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SUITABILITY OF SOME CULTIVARS OF PEPPER AS HOSTS FOR MELOIDOGYNE JAVANICA AND RACES OF M. INCOGNITA

by

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Summary. Fourteen cultivars of pepper (*Capsicum annum*) were screened according to the standards set by the International *Meloidogyne* Project, against *Meloidogyne javanica* and all the 4 races of *M. incognita* to evaluate/revaluate their degree of resistance. Eleven were susceptible to all the 4 races of *M. incognita*. Two, Jwala and Pusa Jwala, showed race specific resistance. A number of cultivars were rated as resistant or immune to *M. javanica*. Suryamukhi Green and Chilli P.C.I. were susceptible to this species.

In a recent nematode survey of some districts of western Uttar Pradesh, *Meloidogyne incognita* (Kofoid et White) Chitw. and *M. javanica* (Treub) Chitw. were found as common species (Khan, 1988) and *M. incognita* populations consisted of four races (Khan *et al.*, 1988). Thus it was thought useful to screen a number of cultivars of pepper (*Capsicum annum* L.) for resistance to these races and to *M. javanica* in the glasshouse by standard methods adopted by the International *Meloidogyne* Project (Sasser *et al.*, 1984).

Materials and methods

Populations of nematodes were established separately by inoculating tomato (cv. Pusa Ruby) with a single egg-mass. The populations were sub-cultured every two months, by inoculating tomato seedlings with at least 15 egg-masses each, to maintain sufficient inoculum for the study. Seedlings of the pepper cultivars (Table II) were raised in clay pots (20 cm. diam.) filled with a mixture of autoclaved field soil and sand (3:1). Three-week-old seedlings were transplanted one seedling/pot and each inoculated with 5000 freshly hatched second stage juveniles (Pi) of the nematodes. Juveniles (J2) of the nematodes were obtained by placing egg-masses from their cultures in a sieve lined with a double layer of coarse tissue paper. The sieves were placed in 10 cm diam. petridishes containing sterilized distilled water, with the water level adjusted so that it just touched the bottom of the sieve containing the egg-masses. The juveniles were collected after 72 h for the inoculum suspension. Each cultivar was replicated three times. After inoculation plants were grown for two months

at a temperature of 22-30° C in a glasshouse. At the end of this period, they were removed from the pots and the roots were washed to free them from adhering soil particles. Gall index (GI) on 0-5 scale (Taylor and Sasser, 1978) and reproduction factor (R) were determined.

The reproduction factor was determined by counting eggs that were extracted from the roots separately by using the chlorox method of Hussey and Barker (1973) modified to include roots that were chopped and blended in a Waring blender with a solution of 1% NaOCl. Extracted eggs were stained in hot acid fuchsin (3.5 g) acetic acid solution (250 ml) in 750 ml distilled water. The number of eggs/plant was counted and mean of the replicates calculated. The reproduction factor, $R = Pf/Pi$, was calculated, Pf being the average final egg count and Pi, the original inoculum of 5000 J₂. Based on the gall index and reproduction factor, the host suitability (degree of resistance) of the cultivars was allocated according to the modified scheme of Canto-Saenz (Sasser *et al.*, 1984) (Table I).

TABLE I - Designation of resistance based on plant damage and host efficiency.

| Plant damage (gall index) | Host efficiency (R factor) | Degree of resistance designation (DR) |
|------------------------------|-------------------------------|--|
| ≤ 2 | ≤ 1 | Resistant |
| ≤ 2 | > 1 | Tolerant |
| > 2 | ≤ 1 | Hypersusceptible |
| > 2 | > 1 | Susceptible |

Plants with nematode reproduction (R = 0) and root galling (GI = 0) were categorized as immune.

Results and discussion

Of the fourteen cultivars of pepper included in the study, eleven, namely Suryamukhi Green, Bull Nose, Hungarian Wax, Chinese Giant, Elephant Struck, Chilli 6-4, Chilli NP-46A, Chilli G-3, Chilli P.C.I., Suryamukhi and California Wonder, were susceptible to all four races of *M. incognita*. All of the races of *M. incognita* produced many galls on the cultivars with the GI ranging between 4 and 5; thus GI was invariably > 2. Many eggmasses were also produced by all the races of *M. incognita* and the reproduction factor (R) was invariably > 1. Based on GI and R all eleven cultivars were susceptible to all of the races of *M. incognita*. The reactions of the other three cultivars were variable. Pusa Jwala was susceptible to Races 2 and 4 but resistant to Races 1 and 3. Cultivar Suryamukhi Black was susceptible to Races 1, 3, and 4 and hypersusceptible to Race 2. Cultivar Jwala was resistant to Races 1, 2 and 4 and immune to Race 3 (Table II).

