HOST STATUS OF SELECTED PLANT SPECIES FOR *MELOIDOGYNE MEGADORA*†

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ABSTRACT

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Thirty-two plant genotypes, mainly cultivars from nineteen plant species, were tested as hosts for *Meloidogyne megadora* under growth-room conditions at ambient temperature ranging from 20 to 28°C. Each plant was inoculated with 5 000 eggs and second-stage juveniles. Host suitability was assessed 60 days after inoculation, based on root gall index and final population level. The cultivars of cucumber (*Cucumis sativus*) and one of banana (*Musa acuminata* cv. Grande Anã) were the most susceptible hosts. Two banana genotypes (*M. acuminata* cv. Hybrid Williams and *M. paradisiaca*), sweet potato (*Ipomoea batatas*) and two pea (*Pisum sativum*) cultivars were also susceptible. Resistant were: two cultivars of pepper (*Capsicum annuum*), three of lettuce (*Lactuca sativa*), and one cultivar each of cabbage (*Brassica oleracea* cv. Tronchuda Portuguesa), watermelon (*Citrullus vulgaris*), relish (*Petroselinum crispum*), eggplant (*Solanum melongena*), potato (*Solanum tuberosum*), papaya (*Carica papaya*), and dwarf balsam (*Impatiens balsamina*). Several plants appeared to be hypersensitive; they exhibited galling, but suppressed nematode development. These included: one cultivar of beet (*Beta vulgaris*), four cultivars of cabbage, two of turnip (*Brassica napus*), one of cantaloupe (*Cucumis melo*), one of soybean (*Glycine max*), and two of radish (*Raphanus sativus*). Results are discussed in terms of the potential use of some of these plants in cropping systems in *M. megadora*-infested soils in the Democratic Republic of S. Tomé and Príncipe.

Key words: cropping systems, host range, *Meloidogyne megadora*, root-knot nematodes.

RESUMEN

de Almeida, A. M. S. F., M. S. N. de A. Santos y M. F. Ryan. 1997. Capacidad hospedante de especies de plantas seleccionadas frente a *Meloidogyne megadora*. Nematrópica 27:1-6.

Treinta y dos plantas de diferentes genotipos, principalmente cultivares de diez y nueve especies fueron evaluadas como hospedantes para *Meloidogyne megadora*, bajo condiciones de crecimiento a temperatura ambiente oscilando entre 20 a 28C. Cada planta fue inoculada con 5 000 huevos y juveniles de segundo estadío. La compatibilidad con el huésped fue estimada 60 días después de la inoculación, basado en el índice de agallamiento de la raíz y los niveles finales de la población. Las variedades de pepino (*Cucumis sativus*) y un de banana (*Musa acuminata* cv. Grande Anã) fueron los huéspedes más susceptibles. Dos genotipos de bananas (*M. acuminata* cv. Hybrid Williams y *M. paradisiaca*), el camote (*Ipomoea batatas*) y dos cultivares de guisantes (*Pisum sativum*) también fueron susceptibles. Resistentes fueron: dos cultivares de pimiento (*Capsicum annuum*), tres de lechuga (*Lactuca sativa*) y solo una cultivar en cada una de las siguientes especies: col (*Brassica oleracea* cv. Tronchuda Portuguesa), melón de agua (*Citrullus vulgaris*), pepino relish (*Petroselinum crispum*), berenjena (*Solanum melongena*), papa (*Solanum tuberosum*), papaya (*Carica papaya*) y el bálsamo enano (*Impatiens balsamina*). Varias plantas mostraron hipersensibilidad; estas exhibieron nodulos, pero suprimieron el desarrollo de

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los nematodos. Este grupo incluyó: un cultivar de remolacha (*Beta vulgaris*), cuatro cultivares de col, dos cultivares de nabo (*Brassica napus*), uno de melón de castilla (*Cucumis melo*), uno de soja (*Glycine max*), y dos de rábano (*Raphanus sativus*). La discusión de los resultados está basada en el uso potencial de algunas de estas plantas para sistemas de producción, en suelos de la República de S. Tome y Príncipe infestados con *M. megadora.*

Palabras claves: gama de hospedantes, nemátodos agalladores, sistemas de producción.

INTRODUCTION

Meloidogyne megadora Whitehead is one of the lesser known species of root-knot nematodes (Sasser, 1977). It was first found in 1968 in coffee plantations (*Coffea canephora* Pierre var. *robusta*) and on *Coffea arabica* L., *Coffea congensis* Froehn., *Coffea eugenioides* S. Moore, and *Coffea* sp. in Angola (Whitehead, 1968; 1969). Later, in Sudan, a root-knot nematode, possibly *M. megadora,* was found on *Musa* sp., pepper (*Capsicum annuum* L.), fennel (*Foeniculum vulgare* Mill.), lettuce (*Lactuca sativa* L.), guava (*Psidium guajava* L.), *Phyllathus* sp., and *Euphorbia atropurpurea* Bronss. (Decker *et al.*, 1980; Yassin and Zeidan, 1982). More recently, *M. megadora* was found on banana (*Musa paradisiaca* L. var. *sapientum*) in China (Zhang and Ziming, 1991), and on coffee plants (*C. arabica*) in the Democratic Republic of S. Tomé and Príncipe (Abrantes *et al.*, 1995 a, b; Rodrigues and Santos, 1993). *Meloidogyne megadora* is becoming widespread in Democratic Republic of S. Tomé and Príncipe and could threaten other hosts as coffee plantations are being replaced by other crops (Abrantes *et al.*, 1995 b).

