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INTERACTIONS OF *MELOIDOGYNE INCOGNITA, ROTYLENCHULUS RENIFORMIS* AND *TYLENCHORHYNCHUS BRASSICAE* AS COHABITANS ON EGGPLANT

by
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Most experiments on the effect of nematode pathogens on plant growth are done in isolation without considering the interactive effects of other living components of the ecosystem. It is now established that behaviour and effect of plant nematodes in polyspecific communities may be quite different from those in a monospecific community (Norton, 1978).

A survey of nematode problems of vegetable crops in the Aligarh area identified the root-knot nematode, *Meloidogyne incognita* (Kofoid *et* White) Chitw., the reniform nematode, *Rotylenchulus reniformis* Linford *et* Oliveira and the stunt nematode, *Tylenchorhynchus brassicae* Siddiqi as the most frequently occurring nematode pathogens associated with crops of eggplant (*Solanum melongena* L.). Experiments were undertaken to study the effect of mono-pathogen and multi-pathogen systems on the multiplication and sex-ratios of nematodes and on the dry weight of eggplants.

Materials and Methods

Seeds of eggplant cv. Pusa Purple Long were surface sterilized and sown in trays containing autoclaved soil. When 15 days old, the seedlings were transplated into 15 cm clay pots filled with autoclaved soil. A day later the pots were inoculated separately and in combination with second stage juveniles of *M. incognita,* immature females (mixed with males) of *R. reniformis* and juveniles and adults of *T. brassicae,* at the inoculum

levels shown in Tables I and II. Uninoculated pots served as controls. There were 3 replicates of each of the single species treatments and 5 replicates of the two species treatments. The pots were arranged in a randomized block design in a glasshouse at 27-30°C. Sixty days after inoculation the numbers of nematodes in different stages of development in the soil and roots were assessed and the dry weights of the plants were determined.

Results and Discussion

In single species inoculation, *M. incognita*, *R. reniformis* and *T. brassicae* multiplied on eggplant but at different rates (Table I). The rate of multiplication, however, declined with increase in initial inoculum level from 100 to 900 in all three species. *M. incognita* showed the highest and *T. brassicae* the lowest rate of multiplication, with *R. reniformis* in between. The number of males also generally increased with increase in the initial inoculum level. The three nematode species significantly decreased the plant dry weight but without significant differences between initial nematode inoculum levels, with the exception of *M. incognita* where significant decreases of plant dry weight occurred as nematode numbers were increased from 0 to 100 and 100 to 500.

In concomitant inoculations of *M. incognita* and *R. reniformis*, the multiplication rate of both species declined at all combinations when compared with single species at the same level of inoculum (Table II). The reductions were more pronounced for *M. incognita* than *R. reniformis*. At 100 Pi, the Pf/Pi ratio of *M. incognita* in single species inoculations was 19.7 but with 900 Pi of *R. reniformis*, the Pf/Pi ratio of *M. incognita* decreased to 2.3. Similarly, the rate of multiplication of *M. incognita* both at 500 and 900 Pi when combined with 500 and 100 Pi of *R. reniformis* respectively, declined considerably. Similar reductions were observed for *R. reniformis* at all inoculum levels when inoculated with *M. incognita*. Significant increases in the numbers of *R. reniformis* males also occurred. This effect was also more evident for *M. incognita*.

In the combination of *R. reniformis* and *T. brassicae*, the rate of multiplication of *R. reniformis* remained almost unaffected. Multiplication of *T. brassicae* declined, however, in the presence of *R. reniformis* in all combinations. The sex-ratio of both nematode species remained unchanged when compared with the sex-ratio of each species when added alone except at 900 *T. brassicae* + 100 *R. reniformis*, where the sex-ratio of *R. reniformis* increased.

Table I - *Multiplication, sex-ratio and effect on plant growth of single populations of* Meloidogyne incognita, Rotylenchulus reniformis *and* Tylenchorhynchus brassicae.

Initial inoculum (Pi)	Final population (Pf)	Pf/Pi ratio	Male/Female ratio	Dry wt/plant (g)
M. incognita				
100	1968 a	19.7 a	0.05 a	4.0 a
500	7022 b	14.0 b	0.24 b	1.7 b
900	7241 b	8.0 c	0.26 c	1.5 b
R. reniformis				
100	788 a	7.9 a	0.31 a	5.0 a
500	1264 b	2.5 b	0.40 b	4.6 a
900	1994 c	2.2 c	0.50 c	4.4 a
T. brassicae				
100	502 a	5.0 a	0.11 a	5.2 a
500	918 b	1.8 b	0.14 b	5.0 a
900	1086 c	1.2 c	0.31 c	4.7 a
CONTROL (Uninoculated)				8.0

Figures followed by same letter are not significantly different at P=0.05 or P=0.01 according to Duncan's Multiple Range Test. ANOVA and Duncan's Multiple Range Test apply to the individual final populations (Pfs), the reproduction factors (Pf/Pi), male and female ratios and plant weights for MI, RR and TB and not for the total data set in columns.

