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HOST STATUS OF BANANA FOR FOUR MAJOR SPECIES AND HOST RACES OF *MELOIDOGYNE*

by

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Summary. Glasshouse experiments were conducted to determine the host suitability of eight root-knot nematodes viz. *Meloidogyne incognita* races 1, 2, 3, and 4, *M. arenaria* races 1 and 2, *M. javanica* and *M. hapla* on banana. Except for *M. hapla* all root-knot nematodes tested reproduced readily on banana and induced extensive root galling. Banana was found to be a poor host for *M. hapla* which had the lowest gall index of 0.8 and a very low reproduction factor (>3). Root necrosis was significantly high with *M. arenaria* race 2 and *M. incognita* race 2. Significant restriction in plant growth as reflected in pseudostem diameter, shoot weight and root weight was observed in the nematode-inoculated plants, as compared to non-inoculated control.

Banana (*Musa* spp.) is an important commercial fruit crop grown in tropical and subtropical conditions. The root-knot nematode, *Meloidogyne incognita,* is commonly associated with the crop and causes about 29 per cent yield loss (Jonathan, 1994). Several workers have reported the association of *M. incognita* and *M. javanica* in banana (Gowen and Quénéhervé, 1990), but there is little information on the association of other root-knot species on banana. The objective of this study, therefore, was to evaluate the nematode host status with the four major *Meloidogyne* spp. and host races on banana.

Materials and methods

Banana-tissue culture plants cv. William hybrid with uniform height of 25 cm were planted in 15 cm diameter pots filled with steam-sterilized sand and soil mixture (85% sand, 10% silt and 5% clay). Seven days later, the plants were inoculated with *M. incognita* (Kofoid *et* White) Chitw. races 1, 2, 3 and 4; *M. arenaria* (Neal) Chitw. races 1 and 2, *M. javanica* (Treub) Chitw. and *M. hapla* Chitw. The nematode inocula were obtained from the North Carolina State University Cultures maintained in glasshouses. With the exception of *M. incognita* race 2, the eggs of the various cultures were obtained from populations maintained on tomato cv. Rutgers; those of *M. incognita* race 2 from a population maintained on tobacco cv. NC 95. Inoculum of each root-knot species was prepared by the NaOCl method (Hussey and Barker, 1973) with an inoculum level of 10,000 eggs per pot. There were five replications in each treatment.

Plants were de-potted ten weeks after nematode inoculation and growth parameters viz.

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shoot weight, pseudostem diameter and root weight were recorded. The roots were carefully washed with tap water, and the per cent gall index was recorded both in primary and secondary roots. Also the per cent necrosis of the root was recorded. The eggs per plant were estimated by collecting 5 g root sub-sample from each plant and then treating it with 0.5% NaOCl to extract nematode eggs (Hussey and Barker, 1973). The data were subjected to analysis of variance and the Waller-Duncan k-ratio t-test (where K=50) was used to separate means (Waller and Duncan, 1969).

Results and discussion

Meloidoyne incognita races 1, 2, 3, and 4; *M. arenaria* races 1 and 2 and *M. javanica* significantly suppressed plant growth, as evidenced by shoot weights, pseudostem diameter and root weights of banana plants. *M. hapla*-inoculated plants did not induce any significant effect on shoot growth, but did negatively affect root biomass (Table I).

The highest gall index of 54 per cent was observed on primary roots of plants inoculated with *M. javanica*, followed by *M. incognita* race 2, and *M. arenaria* race 2 which registered 50 and 49 per cent, respectively. *M. hapla* recorded the minimum gall index of 0.8 per cent which was statistically on par with the uninoculated control plants. Also, the gall index on secondary roots was high (48%) in *M. javanica* and was followed by *M. incognita* race 3 at 47 per cent.

Root necrosis was significantly high in *M. arenaria* race 2 and *M. incognita* race 2, recording 22 and 21 per cent, respectively.

