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EFFECT OF ROOT-KNOT AND RENIFORM NEMATODES ALONE AND IN COMBINATION ON THE GROWTH OF PIGEONPEA

by
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Summary. An increase in the inoculum level of *Meloidogyne incognita* and *Rotylenchulus reniformis* resulted in a relative decrease in plant growth parameters and bulk-density of pigeonpea stems. *M. incognita* caused greater reduction than *R. reniformis* at the same inoculum level. In concomitant inoculation of *M. incognita* and *R. reniformis* there was greater suppression in plant growth and bulk density of pigeonpea stems. The suppression in concomitant inoculations was less than the sum of the suppression caused by the same levels of inoculations of the individual species. The multiplication rate of the nematodes decreased as the inoculum level increased. The results also suggest competition for feeding sites between the two nematode species. The multiplication rate of one species progressively decreased with the increase in the inoculum level of the other nematode.

A survey conducted in the Aligarh district revealed the presence of the root-knot nematode, *Meloidogyne incognita* (Kofoid *et* White) Chitw., and the reniform nematode, *Rotylenchulus reniformis* Linford *et* Oliveira, on pigeonpea, *Cajanus cajan* (L.) Hutho. Pathogenicity tests have shown that these nematodes can cause significant damage to the crop (Anver, 1990). Therefore this study was undertaken to determine the damaging potential of *M. incognita* and *R. reniformis* on pigeonpea at different inoculum levels and in single or concomitant inoculation.

Materials and methods

Clay pots (15 cm diam.) were filled with 1 kg soil (clay, sand and compost mixture in the ratio of 7:2:1) and then autoclaved. Four surface sterilized and *Bradyrhizobium* sp. treated seeds of pigeonpea cv. Prabhat Line were sown in the pot. Three weeks after emergence plants were thinned to one per pot and inoculated with either *M. incognita* (2nd stage juveniles) or *R. reniformis* (immature females) individually or concomitantly at different inoculum levels and combinations (Table I). Uninoculated plants served as control. There were six replicates for each inoculum level and the uninoculated control. Pots were randomized on a glasshouse bench at 28-30 °C temperature and watering was done as required.

The experiment was terminated three months after inoculation. Plant roots were removed and thoroughly washed in running water. Water absorption capability of roots was determined by the method described by Alam *et al.* (1974). The chlorophyll content of leaves was determined by the method of Hiscox and Israelstam (1979). Total number of root nodules were counted per root system. The bulk density of dried stems was calculated by dividing the weight (g) by the volume (cm^3) (Jain *et al.*, 1986).

The extent of root-knot infection at harvest was assessed by counting root galls per root system. Final soil populations (Pf) of the renif-

TABLE I - *Effect of* Meloidogyne incognita *and* Rotylenchulus reniformis *alone or in combination on final nematode densities, root galls, root nodulation and plant growth of pigeonpea cv. Prabhat.*

Treatment		Length (cm)		Dry weight (g)		Bulk density		No. of pods/ plant	No. of root nodules /plant	Chlorophyll content (mg/g)			No. of root galls/ plant	No. of female of *R. reniformis*/pot (Pf)	Water absorbed /plant (g/day)
Mel	Rot	Total	% reduction	Total	% reduction	gcm^{-3}	% reduction			Chl.a	Chl.b	Total (a+b)			
Control	–	110.5	–	9.4	–	0.28	–	12	80	1.58	0.94	2.52	–	–	30.8
50	–	105.0	4.9	8.5	9.5	0.27	3.5	11	76	1.53	0.92	2.45	15	–	29.5
500	–	97.5	11.7	6.7	28.7	0.25	10.7	7	65	1.32	0.87	2.19	75	–	25.0
5000	–	74.0	33.0	4.5	52.1	0.19	32.1	5	46	1.10	0.73	1.83	130	–	18.5
–	50	108.0	2.2	8.7	7.4	0.27	3.5	12	78	1.53	0.94	2.47	–	700	30.0
–	500	100.0	9.5	6.9	26.5	0.26	7.1	9	66	1.36	0.88	2.24	–	2582	26.2
–	5000	82.0	25.7	5.3	43.6	0.20	28.5	6	51	1.19	0.78	1.97	–	18002	19.2
50		104.0	5.8	8.0	14.8	0.26	7.1	10	71	1.51	0.89	2.40	13	612	29.0
50	5000	91.0	17.6	6.4	31.9	0.24	14.2	8	60	1.41	0.85	2.26	11	2325	25.5
50	50	80.5	27.1	5.2	44.6	0.19	32.1	5	50	1.31	0.75	2.06	9	16523	18.8
500	500	84.5	23.5	6.4	31.9	0.24	14.2	7	57	1.30	0.81	2.11	70	508	24.6
500	5000	78.5	28.9	5.8	38.2	0.23	17.8	6	50	1.23	0.79	2.02	61	2085	23.0
500	50	75.0	32.1	4.7	50.0	0.18	35.7	5	46	1.15	0.75	1.90	42	14126	17.0
5000	500	71.0	35.7	4.3	54.2	0.18	35.7	5	43	1.06	0.69	1.75	125	362	17.1
5000	5000	66.3	40.0	4.0	57.4	0.17	39.2	3	38	0.90	0.60	1.50	100	1792	16.2
5000	50	50.0	54.7	2.2	76.5	0.13	53.5	2	26	0.80	0.48	1.28	78	10025	13.4
C.D. (P = 0.05)	500 5000		8.98	2.17		0.02		1.56	7.79			0.30			2.57
C.D. P = 0.01)			10.31	2.49		0.03		1.79	8.94			0.35			2.96

