EFFECT OF RICE RESISTANCE ON INFECTION BY *MELOIDOGYNE INCOGNITA*

O. A. Fademi and B. Fawole

Rice Research Program, National Cereals Research Institute, Badeggi, PMB 8 Bida, Nigeria, and Department of Agriculture Biology, University of Ibadan, Ibadan, Nigeria.

RESUMEN

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La penetración radical por *Meloidogyne incognita* y el desarrollo subsecuente de los juveniles infectivos (J2) fueron estudiados en los cultivares resistentes Le Mont y los susceptibles Mars. Ambos fueron penetrados por *M. incognita* (J2), sin embargo, se observaron diferencias en el desarrollo del nematodo en ambas variedades. El desarrollo de J2 a hembras adultas fue significativamente mayor en las variedades susceptibles que en las resistentes. Las raices en las plantas resistentes fueron más grandes y menos agalladas.

Palabras clave: *Meloidogyne incognita, Oryza sativa*, variedad resistente, variedad susceptible.

Meloidogyne incognita (Kofoid and White) Chitwood is an economically important endoparasitic nematode with a wide host range. Rice, *Orvza sativa* (L.), has been recommended in crop rotation schedules for management of *Meloidogyne* spp. in many upland crops (3). However, using rice in a crop rotation may not succeed in reducing nematode populations because many commercial rice cultivars are hosts of *Meloidogyne* spp. (1,5,7). A few rice breeding lines with resistance to *M. incognita* have been identified, but many lack the desired agronomic and yield qualities.

This investigation was conducted to examine the effect of rice resistance and susceptibility on root penetration by second-stage juveniles (J2) of *Meloidogyne incognita* and their development in the roots.

Race 4 of *M. incognita* used in this experiment was obtained from *Lycopersicum esculentum* Mill. cv. Rutgers. Eggs of *M. incognita* were recovered from galled roots using the method described by Hussey and Barker (10). They were then incubated for eggs to hatch using a modified Baermann funnel method. Seed of two rice varieties (Mars, *M. incognita* susceptible and LeMont, *M. incognita* resistant) were sown in plastic germination trays containing sterile sand. After radicle emergence and root growth to about 1 cm, seedlings were removed and transplanted into 10-cm-diam plastic pots containing sandy loam soil. At transplanting, 1 ml of suspension containing 500 freshly hatched *M. incognita* J2 were introduced around the roots of each seedling. The depression into which the inoculum was introduced was then lightly covered with soil. Plants were arranged on benches and watered as required. Five seedlings of each variety were examined for number of root galls at 7 and 14 days after inoculation. Root length also was determined.

In another test, seedlings of the two rice varieties were inoculated with *M. incognita* at transplanting as described earlier and placed on greenhouse benches. At 2, 8, 15, and 22 days, 5 seedlings of each variety were uprooted for observation. Roots of these plants were washed and cleared of adhering soil particles using sodium hypochlorite. They were then processed for detection of nematodes using the method described by Byre *et. al.* (2). The number of nematodes in each root system and their developmental stage was recorded. The experimental design in the two experiments was completely randomized. Data were analyzed by ANOVA and treatment means compared using Fisher's least significant differences test (FLSD).

Roots were longer in the resistant LeMont variety than in the susceptible variety at both 7 and 14 days after inoculation (Table 1). Number of galls per root system was greater in the susceptible variety, Mars, than in LeMont. Root penetration was not different between the two varieties 7 days after inoculation. Roots of the resistant LeMont, however, supported fewer *M. incognita* juveniles when examined 14 days after inoculation than did the susceptible Mars. By day 14, a few nematodes with the characteristically enlarged shape of the third-stage juveniles (J3) also were found. None of the juveniles found in the roots of LeMont showed morphological changes beyond the J2 stage.

In experiment 2, an almost equal number of *M. incognita* J2 penetrated the roots of both varieties after 2 days. Differences, however, in developmental stages of the J2 were observed between varieties 8, 15, and 22 days after inoculation (Table 2). In the susceptible Mars variety, the number of J2 with the characteristic vermiform shape decreased gradually with time, with a corresponding increase in the number of J3 and J4 and finally adult females at 22 days after inoculation. In the resistant LeMont variety, there was no development of the juveniles beyond the J2 stage.

Results from this study indicated that root penetration was not affected by plant resistance or susceptibility, agreeing with previous observations on other crops such as rye (14) and soybean (8). These data further show development of J2 that penetrated roots of the resistant variety was arrested similar to the observations of Sasser (14). In spite of the apparent non-development of these J2, galling was initiated in the resistant variety. Madamba *et al.* (11) reported similar observations on some host crops.

Table 1: Penetration and development of *Meloidogyne incognita* on susceptible Mars and resistant LeMont rice varieties at 7 and 14 days after inoculation.

Rice Variety	Root Length (cm)	Gall Number	Number of Juveniles[y]	
			J2	J3
Mars 7D[z]	3.6	24.8	18.6	2.4
LeMont 7D	4.5	22.6	18.2	0.0
FLSD ($P \leq 0.05$)	0.8	6.2	5.5	0.6
Mars 14D	5.8	26.4	23.5	4.8
LeMont 14D	7.3	23.2	4.4	0.0
FLSD ($P \leq 0.05$)	0.8	7.3	4.3	1.3

[y]Number of second-stage (J2) and third-stage (J3) juveniles per seedling root system.
[z]7D and 14D indicate number of days after inoculation.

Several authors have indicated that resistance or host unsuitability is manifested in retarded development, not failure of juveniles to enter host roots in large numbers (4,12,13). Herman *et al.* (8) added that even where endoparasites initially penetrate roots of resistant crop variety, few nematodes are present a few days afterwards. They suggested that this could be due to egress, adding that generally, this process was higher in roots of resistant plant varieties than from roots of susceptible ones. In our study, rice root penetration by *M. incognita* juveniles was not significantly different in both varieties 2 days after inoculation. By the eighth day, numbers in roots were significantly lower in the resistant variety. Huang (9) suggested that such juvenile egression from roots of resistant varieties was not likely to be nutritional since galling was initiated.

In conclusion, our results have shown that penetration of rice roots was not affected by host variety. However, development beyond the J2 was hindered in the resistant variety . whereas the nematodes grew and developed to maturity in the susceptible rice variety.

Table 2. Development of *Meloidogyne incognita* juveniles on susceptible Mars and resistant LeMont rice varieties at 2, 8, 15 and 22 days after inoculation.[x]

	Meloidogyne incognita developmental stage			
Rice Variety	J2	J3	J4	AF[z]
Mars 2D[y]	24.6	0.0	0.0	0.0
LeMont 2D	22.8	0.0	0.0	0.0
FLSD ($P \leq 0.05$)	7.1	—	—	—
Mars 8D	35.2	0.0	0.0	0.0
LeMont 8D	2.4	0.0	0.0	0.0
FLSD ($P \leq 0.05$)	7.4	—	—	—
Mars 15D	11.8	2.8	4.4	0.6
LeMont 150D	4.4	0.0	0.0	0.0
FLSD ($P \leq 0.05$)	1.2	4.3	2.4	0.9
Mars 22D	14.2	3.2	5.2	5.8
LeMont 22D	3.2	0.0	0.0	0.0
FLSD ($P \leq 0.05$)	3.7	1.3	2.0	2.9

[x]Values means of 5 replicates.
[y]2D, 8D, 15D, and 22D equal number of days after inoculation.
[z]AF=Adult Female

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