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INTERACTION BETWEEN *MELOIDOGYNE INCOGNITA* AND *FUSARIUM OXYSPORUM F. SP. LENTIS* ON LENTIL

by
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Summary. The interaction between *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. *lentis* on lentil (*Lens culinaris*) was studied using various combinations of each pathogen. Individually, *F. oxysporum* f. sp. *lentis* was the most aggressive pathogen. At all combinations, reduction in growth parameters in concomitant inoculation was greater than the additive of the pathogens acting independently, thus showing a synergistic relationship. Rate of nematode multiplication and galling in the presence of fungus were significantly reduced.

Concomitant occurrence of *Meloidogyne* and *Fusarium* spp. has been found in the soil but there is no report of their interaction in lentil (*Lens culinaris* Medic.). In this work the effect of *M. incognita* (Kofoid et White) Chitw. and *F. oxysporum* f. sp. *lentis* (Vasudeva and Srinivasan) Gordon in various combinations on plant growth and nematode multiplication is investigated.

Materials and methods

Seedlings of lentil (cv. Lens 830) were raised in 15 cm clay pots containing 1 kg autoclaved potting mixture (soil: farmyard manure, 3:1 ratio) from surface sterilized seeds (0.1% mercuric chloride) subsequently treated with *Rhizobium* (lentil strain). After germination one healthy seedling per pot was retained.

Meloidogyne incognita inoculum was obtained from a pure culture maintained in a glasshouse on egg plant in greenhouse. Freshly hatched second stage juveniles (J_2) used for inoculation were obtained by incubating egg masses in 9 cm Petri dishes containing distilled water and incubated at 25 °C. One week old seedlings were inoculated with 1000 J_2 per pot (P_i) by pipetting the nematode suspension into depressions made in the soil around the root zones of the seedlings.

The fungus, *F. oxysporum* f. sp. *lentis* was cultured on potato dextrose agar (PDA) slopes. For mass production the fungus was grown in Richard's liquid medium (Riker and Riker, 1936) for 15 days at 28±2 °C to obtain mycelium. A mycelial suspension was prepared by blending 100g of mycelial mat in 1000 ml distilled water so that 10 ml of suspension consisted of approximately 1 g mycelium for application. The mycelial suspension was poured into depressions made in the soil around the root system of the seedlings at the rate of 2 g per seedling.

The experiment was designed according to the scheme indicated in Table I, carried out in a completely randomised design with three replicates per treatment, and discontinued after 2 months. Plants from each treatments were uprooted and rinsed free of. soil. The following parameters were considered: (i) dry shoot weight, (ii) nodule number per plant, (iii) pod number per plant, (iv) number of galls per plant, and (v) rate of nematode multiplication (R_f). For determining the rate of nematode multiplication, total population (root + soil) was counted (Southey, 1986) and R_f was calculated from the formula given by Oostenbrink (1966). The data obtained were analysed statistically.

Results and discussion

Inoculation of lentil seedlings with either *M. incognita* or *F. oxysporum* f. sp. *lentis* significantly (P=0.05) reduced the dry shoot weight, nodule number and yield (as indicated by number of pods per plant) compared with the uninoculated control (Table I). The pathogenic effect of *F. oxysporum* f. sp. *lentis* was greater than *M. incognita*. Dry shoot weight, nodule number and yield were significantly reduced by each combination of concomitant inoculations in comparison to the uninoculated control. Reduction in concomitant inoculations at each combination was comparatively greater than the sum total of reductions caused by single species inoculation. For example, the sum total

TABLE II *Interacton between* Meloidogyne incognita *and* Fusarium oxysporum *f. sp.* lentis *on lentil.*

Treatment	Dry shoot weight (g)	Nodules/Plant	Pod/Plant	Nematode Multiplication $R_f=P_f/P_i$	Galls/Plant
Control	2.9	58.4	20.6	–	–
Nematode alone	2.4	46.3	15.3	8.7	69
	(17.4)	(20.7)	(25.7)	–	–
Fungus alone	2.2	43.3	13.8	–	–
	(24.1)	(25.8)	(33.0)	–	–
Nematode + Fungus Simultaneously	0.1	22.6	7.3	4.9	36
	(75.8)	(61.3)	(64.5)	(43.6)	(47.8)
Nematode + Fungus 7 days later	0.6	20.9	6.9	5.2	41
	(77.7)	(64.2)	(66.5)	(40.2)	(40.5)
Fungus + Nematode 7 days later	0.9	25.4	8.1	4.1	28
	(66.6)	(56.5)	(60.6)	(52.8)	(59.4)
C.D. 5%	0.39	8.2	4.4	**1.1**	10.2

Figure in parenthesis indicates per cent reduction with respect to control.

of reduction in dry shoot weight caused by *M. incognita* and *F. oxysporum* f. sp. *lentis* in single species inoculation was 1.2 g whereas, in simultaneous inoculation with both the pathogen was 0.7 g. The same was true for other combinations as well as for other parameters (Table I).

Amongst concomitant inoculations, reduction in dry shoot weight was maximum (78%) when nematode inoculation preceeded fungus by seven days; on the other hand, the reduction was minimum (67%) when fungus inoculation preceeded nematode inoculation by seven days. The same was true for other parameters.

Host infestation by the nematode, as evident from reproduction (R_f) and root galling, was maximum when the nematode occurred alone. In the presence of fungus, in all the combinations, reproduction and root galling was significantly reduced in comparison with nematode alone. Prior inoculation with the fungus was comparatively more inhibitory to nematode multiplication and galling compared with fungus inoculation after that of the nematode or when the two pathogens were inoculated simultaneously.

Significant (P=0.05) damage due to pathogenic infection of lentil and high nematode multiplication in single species inoculation suggest that lentil is a good host for *M. incognita* and *F. oxysporum* f. sp. *lentis*.

It appears that nematode infestation acted as a predisposing agents as there was significantly greater reductions when nematode infection preceeded fungus or in simultaneous inoculations. Lesser damage in plants infected with fungus succeeded by nematode is understandable, as it is likley that by the time the plants were inoculated with nematode the fungus had sufficient time to colonize the cortex, making it less suitable for nematode attack or the fungus metabolities produced adverse effect on the nematode or affected the feeding cells.

Significant reduction in nodule number in single species as well as in various combinations of concomitant inoculations might have been due to the formation of *Meloidogyne* galls thus occupying space in the roots (Barker and Hussey, 1976) and/or destruction of root tissues by the fungus or due to inhibitory effect of toxic substances of nematode and/or fungus origin on *Rhizobium* or due to interruption in translocation by the nematode and/or fungus.

Decrease in the rate of nematode multiplication and galling in the presence of fungus shows antagonistic effect of the fungus on the development and reproduction of nematode. This can be ascribed to the possible toxic effect of fungal metabolities on nematode. Reduced nematode multiplication in the presence of *F. oxysporum* f. sp. *lentis* might also be due to destruction of root tissue by the fungus before the completion of nematode life cycle or because of certain physiological and biochemical changes in the host as a result of nematode and fungus interaction.

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