Table II - *Multiplication, sex-ratio and effect on plant growth of multiple species populations of* Meloidogyne incognita *(MI),* Rotylenchulus reniformis *(RR) and* Tylenchorhynchus brassicae *(TB).*

Initial inoculum (Pi)			Final population (Pf)			Pf/Pi ratio			Male/Female ratio			Dry wt/plant (g)
MI	RR	TB	MI	RR	TB	MI	RR	TB	MI	RR	TB	
100	900		230 a	1125 a		2.3 a	1.2 a		1.20 a	0.52 a		4.5 a
500	500		1524 b	773 b		3.0 b	1.5 a		0.68 b	0.45 b		4.7 b
900	100		1966 c	643 b		2.2 a	6.4 b		1.11 c	1.0 c		4.1 c
	100	900		678 a	900 a		6.8 a	1.0 a		0.50 a	0.24 a	4.6 a
	500	500		1235 b	769 b		2.5 b	1.5 b		0.40 a	0.15 b	5.0 b
	900	100		1964 c	53 c		2.2 b	0.5 c		0.48 a	0.12 b	5.0 b
100		900	1781 a		1098 a	17.8 a		1.2 a	0.42 a		0.26 a	3.2 a
500		500	5944 b		605 b	11.8 b		1.2 a	0.48 a		0.16 b	3.8 b
900		100	6890 c		356 c	7.6 c		3.6 b	0.48 a		0.15 c	2.9 c

Figures followed by same letter are not significantly different at P=0.05 or P=0.01 according to Duncan's Multiple Range Test. ANOVA and Duncan's Multiple Range Test apply to the individual final populations (Pfs), the reproduction factors (Pf/Pi), male and female ratios and plant weights for various combinations of MI, RR and TB and not for the total data set in columns.

In the combination of *M. incognita* and *T. brassicae*, the rate of multiplication of *M. incognita* was adversely affected, but it was comparatively more than the rate in the combination with *R. reniformis*. The rate of population increase of *T. brassicae* also declined to some extent in the presence of *M. incognita* except at 900 *T. brassicae* + 100 *M. incognita* combination when compared with respective levels of single *T. brassicae* inoculations. The sex-ratio of *M. incognita* increased to a great extent; a slight increase in the sex-ratio of *T. brassicae* also occurred.

The plant weight at each combination was particularly low in comparison with the control (Table II). Reduction in plant weight in concomitant inoculations at each combination was comparatively much less than would be expected from the independent effect of the single species at the same level of inoculation. For example, the sum total of reductions in plant weight caused by 100 *M. incognita* and 900 *R. reniformis* in single species inoculations was 7.6 g but in concomitant inoculation with 100 *M. incognita* and 900 *R. reniformis*, the reduction was only 3.5 g which was less than the reduction of each species acting independently. Similar results were obtained for other combinations (Tables I and II).

Meloidogyne incognita achieved the greatest rate of multiplication on eggplant, followed by *R. reniformis* and *T. brassicae*. In single species inoculations, the rate of multiplication declined at higher inoculum levels (500 and 900 Pi) in comparison to the lowest inoculum level (100 Pi). There was a significant increase in the number of males in all three species when Pi was increased from 100 to 500 or from 500 to 900. These effects appeared primarily to be due to competition between the individuals of the same species both at pre-penetration and post-penetration stages.

The interactive effects, in general, were mutually inhibitory in concomitant inoculations which resulted in the population decline of the species and relative increase in plant weight. *M. incognita* and *R. reniformis* suppressed multiplication of each other when they cohabited. The suppression was more for *M. incognita*. This indicates that in such a pathosystem, *R. reniformis* can adapt and compete more effectively than *M. incognita*. The numbers of males of both species increased which is regarded as an adaptation to adverse environmental conditions. The interactive effects of the nematode species which resulted in a lesser reduction in plant weight than expected from the results of single species inoculations was similar to an earlier study where we obtained a similar negative interaction between *M. incognita* and *R. reniformis* (Khan *et al.*, 1985). Concomitant inoculations on tomato resulted in reduced penetration

and multiplication of each species and this reduced the expected level of their adverse effect on plant growth.

In the interactions of *M. incognita* and *T. brassicae*, mutual suppressive effects were evident. Antagonistic interactions of cohabiting species resulted in relative increase in plant weight. Reduction in plant weight due to their cohabiting was less than the sum total of reductions in their single species inoculations. Suppression of *M. incognita* was, however, relatively less than in its cohabitation with *R. reniformis*. These variations are attributable to the mode of parasitism of the cohabiting species and their specific requirements of feeding sites, food and space in such a competitive system.

The initial density of cohabitants, availability of space and food for growing individuals are apparently among vital factors determining the rate of population increase in a multiple species nematode population. Mode of parasitism and host efficiency are other important contributing factors.

SUMMARY

The interactions of *Meloidogyne incognita, Rotylenchulus reniformis* and *Tylenchorhynchus brassicae* on eggplant were studied in pot experiments. In single species inoculations, multiplication of each nematode declined and the proportion of males increased at higher inoculum levels. In concomitant inoculations, mutual inhibition in population increase occurred and sex-ratios were altered. Reduction in plant weight was less in concomitant inoculations than the sum total of reductions in their single species inoculations. However, when *R. reniformis* and *T. brassicae* were together, their sex-ratios remained unchanged and multiplication of *R. reniformis* was not affected.

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