Nematol. medit. (1992), *20*: 189-191

Nematology Laboratories, Department of Botany, Aligarh Muslim University, Aligarh - 202 002, India

EFFECT OF DIFFERENT INOCULUM LEVELS OF *MELOIDOGYNE INCOGNITA* RACE 3 ON THE GROWTH OF CHICKPEA

by
Z. A. SIDDIQUI and I. MAHMOOD

Summary. The growth and nodulation of chickpea (*Cicer arietinum*) plants progressively decreased as the inoculum level of *Meloidogyne incognita* race 3 increased. Significant reduction in dry shoot weight occurred with an inoculum of 2000 or more second stage juveniles of *M. incognita*. Peroxidase activity and protein contents were high in *M. incognita* inoculated plants compared with uninoculated controls. Maximum peroxidase activity was observed when plants were inoculated with 2000 juveniles and was correlated with economic threshold level.

Siddiqui and Husain (1992) evaluated resistance/susceptibility of chickpea (*Cicer arietinum* L.) cultivars on the basis of percentage increase in peroxidase activity and protein contents of plants infected by *Meloidogyne incognita* (Kofoid *et* White) Chitw. In the present paper we studied the effect of different inoculum levels of *M. incognita* race 3 on peroxidase activity and protein content of chickpea plants. Peroxidase is a key enzyme for lignin synthesis and other terpenoids involved in phytoalexin production. It also catalyzes several reactions, including those involved in the matabolism of phenols and indoles. Protein content of galled roots has been used as an index of root-knot nematode infestation in okra plants (*Abelmoschus esculentus* Moench.) by Chatterjee and Sukul (1981).

Materials and methods

Seeds of chickpea cv. P-256 were surface sterilized with 0.1% mercuric chloride for 2 minutes, washed three times in distilled water and then treated with the chickpea strain of *Rhizobium* before sowing. Five bacterilized seeds were sown in 15 cm diam. earthen pots containing 1 kg steam sterilized soil. After germination the seedlings were thinned to one per pot. One week after germination seedlings were inoculated with 500, 1000, 2000, 4000 or 8000 second stage juveniles of the root-knot nematode.

M. incognita was collected from a chickpea field and multiplied on egg-plants (*Solanum melongena* L.) using a single egg-mass. It was identified as race 3 using host differential tests (Taylor and Sasser 1978). Egg masses were hand picked using sterilized forceps and freshly hatched juveniles were inoculated around the root system. Each treatment was replicated six times (three replicates for dry weight and three for peroxidase and protein) and watered whenever needed. The experiment was terminated 90 days after inoculation. Dry weight of roots and shoots, number of galls, nodules and final nematode density were recorded. The nematode population was extracted per pot by Cobb's sieving and decanting technique and counted. The roots were cut into small pieces and mixed homogenously. One g root was comminuted for 45 seconds in a blender and juveniles, eggs and females were counted. Data were analysed statistically.

Peroxidase activity of control and inoculated plants (5 days after inoculation) was determined by the method of Change and Maehly (1955). A calibrated standard curve was plotted by graded concentration of pure purpurogallin. The specific acitivity of peroxidase was calculated by purpurogallin formed/mg protein/minute. Protein was estimated by the method of Lowry *et al.* (1951) and amount of protein was determined from the standard curve using serum albumin.

Results

Plant growth progressively decreased with the corresponding increase in the inoculum level of *M. incognita* (Table I). Significant reductions in dry shoot weight with respect to control were found only when 2000 or more second stage juveniles of *M. incognita* per kg soil were inoculated. The largest reduction was observed in plants receiving the highest inoculum; root nodulation decreased considerably due to parasitism of *M. incognita*. Significant reduction in nodulation was observed when

TABLE I - *Effect of different inoculum levels of* Meloidogyne incognita, *race 3 on dry weight, nodulation and nematode multiplication on chickpea.*

