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PATHOGENICITY OF *MELOIDOGYNE JAVANICA* IN MUNG AND CLUSTER BEANS AS AFFECTED BY *RHIZOBIUM*

by
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Summary. In mung bean, an inoculum level of 100 *Meloidogyne javanica* second stage juveniles per kg soil was recorded as the damaging threshold in both *Rhizobium*-treated as well as untreated plants. In cluster bean, a singificant decrease in yield was associated with 10,000 second stage juveniles/kg soil in *Rhizobium*-treated plants, whereas 1,000 juveniles decreased the yield, fresh shoot weight and length significantly in untreated plants over the check.

Mung [*Vigna radiata* (Linn.) Wilczek] and cluster beans [*Cyamopsis tetragonoloba* (L.) Taub.] are important constituents of food for humans and cattle and are among the most important leguminous crops grown in Haryana State. Cluster bean is also used in industry as a raw material for the production of gum. An important nematode pest, *Meloidogyne javanica* (Treub) Chitw., commonly occurs in Haryana and has been reported to be pathogenic to cluster bean by Dalal and Bhatti (1983).

Use of *Rhizobium* culture is recommended as a seed treatment to increase the yield of pulse crops. In view of the wide-spread occurrence of *M. javanica* in various pulse crops and its economic importance in pulse production, the present study was conducted to evaluate the effect of *Rhizobium* treatment on the pathogenicity of *M. javanica* in these crops.

Materials and methods

Pathogenicity studies were conducted in a screen-house in 15 cm earthen pots each containing 1 kg steam-sterilized sandy soil. Two surface-sterilized seeds of mung bean (cv. PS-7) or cluster bean (cv. FS-277) were sown per pot. The experiment was conducted in two sets. The seeds of one set were bacterized with *Rhizobium* sp. and those of the other set were not bacterized. After germination one plant per pot was retained.

After a week the seedlings were inoculated in a logarithmic series with freshly hatched second stage juveniles of *M. javanica* at 10, 100, 1000 and 10,000 per pot. An uninoculated check was also maintained. Each treatment was replicated four times. Sixty and 105 days after sowing, the experiment was terminated for mung bean and cluster bean, respectively. Shoot and root length, fresh shoot and root weight, number and weight of nodules and female population in soil and roots per plant were recorded.

Results and discussion

In general, the growth of mung bean was inversely correlated with the level of nematode inoculum. However, a slight increase in shoot length, shoot weight, number and weight of nodules and yield in *Rhizobium* treated plants was observed at the inoculum level of 10 juveniles per plant compared to the uninoculated check (Table I). A significant reduction in plant growth characters was recorded at an inoculum level of 100 juveniles per plant and above in both the sets (*Rhizobium* treated and untreated), although significant reduction in weight and number of nodules was observed at 1000 juveniles/plant. Gupta *et al.* (1986) also found that 100 *M. javanica* juveniles/plant damaged mung bean. Slight increase in plant growth at lower nematode inoculation levels may be due to their stimulatory effect. This phenomenon of "overshoot" in the plant growth characters has been reported earlier by Wallace (1970) and Zaki and Bhatti (1986). It was observed that with an increase in the inoculum level there was a corresponding increase in host infestation as indicated by number of galls and egg masses produced (Table I). The number of galls and egg masses was more in untreated plants at lower nematode inoculum levels but at the highest inoculum level, i.e., 10,000 juveniles/plant more galls and egg masses were formed in *Rhizobium* treated plants. This observation agrees with Singh *et al.* (1977) who reported that more galls were formed on *Rhizobium* treated plants compared with untreated plants at higher inoculum levels. This may be due to the better plant growth in *Rhizobium* treated plants which provides more nourishment and opportunities for multiplication of the nematode. Similar observations on reduction in plant growth characters, nodulation and increased galling in mung bean has been reported by Raut and Sethi (1980).

The results of the pathogenicity experiment on cluster bean indicated that 10,000 juveniles per plant reduced the number and weight of nodules and yield, but not shoot length and weight in *Rhizobium* treated plant as compared to the uninoculated check. The yield, however, increased at the lower level of inoculum in comparison to the check and it was significantly more at the level of ten juveniles per plant (Table II).

In untreated plants (without *Rhizobium*) 1000 juveniles per plant were found to be the damag-

TABLE I - *Effect of different population densities of* Meloidogyne javanica *on growth and yield of mung bean in the presence (Yes) or absence (Not) of* Rhizobium.