The numbers of eggs extracted per root system were high in all the root-knot nematodes tested except *M. hapla*. The reproduction factor Rf value was significantly high in all the root-knot nematodes other than *M. hapla* which had a value of <3. The highest Rf values of 124 and 121 were observed in *M. incognita* races 2 and 1, respectively (Table II). Compared to the *M. incognita* races 1 and 2 (Rf of 121 and 124), the Rf for *M. javanica* (26) was rather low, although not different statisfically (Table II). Undoubtedly, the extreme suppression of root growth caused by *M. javanica* had a major negative impact on its reproduction.

The experimental data clearly show that there were few significant differences in plant-growth parameters between uninoculated control and

TABLE I - *Effect of* Meloidogyne *spp. on the growth of banana.*

Nematode sp./race	Shoot weight (g)	Pseudostem diam (cm)	Root weight (g)
Meloidogyne incognita Race 1	90.2 B	2.1 BC	186.4 BC
M. incognita Race 2	94.8 B	2.2 B	184.4 BC
M. incognita Race 3	92.2 B	2.1 BC	213.8 B
M. incognita Race 4	97.8 B	2.2 BC	181.6 BCD
M. javanica	82.6 B	2.0 C	147.4 D
M. arenaria Race 1	95.6 B	2.2 BC	213.2 B
M. arenaria Race 2	91.6 B	2.0 C	172.4 CD
M. hapla	146.6 A	2.6 A	213.4 B
Control	154.6 A	2.7 A	264.4 A

Means followed by the same letter are not significantly different according to the Waller-Duncan k-ratio t-test (k=50).

TABLE II - *Infection and reproduction of* Meloidogyne *spp. and host races on banana.*

Nematode sp./race	Gall index on primary root (%)	Gall index on secondary root (%)	Root-necrosis (%)	Eggs/root system	$Rf=P_f/P_i$
Meloidogyne incognita					
Race 1	39.0 (0.40) D	35.0 (0.36) D	18.0 (0.18) AB	1,208,611 (6.0) A	121A
M. incognita Race 2	50.0 (0.52) AB	42.0 (0.43) C	21.0 (0.21) A	1,237,966 (6.0) A	124A
M. incognita Race 3	44.0 (0.46) C	47.0 (0.49) AB	10.0 (0.10) CD	682,930 (5.7) A	68A
M. incognita Race 4	46.0 (0.48) BC	44.0 (0.46) ABC	17.0 (0.17) AB	985,441 (5.9) A	99A
M. javanica	54.0 (0.57) A	48.0 (0.50) A	13.0 (0.13) BC	255,086 (5.4) A	26A
M. arenaria Race 1	46.0 (0.48) C	44.0 (0.46) ABC	13.0 (0.13) BC	452,610 (5.6) A	45A
M. arenaria Race 2	49.0 (0.51) B	43.0 (0.45) BC	22.0 (0.22) A	867,453 (5.9) A	88A
M. hapla	0.8 (0.01) E	0.8 (0.01) E	9.0 (0.09) CD	26,069 (1.8) B	<3 B
Control	0.0 E	0.0 E	5.4 (0.05) D	0.0 C	0 B

Means followed by the same letter are not significantly different according to the Waller-Duncan k-ratio t-test (k=50). Figures in parentheses for gall index and root necrosis are Arcsin transformed values and figures in parentheses for eggs/root system are log transformed values.

M. hapla-inoculated banana plants. This finding indicates that banana is a very poor host for *M. hapla*. In contrast, the other species and host races viz. *M. incognita* races 1, 2, 3 and 4; *M. arenaria* races 1 and 2 and *M. javanica* are able to infect and multiply very well in the crop.

The experiment was repeated during 1998 at 10-day interval with very similar results. The evidence of the high host suitability of banana to all temperate/tropical *Meloidogyne* populations emphasizes the hazard that these pathogens pose for this important crop.

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