Two cultivars (Suryamukhi Green and Chilli P.C.I.) were susceptible to *M. javanica*; two (Elephant Struck and Chilli 6-4) were hypersusceptible, and five (Pusa Jwala, Suryamukhi Black, Hungarian Wax, Chilli G-3, and California Wonder) were resistant according to their GI and R ratings. Five cultivars, namely Jwala, Bull Nose, Chinese Giant, Chilli N-P. 46-A and Suryamukhi, were immune,

since galling and egg-mass production were not evident (Table II).

When the degree of resistance of cultivars was analysed for each test nematode population, it was found that 12 cultivars were susceptible and two resistant to Race 1 of *M. incognita*; 12 were susceptible, one hypersusceptible and one was resistant to Race 2; 12 were susceptible, one resistant and one immune to Race 3; 13 were susceptible and one resistant to Race 4 and two were susceptible, two hypersusceptible, five resistant and five immune to *M. javanica* (Table II).

One cultivar of pepper, Pusa Jwala was resistant to Races 1 and 3 and susceptible to Races 2 and 4. This finding supports the contention that race-specific resistance may be shown by crop cultivars and susceptibility or resistance to *M. incognita* were designated in earlier studies without considering the accuracy of race characterization of the populations. For this reason Fassuliotis (1985) advocated the re-evaluation of crop cultivars to races of *M. incognita*. Therefore, knowledge about the race composition of *M. incognita* population of a region or area form the basis for disease management through host resistance and breeding programmes. Several cultivars were immune or resistant to *M. javanica* while others were susceptible or hypersusceptible. Hypersusceptible cultivars would not suffer great plant damage but nematode population would

TABLE II - Host suitability (resistance) of 14 cultivars of pepper to races of *Meloidogyne incognita* and *Meloidogyne javanica*.

