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RELATIVE RESISTANCE OF SIX COWPEA CULTIVARS AS AFFECTED BY THE CONCOMITANCE OF TWO NEMATODES AND A FUNGUS

by
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Summary. Cowpea cultivars that were resistant or moderately resistant against individual pathogens lost their resistance in the presence of the other pathogens except cv. IC-503 (moderately resistant to *Meloidogyne incognita*). Cv. S-488 (resistant to *Rotylenchulus reniformis*) did not remain resistant in the presence of *M. incognita* though it did not lose its resistance in the presence of *Rhizoctonia solani*. Similarly, the resistance of cv. CO-4 to *R. solani* broke down in the presence of *M. incognita* but not in the presence of *R. reniformis*. Both *R. reniformis* and *M. incognita*, when present in association with *R. solani*, broke the resistance of cv. IC-244 against *R. solani*. The moderately resistant response of cvs. RC-8 and EC-4213A to *R. reniformis* and their complete resistance against *R. solani* broke down when simultaneously inoculated with both the nematode species or *R. solani* with either *R. reniformis* or *M. incognita*.

Khan (1986) observed that six cowpea (*Vigna unguiculata* L. Walp) cultivars were resistant or moderately resistant to one or more of the pathogens *Rotylenchulus reniformis* Linford *et* Oliveira, *Meloidogyne incognita* (Kofoid *et* White) Chitw. and *Rhizoctonia solani* Kühn. In the present experiment the same cultivars were tested again to find out whether their resistance persists when two or more pathogens are present simultaneously.

Materials and methods

Surface sterilized seeds of six cowpea cultivars (S-488, CO-4, RC-8, EC-4213A, IC-244, IC-503) were sown in six inch earthern pots containing one kg of a 3:1:1 autoclaved compost: river sand: farmyard manure mixture. Prior to sowing, seeds were bacterized with a cowpea strain of *Rhizobium* (with 5% sucrose solution as a sticker). One week old seedlings of uniform size of each cultivar were inoculated with *R. reniformis*, *M. incognita* (1000 nematodes/plant) or *R. solani* (1 g fungus/plant) individually or concomitantly in various combinations (Table I) by carefully pipetting the suspensions on to the exposed roots which were then covered with soil. Uninoculated plants of each cultivar were kept as controls. Each treatment was replicated five times and randomized on a glasshouse bench.

Data on plant growth (dry weight of shoot and root), root-knot index (0 = no galling; 1 = 1-25 galls/plant; 2 = 26-50; 3 = 51-75; 4 = 76-100; 5 = more than 100), number of nodules/root system, and the reproduction factor (R = Pf/Pi) of each nematode species were collected at the termination of the experiment after two months. To estimate nematode populations in roots, one g root in water was comminuted in a Waring blender for 30 seconds; this released the females in the roots for counting. Nematodes from the soil washings in each pot were also counted. The data were analysed statistically.

Results and discussion

The dry weight of roots and shoots of four of the cultivars (CO-4, IC-4213A, RC-8, IC-244) were virtually unaffected by the presence of *R. solani* alone, and therefore were considered to be resistant to the pathogen. With the cvs. S-488 and IC-503, there was a reduction of 42 and 43% in dry weight respectively, and 42 and 31% reduction in nodular formation (Table I).

All four cultivars were susceptible to *R. solani* when the roots were infested with either *R. reniformis* or *M. incognita*. Only cv. S-488 was resistant to *R. reniformis* (Pf/Pi < 1) but EC-4213A and RC-8 could be considered to be moderately resistant (Pf/Pi 1.9 and 3.7, respectively) (Table I); none of the cultivars showed any significant reduction in dry weight compared with the untreated controls.

None of the cultivars exhibited a high level of resistance to *M. incognita*, but cv. IC-503 was moderately resistant with a Pf/Pi ratio of 2.1 and a root-knot index of 0.5 (Table I). The Pf/Pi ratios for the other five cultivars ranged from 8.4 to16.8 and the root-knot indices from 1.8 to 5.

The resistance of S-488 to *R. reniformis* was unaffected

TABLE I - *Response of cowpea cultivars to* Rotylenchulus reniformis, Meloidogyne incognita *and* Rhizoctonia solani *singly and concomitantly.*

