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Interaction Between *Meloidogyne incognita* **and** *Tylenchorhynchus brassicae* **on Tomato.**

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ABSTRACT

Field soils harbour a number of plant parasitic nematodes with different parasitic ability for a host crop. Tomato is one of the most efficient host for *Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, 1949 and also efficient for *Tylenchorhynchus brassicae* Siddiqi, 1961. An observation was made on the interaction of these nematodes, and its effect on population build up using tomato plants. The population dynamics of each species were influenced in almost all combinations by other species sharing the same host plant. The presence of both nematodes together on tomato caused reduction in their rate of multiplication and population build up. In concominant inoculations, when inoculum level of *M. incognita* was kept constant and those of *T. brassicae* was varied, the population of *M. incognita* decreased gradually. There was a gradual increase in the final population of *T. brassicae* with increase in its initial population. But this final population at each level was much below than the population in single inoculations. Reproduction rate of *T. brassicae*, however, exhibited a gradual decline with increase in the initial population.

When inoculum level of *T. brassicae* was kept constant and those of *M. incognita* was varied, in most of the combinations *T. brassicae* could not maintain its initial population. The population of *M. incognita* also decreased and was lower than those obtained in single inoculations. The reproduction rate of *M. incognita*, however, did not show any definite trend.

INTRODUCTION

Plant parasitic nematodes capable of causing well manifested diseases usually occur in polyspecific communities and majority of them are polyphagous. This ecological situation provides opportunities for competition, synergism and other types of interactions between nematodes. Johnson (7) reported an interaction between the three ectoparasites *Tylenchorhynchus martini*, *Criconemoides ornatus* and *Belonolaimus longi-*

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caudatus on bermuda grasses and observed that root damage caused by either of the nematodes was unfavourable for the reproduction of the other species. Ross (14, 15) found an interaction between *Meloidogyne incognita* and *Heterodera glycines* on soybeans in which the population development of root-knot nematode was adversely affected by the cyst nematode whereas the higher inoculum level of root-knot nematode curtailed the development of cyst nematode. Graham *et al.*, (4) and Turner and Chapman (17) observed reduction in population of *Meloidogyne incognita* when alfalfa and red clover were inoculated with *Pratylenchus penetrans.* Jatala and Jensen (6) observed self-interaction in *Meloidogyne hapla* and in *Heterodera schachtii* on *Beta vulgaris.* Sikora *et al.*, (16) recorded an interaction of *Meloidogyne naasi, P. penetrans* and *Tylenchorhynchus agri* on creeping bent grass in which population of *M. naasi* was inhibited. Pinochet *et al.*, (13) reported that population of *Xiphinema index* was suppressed by *Pratylenchus vulnus.*

Meloidogyne incognita (Kofoid & White, 1919) Chitwood, 1949, an endoparasite and *Tylenchorhynchus brassicae* Siddiqi, 1961, an ectoparasite are commonly encountered in mixed population associated with the roots of tomato in Northerm India. No information, however, exists about any interaction between these nematodes on this host. Therefore, attempts were made to study their interaction if any, on tomato plants.

MATERIALS AND METHODS

Seedlings of tomato, *Lycopersicum esculentum* L. were grown in sterilized soil contained in trays in the greenhouse. Pure populations of *Meloidogyne incognita* and *Tylenchorhynchus brassicae* were reared on pepper and cauliflower respectively under greenhouse conditions. Three week old seedlings of tomato were transplanted to 15 cm pots containing sterilized soil.

Inoculum of *T. brassicae* were obtained by isolating its pure population from the rhizosphere soil of cauliflower plants. Egg masses of *M. incognita* from roots of pepper were incubated for hatching in order to obtain the inoculum in larval form.

Table 1 Population build up of *Meloidogyne incognita* and *Tylenchorhynchus brassicae* on tomato in single inoculations.

Inoculum levels	Final Population[a]	Reproduction factor (R)
	Meloidogyne incognita	
100 M[b]	1025	10.2
500 M	1650	3.3
1000 M	3200	3.2
5000 M	20395	4.0
L.S.D. at 5% level	132.54	
	Tylenchorhynchus brassicae	
100 T[c]	1175	11.7
500 T	1820	3.6
1000 T	2740	2.7
5000 T	8235	1.6
L.S.D. at 5% level	335.62	

[a] Figures represent mean of five replicates.
[b] M = *Meloidogyne incognita* larvae.
[c] T = *Tylenchorhynchus brassicae.*

Table 2 Population build up of *Meloidogyne incognita* and *Tylenchorhynchus brassicae* on tomato in concomitant inoculations.