Inoculum level	Shoot length (cm)		Shoot weight (g)		Root length (cm)		Root weight (g)		No. of nodules		Weight of nodules (g)		Yield (g)		No. of galls/ plant		No. of egg masses/ plant	
	Yes	Not	Yes	Not	Yes	Not	Yes	Not	Yes	Not	Yes	Not	Yes	Not	Yes	Not	Yes	Not
0 (Check)	21.8	20.1	3.6	2.4	23.6	20.5	3.9	3.7	33.4	31.6	0.5	0.4	9.8	9.0	0 (1)	0 (1)	0 (1)	0 (1)
10	24.0	19.0	3.7	2.9	22.2	18.2	3.4	3.2	41.0	31.2	0.6	0.4	10.8	8.4	7.8 (2.9)	13.8 (3.8)	3.8 (2.1)	6.4 (2.7)
100	19.2	17.7	2.3	1.7	21.2	15.8	2.2	2.4	32.4	22.8	0.4	0.3	7.1	6.0	27.2 (5.3)	43.6 (6.6)	14.0 (3.8)	16.8 (4.2)
1000	15.1	13.1	1.6	1.3	17.4	12.9	2.0	2.6	26.4	16.2	0.2	0.1	6.0	3.2	62.6 (7.9)	66.2 (8.2)	22.2 (4.8)	23.2 (4.9)
10000	10.5	9.2	0.9	0.8	13.8	14.2	1.6	1.8	11.8	18.6	0.1	0.2	3.4	3.8	89.8 (9.3)	67.6 (8.2)	32.2 (5.7)	32.2 (5.7)
C.D. at 5%	2.30	2.10	0.84	0.66	2.25	2.54	1.13	1.17	5.43	8.78	0.16	0.12	1.86	1.04	(0.80)	(0.93)	(0.37)	(0.54)

Figures in parentheses are $\sqrt{n+1}$ values.

Table II - *Effect of different population densities of* M. javanica *on growth and yield of cluster bean in the presence (Yes) or absence (Not) of* Rhizobium.

Inoculum level	Shoot length (cm)		Shoot weight (g)		No. of nodules		Weight of nodules (g)		Yield (g)		No. of galls/ plant		No. of egg masses/ plant	
	Yes	Not	Yes	Not	Yes	Not	Yes	Not	Yes	Not	Yes	Not	Yes	Not
0 (Check)	29.0	29.4	6.0	7.1	11.4	16.0	1.9	1.6	13.0	15.0	0 (1)	0 (1)	0 (1)	0 (1)
10	29.4	26.1	7.2	6.6	12.0	13.4	1.4	1.4	15.2	14.5	2.4 (1.8)	5.2 (2.5)	1.2 (1.5)	1.7 (1.6)
100	28.8	22.0	6.1	3.7	14.2	16.2	1.6	1.3	14.0	12.6	8.2 (3.0)	12.0 (3.6)	2.2 (1.8)	4.5 (2.1)
1000	28.2	18.5	6.4	2.9	9.0	12.0	1.1	0.9	11.5	6.5	40.0 (6.3)	58.0 (7.6)	6.6 (2.8)	10.3 (3.6)
10000	25.0	21.5	5.9	3.6	8.0	15.0	1.0	1.3	10.0	7.5	70.0 (8.2)	38.0 (6.2)	13.1 (3.7)	7.1 (2.8)
C.D. at 5%	NS	4.82	NS	2.65	2.33	NS	0.36	0.34	2.06	3.32	(1.54)	(0.84)	(0.13)	(0.19)

Figures in parentheses are $\sqrt{n+1}$ values.

ing threshold level. These observations are in agreement with those of Dalal and Bhatti (1983) who reported 1000 second stage *M. javanica* juveniles per plant as the damaging threshold level. However, significant reduction in shoot length and weight was found even at the inoculum level of 100 juveniles per plant. Root length, root weight and number of nodules were not significantly different from the uninoculated check.

Data on the production of galls and egg masses (Table II) indicate that an increase in initial inoculum level resulted in increase in the number of galls and egg masses in the *Rhizobium* treated plants, but the same trend was not observed in the untreated plants. In the untreated plants maximum numbers of galls and egg-masses were produced at 1000 inoculum level per plant and a further increase resulted in reduction of galls and egg masses.

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