Treatments	Nematode Population						Root-knot index	No. nodules /root system	% reduction over control	Shoot + Roots dry wt (g)	% reduction over control
	R. reniformis (Rr)			*M. incognita* (Mi)							
	Js/kg soil	♀♀/g root	$R = \frac{Pf}{Pi}$	Js/kg soil	♀♀/g root	$R = \frac{Pf}{Pi}$					
Cv. S-488											
C	—	—	—	—	—	—	—	72	—	6.2	—
Rr	533	40	0.6	—	—	—	—	68	5	5.9	32
Mi	—	—	—	13633	347	14.0	5.0	51	29	4.0	35
Rs	—	—	—	—	—	—	—	42	42	3.6	42
Rr + Mi	2533	127	2.7	14267	313	14.6	4.8	37	48	3.5	43
Rr + Rs	833	53	0.9	—	—	—	—	38	47	3.1	48
LSD (5%)			0.90			0.81	0.44	6.64		0.40	
Cv. C0-4											
C	—	—	—	—	—	—	—	88	—	9.8	—
Rr	11400	207	11.6	—	—	—	—	68	23	7.2	26
Mi	—	—	—	8200	213	8.4	1.8	71	19	7.7	21
Rs	—	—	—	—	—	—	—	84	4	9.8	0
Rr + Rs	10067	247	10.3	—	—	—	—	63	28	6.9	29
Mi + Rs	—	—	—	9533	187	9.7	2.0	45	48	5.4	45
LSD (5%)			1.63			1.30	0.65	9.34		0.70	
Cv. IC-503											
C	—	—	—	—	—	—	—	77	—	9,0	—
Rr	9533	180	9.7	—	—	—	—	57	26	6.3	30
Mi	—	—	—	2000	133	2.1	0.5	76	1	8.6	4
Rs	—	—	—	—	—	—	—	53	31	5.1	43
Rr + Mi	10700	167	10.9	1200	107	1.3	0.7	57	26	5.9	34
Mi + Rs	—	—	—	833	87	0.9	0.4	48	38	4.8	47
LSD (5%)			1.14			0.82	0.74	8.65		0.70	
Cv. IC-244											
C	—	—	—	—	—	—	—	42	—	7.1	—
Rr	13633	287	13.8	—	—	—	—	30	28	4.6	35
Mi	—	—	—	12733	307	13.0	3.4	34	19	4.9	31
Rs	—	—	—	—	—	—	—	40	5	6.5	8
Rr + Rs	10933	253	11.2	—	—	—	—	21	50	3.6	49
Mi + Rs	—	—	—	11867	273	12.1	3.0	20	52	3.2	55
LSD (5%)			1.05			0.82	0.37	7.36		0.86	
Cv. EC-4213A											
C	—	—	—	—	—	—	—	106	—	7.0	—
Rr	1800	80	1.9	—	—	—	—	104	2	6.4	9
Mi	—	—	—	16500	347	16.8	4.0	72	32	4.6	34
Rs	—	—	—	—	—	—	—	100	3	6.5	7
Rr + Mi	9200	220	9.4	14167	367	14.5	3.8	56	47	3.9	44
Rr + Rs	2600	120	2.7	—	—	—	—	87	18	5.5	21
Mi + Rs	—	—	—	12000	307	12.3	3.2	44	58	3.5	50
LSD (5%)			2.00			2.27	0.51	12.20		0.65	

Treatments	Nematode Population						Root-knot index	No. nodules /root system	% reduction over control	Shoot + Roots dry wt (g)	% reduction over control
	R. reniformis (Rr)			*M. incognita* (Mi)							
	Js/kg soil	♀♀/g root	$R = \frac{Pf}{Pi}$	Js/kg soil	♀♀/g root	$R = \frac{Pf}{Pi}$					
Cv. RC-8											
C	—	—	—	—	—	—	—	69	—	8.3	—
Rr	3533	153	3.7	—	—	—	—	66	4	7.6	8
Mi	—	—	—	14933	313	15.2	3.6	51	26	5.9	29
Rs	—	—	—	—	—	—	—	64	7	7.6	8
Rr + Mi	7200	207	7.4	12866	333	13.2	3.3	44	36	4.5	46
Rr + Rs	5033	187	5.2	—	—	—	—	47	21	5.9	29
Mi + Rs	—	—	—	11200	253	11.4	3.5	31	36	4.2	49
LSD (5%)			1.47			1.68	0.48	9.47		1.26	

C = Control, Rr = *Rotylenchulus reniformis*, Mi = *Meloidogyne incognita*, Rs = *Rhizoctonia solani*.

(Pf/Pi 0.9) by the presence of *R. solani* but the two pathogens were apparently interactive in reducing the dry weight of the plants (50%) and nodulation (50%). Concomitant infestation of *R. reniformis* and *M. incognita* affected the resistance to the former (Pf/Pi 2.7) but the dry weight of the plants was similar to those infested with *M. incognita* alone.

The presence of *R. solani* led to a slight increase (not significant at 0.5) in the multiplication rate of *R. reniformis* in the moderately resistant cvs. EC-4213A and RC-8. Concomitant infestation of *R. reniformis* and *M. incognita* greatly increased the multiplication rate of the former, compared with single infestation. The effect of *R. reniformis* on the multiplication rate of *M. incognita* and the root-knot index was not significant with either cultivar.

With cv. IC-503, considered to be moderately resistant to *M. incognita*, the presence of *R. solani* caused a significant reduction in the multipliation rate of the nematode compared with the nematode alone. *M. incognita* alone did not cause a significant reduction in the dry weight of the plants, compared with the untreated control, but *R. solani* caused a 43% reduction and this was increased to 47% with concomitant infestation with *M. incognita*.

Literature cited

KHAN T.A. 1986 - Studies on the interaction of *Meloidogyne incognita*, *Rotylenchulus reniformis* and *Rhizoctonia solani* on cowpea. *Ph. D. Thesis*, Aligarh Muslim University, Aligarh. pp. 291.

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