Inoculum levels	Final population[a] of *M. incognita*	Reproduction factor (R)	Final population[a] of *T. brassicae*	Reproduction factor (R)
5000 M[b] + 100 T[c]	13285 (20395)[d]	2.6	625 (1175)[d]	6.2
5000 M + 500 T	8625 (20395)	1.7	1330 (1820)	2.6
5000 M + 1000 T	8300 (20395)	1.6	2400 (2740)	2.4
5000 M + 5000 T	6050 (20395)	1.2	5235 (8235)	1.0
L.S.D. at 5% level	558.39		312.78	
5000 T + 100 M	145 (1025)	1.4	2015 (8235)	0.4
5000 T + 500 M	615 (1650)	1.2	3587 (8235)	0.6
5000 T + 1000 M	2780 (3200)	2.7	4150 (8235)	0.8
5000 T + 5000 M	6050 (20395)	1.2	5235 (8235)	1.0
L.S.D. at 5% level	112.26		435.23	

[a]Figures represent mean of five replicates.
[b]M = *Meloidogyne incognita* larvae.
[c]T = *Tylenchorhynchus brassicae.*
[d] = Figures in parenthesis represent the final population obtained in single inoculations.

Pots were inoculated with different inoculum levels of both nematodes alone and in different combinations (Table 1, 2). Counting of the nematodes was done under stereomicroscope. Two experiments were set. In one, 5 replicate pots with one tomato seedling in each were inoculated either with 100, 500, 1000 and 5000 nematodes of each species separately. For inoculations adults of *T. brassicae* and second stage larvae of *M. incognita* were used. In another experiment in which concomitant inoculations of both species were made in different combination, in one set inoculum level of *M. incognita* was maintained at 5000 larvae per pot and inoculum levels of *T. brassicae* were varied (i.e. 100, 500, 100 and 5000) Table 2). Similarly in the other set, inoculum level of *T. brassicae* was maintained at 5000 nematodes per pot and inoculum levels of *M. incognita* was varied (i.e. 100, 500, 1000 and 5000) (Table 2). There were five replicates for each inoculum level combinations. Pots were held at the greenhouse benches for 45 days.

After 45 days, population of nematodes in soil and roots from each replicates of single or combined inoculations were estimated. Reproduction factor was calculated by the following formula:

$$R = \frac{P_f}{P_i}$$

where R = Reproduction factor; P_f = Final population; and P_i = Initial population. Data were statistically analysed for significance.

RESULTS AND DISCUSSION

Multiplication of nematodes in single inoculations:

The results obtained are summarized in Table 1. When seedlings were inoculated with different inoculum levels of *M. incognita*, the final population showed gradual increase with the increase in the initial inoculum level. The nematode multiplied vigorously and increased its population. The rate of multiplication as reflected in the reproduction factor was much higher when the inoculum level was at 100. However, it decreased when the inoculum levels were raised further (Table 1).

T. brassicae showed similar behaviour as in case of *M. incognita* (Table 1).

These results indicate that availability of limited feeding sites within the root or on the root surface to a large number of feeding individuals reduced the rate of population growth as a result of competition and resultant population remained at low level. However, the increase in population, when low inocula were used, could be due to the availability of nutrition promoting the growth and multiplication of nematodes.

Multiplication of the nemotodes in concomitant inoculations

When concomitant inoculations were made keeping the inoculum level of *M. incognita* constant at 5000 and varying the inoculum levels of *T. brassicae*, the population of *M. incognita* decreased in proportion with a gradual increase in the inoculum levels of *T. brassicae* (Table 2). The suppression in the rate of multiplication of *M. incognita* was directly related to the number of individuals of *T. brassicae* co-inhabiting on the same root. The reproduction factor of *M. incognita* showed a definite gradual declining trend (Table 2). On the other hand, *T. brassicae* was also suppressed. Its final population was comparatively much lower at each level than those obtained in single inoculations. Although, there was a gradual increase in its final population with an increase in its initial inoculum level, the reproduction factor, however, showed a progressive declining trend (Table 1, 2). This suppression in the rate of multiplication may be attributed to the two factors — firstly, the competition for nutrition offered by *M. incognita* infesting the same root and secondly competition between the individuals of *T. brassicae* for feeding sites and nutrition — operating simultaneously. It becomes evident when the reproduction factor of 100 individuals of *T. brassicae* and those of 500 *T. brassicae* when inoculated in combination with 5000 larvae of *M. incognita* are compared. It was suggested by Gay and Bird (3) that the population of one species in suppressed in the presence of another nematode if the host is susceptible.