| Cultivar | <i>M. incognita</i> | | | | | | | | | | | | | | | | <i>M. javanica</i> | | | |
|-------------------|---------------------|------|-----------|----|---------|------|-----------|----|---------|------|-----------|----|---------|------|-----------|----|--------------------|------|-----------|----|
| | Race 1 | | | | Race 2 | | | | Race 3 | | | | Race 4 | | | | Mean GI | SD | R. factor | DR |
| | Mean GI | SD | R. factor | DR | Mean GI | SD | R. factor | DR | Mean GI | SD | R. factor | DR | Mean GI | SD | R. factor | DR | | | | |
| Pusa Jwala | 1.6 | 0.58 | 0.6 | R | 4.6 | 0.58 | 5.5 | S | 2.0 | 0.00 | 0.5 | R | 4.6 | 0.58 | 3.5 | S | 1.0 | 0.70 | 0.0 | R |
| Suryamukhi Black | 5.0 | 0.00 | 4.0 | S | 4.0 | 0.00 | 5.6 | H | 5.0 | 0.00 | 4.4 | S | 4.0 | 0.00 | 2.5 | S | 0.6 | 0.98 | 0.0 | R |
| Suryamukhi Green | 5.0 | 0.00 | 4.5 | S | 4.0 | 0.00 | 3.6 | S | 5.0 | 0.00 | 5.2 | S | 4.0 | 0.00 | 3.0 | S | 3.3 | 0.57 | 2.0 | S |
| Jwala | 1.3 | 0.57 | 0.0 | R | 2.0 | 0.00 | 0.8 | R | 0.0 | 0.00 | 0.0 | I | 0.6 | 0.40 | 0.0 | R | 0.0 | 0.00 | 0.0 | I |
| Bull Nose | 5.0 | 0.00 | 7.2 | S | 5.0 | 0.00 | 7.3 | S | 4.0 | 0.00 | 3.8 | S | 4.0 | 0.00 | 4.0 | S | 0.0 | 0.00 | 0.0 | I |
| Hungarian Wax | 4.0 | 0.00 | 4.4 | S | 4.6 | 0.58 | 5.4 | S | 4.3 | 0.57 | 7.8 | S | 4.6 | 0.58 | 7.0 | S | 1.0 | 0.70 | 0.0 | R |
| Chinese Giant | 5.0 | 0.00 | 14.8 | S | 5.0 | 0.00 | 10.8 | S | 5.0 | 0.00 | 10.1 | S | 5.0 | 0.00 | 8.4 | S | 0.0 | 0.00 | 0.0 | I |
| Elephant Struck | 5.0 | 0.00 | 9.9 | S | 4.6 | 0.58 | 5.3 | S | 4.3 | 0.57 | 10.0 | S | 5.0 | 0.00 | 7.4 | S | 3.3 | 0.57 | 0.7 | H |
| Chilli 6-4 | 4.0 | 0.00 | 3.0 | S | 4.0 | 0.00 | 1.9 | S | 4.0 | 0.00 | 3.4 | S | 4.0 | 0.00 | 3.7 | S | 3.0 | 1.00 | 0.7 | H |
| Chilli N-P. 46-A | 5.0 | 0.00 | 8.1 | S | 4.3 | 0.57 | 4.2 | S | 5.0 | 0.00 | 8.0 | S | 5.0 | 0.00 | 8.7 | S | 0.0 | 0.00 | 0.0 | I |
| Chilli G-3 | 5.0 | 0.00 | 9.1 | S | 5.0 | 0.00 | 8.2 | S | 5.0 | 0.00 | 12.8 | S | 5.0 | 0.00 | 14.6 | S | 2.0 | 1.00 | 0.0 | R |
| Chilli P.C.I. | 5.0 | 0.00 | 6.5 | S | 4.3 | 0.57 | 5.0 | S | 4.0 | 0.00 | 2.5 | S | 4.0 | 0.00 | 3.2 | S | 3.0 | 1.00 | 7.1 | S |
| Suryamukhi | 4.0 | 0.00 | 4.1 | S | 4.0 | 0.00 | 4.8 | S | 4.0 | 0.00 | 4.6 | S | 4.0 | 0.00 | 3.0 | S | 0.0 | 0.00 | 0.0 | I |
| California Wonder | 5.0 | 0.00 | 12.3 | S | 5.0 | 0.00 | 16.3 | S | 5.0 | 0.00 | 6.9 | S | 5.0 | 0.00 | 7.3 | S | 0.3 | 0.49 | 0.0 | R |

GI = Gall index; SD = Standard deviation; R. factor = Reproduction factor; DR = Degree of resistance; S = Susceptible; H = Hypersusceptible; R = Resistant; I = Immune.

increase and thus they could only be recommended for growing in specific instances where low nematode densities were present.

Cultivar Pusa Jwala reported to be resistant to *M. incognita* by Das (1986) and Nath (1986) was found susceptible to Races 2 and 4. Some of the cultivars, Bull Nose, Chinese Giant, Hungarian Wax, Suryamukhi and California Wonder reported to be susceptible to *M. incognita* by Alam *et al.* (1974) were found susceptible to all 4 races of *M. incognita*. California Wonder listed resistant to *M. javanica* by Taylor and Sasser (1978) and Pusa Jwala, moderately resistant by Jain *et al.* (1983) exhibited resistance to *M. javanica* in the present study. However, cultivar Chillii NP-46-A reported to be susceptible by Jain *et al.* (1983) was found to be immune.

Of the 27 cultivars of pepper screened by Jain *et al.* (1983) against *M. javanica*, ten were found to be susceptible. A similar report was made by Walia and Gupta (1986) that 34 of 35 cultivars of chilli tested were susceptible to *M. javanica*. The results of the present study support their findings. During the survey of field plots, pepper was often found to be infected with *M. javanica* (Khan, 1988) and a similar report was made by Stephan (1988) from Iraq. These findings should be taken into account when growing pepper in *M. javanica* infested field plots or areas. The long term management strategy for *M. incognita* infestation of peppers by breeding cultivars resistant to the various races demands greater attention than at present. The study suggests that race resistant cultivars may be grown in specific race infestations.

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