Mel = *Meloidogyne incognita* (J_2); Rot = *Rotylenchulus reniformis*.

orm nematode were determined for each treatment by Cobb's sieving and decanting and the modified Baermann funnel techniques (Southey, 1986). Statistical analysis of the data for critical difference was performed (Pansey and Sukhatme, 1978).

Results and discussion

Increase in the initial inoculum of *M. incognita* or *R. reniformis* resulted in a progressive decrease in plant growth parameters (length and weight of plants, number of pods and bulk density of woody stem), chlorophyll content of leaves, water adsorption of roots and root nodulation. However, the decrease was statistically significant only at higher inoculum levels, i.e. 500 and 5000 nematodes per plant. *M. incognita* caused greater reduction in all parameters than *R. reniformis* at the same inoculum level (Table I). In concomitant inoculations of *M. incognita* and *R. reniformis* there was greater damage to all parameters. The growth suppression in concomitant inoculations was, however, relatively less than the sum total of reductions caused by the same levels of the single species inoculations.

The root galling increased with an increase

in the inoculum level of *M. incognita*. The final population of *R. reniformis* also increased with an increase in the inoculum level. The rate of nematode multiplication was, however, greater at low inoculum level than the higher level probably because of competition for food and space. The results also suggest competition for feeding sites in concomitant inoculations of the nematode species.

The nematodes, individually as well as concomitantly in various combinations, not only reduced the number of nodules per root system but also reduced the size of the nodules.

The results presented in Table I indicate that water absorption capacity of pigeonpea roots was adversely affected by inoculations of *R. reniformis* and *M. incognita*, individually or concomitantly.

Increase in the nematode inoculum level resulted in a relative decrease in chlorophyll content of plant leaves, with a greater reduction resulting from *M. incognita* than from *R. reniformis*. When plants were inoculated with *M. incognita* and *R. reniformis* together there was greater damage to the chlorophyll content of leaves than that caused by either of them individually.

Bulk density of pigeonpea stems was reduced significantly at 500 and 5000 inoculum levels of *M. incognita* and only at 5000 inoculum level of *R. reniformis*. *M. incognita* caused greater reduction than *R. reniformis* at the same inoculum level. In concomitant inoculations of *M. incognita* and *R. reniformis* there was greater damage, however, relatively less than the sum total of reductions caused by the same levels of the single species inoculations.

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Literature cited

ALAM M. M., HASAN N. and SAXENA S. K., 1974. Effect of root-knot nematode, *Meloidogyne incognita* on water absorption capability of tomato roots. *Indian J. Nematol.*, *4*: 244-246.

ANVER S., 1990. Studies of the inter-relationship and control of root-knot and reniform nematodes on chickpea and pigeonpea, Ph. D. Thesis, Agra University, Agra, pp. 274.

HISCOX J. D. and ISRAELSTAM G. F., 1979. A method for the extraction of chlorophyll from leaf tissue without maceration. *Can. J. Bot.*, *57*: 1332-1334.

JAIN A. K., SHARMA V. R. and PATHAK B. S., 1986. A note on the changes in the bulk density of crop residues due to the application of uniaxial pressure. *Agricul. Wastes*, *16*: 89-95.

PANSEY V. G. and SUKHATME P. V., 1978. *Statistical methods for Agricultural workers* (Revised by P. V. Shukhatme & V. N. Amble). I.C.A.R. New Delhi, pp. 48-67.

SOUTHEY J. F., 1986. *Laboratory methods for work with plant and soil nematodes*. Min. Agri. Fish. Food. HMSO. London, pp. 202.

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