When the inoculum level of *T. brassicae* was maintained at 5000 and inoculum level of *M. incognita* was varied, the final population of *T. brassicae* showed a decrease and could not maintain its initial populations except in one combination. However, gradual increase in the inoculum of *M. incognita* resulted in a corresponding increase in the final *T. brassicae* population. The reproduction factor also gradually increased (Table 1, 2). This trend was reverse of that demonstrated by *M. incognita*. It is hard to provide any plausible explanation for this reverse trend except that its mode of parasitism differs from that of *M. incognita*. In these combined inoculations, the population of *M. incognita* was also suppressed. In combination with 5000 *T. brassicae*, 100 larvae of *M. incognita* could produce 145 individuals and 500 larvae only 215 in comparison to 1025 and 1650 respectively in single inoculations. Even the population obtained with 5000 larvae in simultaneous inoculation was much lower than those obtained in single inoculation. The reproduction rate did not show a definite trend. It slightly decreased at 500 inoculum level and then abruptly increased at 1000 level. Then again it showed an abrupt decline at 5000 level (Table 1, 2). It seems that at 100 and 500 inoculum levels, *M. incognita* could not resist the competition offered by 5000 individuals of *T. brassicae* but at 1000 level it could resist and multiplied at higher rate. But again at 5000 level the decrease in rate of multiplication may be attributed to the competition with *T. brassicae* as well as to the crowding effect. It has been suggested that in concomitant or sequential exposures of two plant parasitic nematodes reduction in the number of one or both of the associates may be to competition for feeding sites and available nutrition (2).

It is evident from the results that there existed some sort of interaction between the two nematodes. The presence of one species adversely influenced the population of the other. The suppression in the nematode population in co-inhabiting situations obtained herewith are similar to the results reported for certain other nematodes. *Heterodera tabacum* is reported to reduce the infection and survival of *P. penetrans* and *Tylenchorhynchus claytoni* on tobacco plant (12). The population of *M. naasi* was inhibited in an interaction between *M. naasi, P. penetrans* and *T. agri.* (16). Miller and McIntyre (11) and McIntyre and Miller (10) reported that *T. claytoni* inhibits the penetration of *P. penetrans* on tobacco. Hasan and Alam (5) obtained suppression of *M. incognita* population by *Hoplolanimus indicus* on tomato. Similarly *M. incognita* was suppressed by *Pratylenchus scribneri, Trichodorus christiei* and *Hemicyliophora* sp. (18). Reproduction rate of *Paratylechus projectus* was recorded to be reduced when it was inoculated in combination with *Helicotylenchus pseudorobustus* and *Criconemoides similis* on soybean (9). Pinochet *et al.*, (13) obtained suppression in population of *X. index* by *P. vulnus.*

The present findings, however, are not in conformity with the observations of Johnson and Nusbaum (8) who obtained greater population of *Pratylenchus zeae* on some corn varieties in presence of *T. christiei* than alone and those of Chapman (1) who reported that the population of *T. martini* increased in combination with *P. penetrans* and *P. penetrans* was not affected.

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التأثير المتداخل لكل من أنواع النياتودا
Meloidogyne incognita, Tylenchorhynchus brassicae
على نبات الطماطم

د. محمد واجد خان ، سلطان الحق

المستخلص

تعتبر التربة الزراعية بيئة صالحة للعديد من النياتودا المتطفلة على النبات . وتختلف أنواع النياتودا في قدرتها التطفلية على المحصول العائل . ويعتبر نبات الطماطم من أهم العوائل لأنواع النياتودا
Meloidogyne incognita, Tylenchorhynchus brassicae

وقد أجريت دراسة على التأثير المشترك لهذين الطفيليين على نبات الطماطم من ناحية ديناميكية تعداد كل من النوعين في حالة وجودها معا على نفس النبات العائل . وقد لوحظ أن وجودها معا بنسب مختلفة بسبب تنافس بينها فيتأثر تعداد كل منها بالآخر في جميع الأحوال مسببا انخفاضًا من معدل زيادة التعداد في كلا النوعين ، وبالتالى قلة التعداد الكلى للطفيليين .