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EFFECT OF DIFFERENT INOCULUM LEVELS OF *MELOIDOGYNE INCOGNITA* ON THE GROWTH OF PEA IN THE PRESENCE AND ABSENCE OF *RHIZOBIUM*

by
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Summary. Effect of five different inoculum levels (500, 1000, 2000, 4000 and 8000 juveniles) of *Meloidogyne incognita* were studied in the presence and absence of *Rhizobium* on *Pisum sativum*. Progressive decrease in plant growth was observed with the increase in the inoculum level of *M. incognita* but the damage caused by nematodes was more in unbacterized plants than in bacterized ones. The damage threshold level of *M. incognita* was found to be 1000 juveniles per kg soil in unbacterized plants and 2000 juveniles in bacterized plants. Nematode multiplication was density dependent. Nematode multiplication was reduced in presence of *Rhizobium*.

In India pea (*Pisum sativum* L.) is susceptible to *Meloidogyne incognita* (Kofoid *et* White) Chitw. which is a serious constraint for its successful cultivation. Crop losses in pea attributed to root-knot nematodes range between 20 and 50% (Reddy, 1985; Upadhyay and Dwivedi, 1987; Sharma, 1989).

In the present study an attempt was made to determine the damage threshold level of *M. incognita* on pea using different inoculum levels both in the presence and absence of *Rhizobium*.

Materials and methods

Seeds of pea cv. Arpana were surface sterilized with 0.1% mercuric chloride solution for 2 minutes then washed three times in sterilized water. Half of the seeds were treated with the pea strain of *Rhizobium* before sowing. Inoculated and uninoculated seeds were sown separately at five seeds per pot in 15 cm diameter pots containing 1 kg steam sterilized sandy loam soil mixed with washed river sand and farm yard manure in the ratio of 3:2:1 (V/V), respectively. One week after germination, pots were inoculated in the root zone with 0, 500, 1000, 2000, 4000 and 8000 J2 of a population of *M. incognita* reproduced on egg plants from a single egg-mass collected in a pea field. Each treatment was replicated five times. Pots were placed randomly on a glasshouse bench maintained at 16±2 °C and watered as needed.

The experiment was terminated 90 days after inoculation. Data were recorded on plant height, fresh and dry weight, number of rhizobia nodules, number of galls and nematode density. Nematodes in the soil were extracted by Cobb's sieving and decanting technique followed by Baermann funnel. Numbers of juveniles, eggs and females were estimated by taking a 1g root sample from a homogenous mixture and comminuted for 45 seconds in a Waring blender. Nematode population density in the roots was also calculated. Data were analysed statistically using bifactorial analysis of variance with ANOVA.

Results and discussion

Individually *M. incognita* and *Rhizobium* had a significant effect on plant height, plant fresh and dry weight, while the interaction effect of *M. incognita* and *Rhizobium* was significant only on shoot length (Table I). There was a significant reduction in plant growth of unbacterized plants only with inocula of 1000 or more second stage juveniles of *M. incognita*. However, there was a significant reduction in plant growth of bacterized plants when 2000 or more second stage juveniles of *M. incognita* per kg soil were introduced. Plant growth progressively decreased with the increase in the inoculum level of *M. incognita* in both bacterized and unbacterized plants. Damage caused by *M. incognita* was more in unbacterized plants than in bacterized plants. The damage threshold level of *M. incognita* was calculated as 1000 juveniles per kg soil in unbacterized and 2000 juveniles in bacterized plants.

Individual and interaction effect of *M. incognita* and *Rhizobium* on nodulation was significant (Table I). There were few modules in unbacterized plants and high nodulation in bacterized ones. A significant reduction in nodulation occurred with increase in the inoculum level of *M. incognita*. All the inoculum levels of *M. incognita* caused significant reduction in nodulation, especially in bacterized plants.

TABLE I - *Effect of different inoculum levels of* Meloidogyne incognita *on pea growth and nodulation in presence and absence of* Rhizobium.

Treatment	Plant height (cm)		Plant fresh wt. (g)		Plant dry wt. (g)		No. of nodules	No. of galls per root system	Nematode population (x1000)
	Shoot	Root	Shoot	Root	Shoot	Root			
Control	45.5	26.5	30.65	3.60	4.19	0.70	10	–	–
M. incognita (MI) 500	42.7	22.9	28.85	3.33	4.01	0.63	9	20	3.6
MI 1000	37.6	20.0	25.88	2.93	3.42	0.50	6	42	6.0
MI 2000	32.4	16.1	20.15	2.30	2.91	0.37	3	69	8.8
MI 4000	26.6	12.6	15.85	2.20	2.22	0.26	1	88	11.7
MI 8000	21.0	9.1	11.08	2.43	1.55	0.22	0	133	14.1
Control+Rhizobium (Rh)	50.3	31.6	33.65	4.00	4.67	0.89	45	–	–
MI 500+Rh	48.6	28.6	32.05	3.98	4.41	0.82	39	14	2.9
MI 1000+Rh	46.2	26.3	30.35	3.75	4.29	0.77	34	36	5.1
MI 2000+Rh	39.7	21.7	25.73	3.20	3.79	0.73	25	58	7.8
MI 4000+Rh	33.0	16.8	21.15	3.00	3.00	0.48	16	77	9.9
MI 8000+Rh	26.2	12.6	16.05	3.00	2.14	0.29	9	107	12.5
C.D. 5%	4.3	2.4	3.57	1.32	0.42	0.14	4	9	0.7
F value for									
Rhizobium	54.3	112.2	37.9	119.58	60.12	44.17	939.7	44.2	51.8
M. incognita	72.2	139.6	68.4	45.42	93.21	29.17	98.1	369.2	489.3
Rhizobium x *M. incognita*	10.7	N.S.	N.S.	N.S.	N.S.	N.S.	29.7	4.0	N.S.

N.S. = Not significantly different at P = 0.05.

Individual and interaction effect of *M. incognita* and *Rhizobium* was found significant on galling while the interaction effect of *M. incognita* and *Rhizobium* was insignificant on nematode density (Table I). There was an increase in number of galls and nematode density with the increase in the inoculum of *M. incognita*. Nematode multiplication was found density dependent i.e. highest being at the lowest and lowest at the highest inoculum. There was reduction in galling and nematode multiplication in the presence of *Rhizobium*.

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