Inoculum densities	Dry Wt. (g)		No. of nodules	Nematode Population (10^3)	No. of galls	% reduct. in dry shoot wt.	% reduct. in nodulation	Reproduction factor
	Shoot	Root						
Control	6.3	1.8	34	–	–	–	–	–
500	5.7	1.7	25	19.4	180	9.5	26.5	38.8
1000	5.2	1.6	22	31.3	225	17.3	35.3	31.3
2000	4.7	1.3	19	44.3	302	25.4	44.1	22.2
4000	4.2	1.0	17	54.7	417	35.3	50.0	13.7
8000	3.5	0.9	13	73.1	506	44.4	61.8	9.1
L.S.D. P = 05	1.1	0.2	7	0.6				
L.S.D. P = 01	1.6	0.3	9	0.8				

plants were inoculated with 500 or more juveniles of *M. incognita* (Table I). Maximum nematode multiplication (38.9 times) occurred at the lowest (500 juveniles) and minimum (9.1 times) at the highest (8000 juveniles) inocula levels.

Protein content in both the shoot and root increased with increase in inoculum level of *M. incognita* (Table II). The amount of protein was more in the shoot than in the root but percentage increase in protein due to *M. incognita* was more in the roots than in the shoots. Inoculation with 1000 juveniles produced a significant increase in protein in both shoot and root at P = 0.1.

Peroxidase activity increased when 500-1000 *M. incognita* juveniles were inoculated (Table III) but there was no further increase in peroxidase activity both in shoot and root after the increase of the inoculum. Significant increases in peroxidase in root and shoot were found when 500 and 1000 juveniles were inoculated respectively.

Conclusion

In the present study the economic threshold of *M. incognita* race 3 was found at 2000 juveniles per kg soil. The parasitic activity of the nematode adversally affected nodulation and there was an increase in the number of galls and final nematode density with the increase in the inoculum level.

In our study increase in inoculum level resulted in increase of protein content of root and shoot but percentage increase was more in the root than in the shoot.

There was progressive increase in peroxidase acitivity with the increase in the inoculum level up to 2000 juveniles.

TABLE II - *Effect of different inoculum levels of* M. incognita *on buffer soluble protein content.*

Inoculum densities	Buffer soluble protein (mg) in one g shoot (fresh weight)	% increase in shoot	Buffer soluble protein (mg) in one g root (fresh weight)	% increase in root
Control	37.078	–	6.750	–
500	33.660	1.8	7.145	5.9
1000	34.623	4.7	7.342	8.8
2000	35.611	7.7	7.692	14.0
4000	36.015	8.9	7.974	18.1
8000	36.399	10.0	8.211	21.4
L.S.D. P = 05	0.489		0.253	
L.S.D. P = 01	0.696		0.359	

TABLE III - *Effect of different inoculum levels of* M. incognita *on peroxidase activity.*

Inoculum densities	Peroxidase activity (unit/mg protein/minute) in shoot	% increase in shoot	Peroxidase activity (unit/ mg protein/ minute) in root	% increase in root
Control	0.138	–	0.418	–
500	0.141	2.2	0.468	12.0
1000	0.146	5.8	0.490	17.2
2000	0.148	7.2	0.496	18.7
4000	0.148	7.2	0.473	13.2
8000	0.147	6.5	0.462	10.5
L.S.D. P = 05	0.005		0.016	
L.S.D. P = 01	0.007		0.022	

Literature cited

CHANCE B. and MAEHLY A. C., 1955. Assay of catalases and peroxidases. In: *Methods in Enzymology* Vol. 2, Eds. S. P. Colowick and M. O. Kaplan, Academic Press N. Y. 773 pp.

CHATTERJEE A. and SUCUL N. C., 1981. Total protein content of galled roots as an index of root-knot nematode infestation in lady's finger plants. *Phytopathology, 71*: 372-374.

LOWRY O. H., ROSENBROUGH N. J., FARR A. L. and RONDALL R. J., 1951. Protein measurement with Folin phenol reagent. *J. Biol. Chem., 193*: 265-275.

SIDDIQUI Z. A. and HUSAIN S. I., 1992. Response of twenty chickpea varieties to *Meloidogyne incognita* race 3. *Nematol. medit., 20*: 33-36.

TAYLOR A. L. and SASSER J. N., 1978. *Biology, identification and control of root-knot nematodes (Meloidogyne species)*. Depart. Pl. Path. Raleigh N. C., North Carolina St. Univ. USAID, North Carolina State Graphics, 111 pp.

Accepted for publication on 12 May 1992.