days the plants were removed from the soil by careful washing, and plants which had no galls were recorded as resistant.

The experimental design used consisted of a simple randomised block replicated 4 times with 12 seedlings per plot each plot corresponded to one unit.

The experimental data were analysed statistically and significant differences were established by the use of Duncan's multiple range test. (Duncan's 1955).

RESULTS

The results of the microscopic examination of the number of larvae present in the roots fixed 48 hours after inoculation are presented in Table I. Results showed that larvae had penetrated all varieties tested.

TABLE I

The number of larvae in roots of each sample of two plants taken 48 hours after inoculation

Variety	Replications				Total	Mean
	I	II	III	IV		
7 ...	35	92	26	48	201	50.25
17 ...	8	8	2	0	18	4.50
24 ...	45	24	16	22	107	26.75
35 ...	24	34	5	19	82	20.50
H 418 (17 × 7) ...	14	12	12	8	46	11.50
H 417 (17 × 24) ...	4	44	36	16	100	25.00
H 419 (17 × 35) ...	22	56	0	36	114	28.50
Total ...	152	270	97	149	668	
Mean ...	21.71	64.28	13.85	21.28	—	23.8

Coefficient of variation = 62.1%
Standard Error of mean = 7.39%

TABLE II

Analysis of variance

Source of variation	df	ss	m.s.	f	f.05
Total	27	11291.43	—	—	—
Replications	3	2294.00	764.66	3.50	5.41
Varieties	6	5065.93	844.32	3.86	2.66
Error	18	3931.50	218.42	—	—

The results of the analysis of variance indicate that there are significant differences at the 5 per cent level between the number of larvae present in roots of the varieties tested.

The mean number of larvae entering roots ranged from 4.50 to 50.25. Duncan's multiple range test.

Variety — 7	H 419	24	H 417	35	H 418	17
Mean —50.25	28.50	26.75	25.00	20.50	11.50	4.50

The results of the Duncan's multiple range test indicate no significant difference between varieties 17, H 418 and 35, and that significantly fewer larvae entered these varieties than H 417, 24, H 419 and 7.

The numbers of plants showing the presence of mature female root-knot nematodes on roots are given in Table III.

TABLE III

The numbers of plants considered as root-knot susceptible 28 days after inoculation.

Account Number	Replications				Total	Mean
	I	II	III	IV		
7 ...	10	10	10	10	40	10.0
17 ...	0	0	0	0	0	0.0
24 ...	9	10	9	9	37	9.25
35 ...	9	5	6	6	26	6.50
H 418 (17×7) ...	0	2	1	2	5	1.25
H 417 (17×24) ...	3	2	3	1	9	2.25
H 419 (17×35) ...	6	3	3	4	16	4.00
Total	37	32	32	32	133	
Mean	5.28	4.57	4.57	4.57		4.75

Coefficient of variation = 21.4%
Standard error of mean = 0.51

TABLE IV

Analysis of variance.

Spruce of variation	df	ss	ms	f	f.05
Total	27	391.25	—	—	—
Replications	3	2.67	0.89	—	—
Varieties	6	370.00	61.66	59.86	2.66
Error	18	18.58	1.03	—	—

The results of the analysis of variance of the data in Table III indicate that there are highly significant differences between the tomato varieties in their susceptibility to nematode infection.

Duncan's multiple test

Variety —	7	24	35	H 419	H 417	H 418	17
Mean	10.00	9.25	6.50	4.00	2.25	1.25	0.0

The results of the Duncan's multiple range test on the means showed that variety 17 was superior for resistance to root-knot nematode. The results further indicate that the crosses involving the resistant variety 17 was significantly more resistant than their susceptible parent varieties.

The results showing the numbers of hybrid plants which succumbed to infection in heavily infested soil are presented in Table V.

TABLE V

The total number of nematode infested plants for each hybrid variety after screening with nematode infested soil.

Variety	Number Infested plants from a total of 40
H 418	8
H 417	10
H 419	16

The results in Table V indicate that variety H 418 had the least number of infected plants from the total of 40 tested of each variety.

DISCUSSION

The results indicate that there is a factor which controls the entry of larvae into the roots of root-knot nematode resistant plants. These findings are in agreement with those obtained by Dean & Struble, (1953).

Of interest to note, however, is the failure of root-knot development in roots of resistant varieties subsequent to larval entry. Dean & Struble (1953) suggested that this failure was attributed to a localised breakdown of host cells around the nematode larvae. The underlying cause which brings about this condition is not completely understood.

Experimental results have illustrated a simple and relatively reliable method for screening tomato lines for resistance to root-knot nematode (*Meloidogyne incognita*). One aspect that requires considerable investigation is the nature of the nematode inoculum to be used for screening particularly since there is ever increasing evidence for different physiological races within nematode species. The screening and selection of a pure line variety from the most promising hybrid *H* 418 could be carried out in order to obtain a variety combining high yield and nematode resistance.

It also appeared from the results that the character for resistance was more highly heritable in certain crosses than in others.

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