Because little is known about the host range of *M. megadora,* the objective of our study was to determine the suitability of various plants as hosts for this nematode.

MATERIALS AND METHODS

Thirty-two genotypes, most of them cultivars from 19 plant species, were evaluated for host suitability for *M. megadora* (Table 1). Banana plants originated from tissue culture, and the two cultivars of *M. acuminata* were provided by the Laboratório Agrícola da Madeira, Portugal. Potato and sweet potato plants were obtained from stem cuttings. All other plants were grown from seeds, obtained from a seed store (Alípio Dias & Irmáo Lda.) in Oporto, Portugal. Young plants and seedlings were transplanted when they were about 8 cm tall, one per 10-cm-diameter pot filled with a 1:2 mixture of steam sterilized sand:sandy loam soil (80% sand, 15% silt, 5% clay).

The population of *M. megadora* was obtained from infected coffee roots (*C. arabica*) collected in Democratic Republic of S. Tomé and Príncipe and identified on the basis of perineal pattern morphology and esterase phenotype (Abrantes *et al.,* 1995 b; Whitehead, 1968). Species identification was also confirmed at the end of each experiment. Since preliminary studies had shown that bean (*Phaseolus vulgaris* L.) cv. Bencanta Trepar was a good host for *M. megadora* (Almeida and Santos, unpubl.), the population was maintained on it and used as a source of inoculum. Nematode eggs were extracted using NaOCl extraction (Hussey and Barker, 1973).

Seedlings and young plants were inoculated with 5 000 eggs and hatched second-stage juveniles (J2) at transplanting. The nematode suspension was poured into 4 holes about 3 cm deep around the base of each plant. The holes were then filled with soil and a little water added. There were five replicates of each genotype, with Bencanta Trepar bean included as a suscepti-

Table 1. Host status of selected plant species and cultivars for *Meloidogyne megadora*, measured 60 days after inoculation with 5 000 juveniles (J2)+eggs per plant.

Plant species (common name)	Cultivar	GI[w]	Pf[x] (× 1 000)	Host status[y]
Beta vulgaris L. (beet)	Vauriac	4	0	R[z]
Brassica napus L. (turnip)	Roxo Comprido	4	0.3 ± 0.18	R[z]
	Sessenta Dias	4	0	R[z]
Brassica oleracea L. (cabbage)				
var. *costata*	Tronchuda Portugesa	0	0	R
	Virtudes	3	0	R[z]
var. *capitata*	Bacalan	3	0	R[z]
	Coração de Boi	3	0	R[z]
	Holanda	3	0	R[z]
Capsicum annuum L. (pepper)	Elvas	0	0	R
	Maor	0	0	R
Carica papaya L. (papaya)	—	0	0	R
Citrullus vulgaris Schrad. (watermelon)	Sugar Baby	0	0	R
Cucumis melo L. (cantaloupe)	Pele de Sapo	4	0.2 ± 0.30	R[z]
Cucumis sativus L. (cucumber)	Ashey	5	57.9 ± 18.29	S
	Inglês Comprido	5	56.2 ± 10.19	S
	Longo da China	5	84.3 ± 59.79	S
Glycine max Merr. (soybean)	FT-Cristalina	4	0	R[z]
Impatiens balsamina L. (dwarf balsam)	—	2	4.2 ± 2.62	R
Ipomoea batatas L. (sweet potato)	—	4	17.9 ± 0.84	S
Lactuca sativa L. (lettuce)	B-Manteiga	0	0	R
	Maravilha das 4 Estações	0	0	R
	M-Inverno	0	0	R
Musa acuminata L. (banana)	Grande Anã	5	60.9 ± 16.47	S
	Hybrid Williams	4	29.3 ± 13.21	S

[w]GI = gall index (0-5): 0 = no galls; 1 = 1-2 galls; 2 = 3-10 galls; 3 = 11-30 galls; 4 = 31-100 galls; 5 = >100 galls per root system.
[x]Pf = final population density (J2 + eggs). Data are means of five replicates ± standard deviation.
[y]Host status categories: R = Resistant; S = Susceptible.
[z]Hypersensitive response.

Table 1. (Continued) Host status of selected plant species and cultivars for *Meloidogyne megadora*, measured 60 days after inoculation with 5 000 juveniles (J2)+eggs per plant.

Plant species (common name)	Cultivar	GI[w]	Pf[x] (× 1 000)	Host status[y]
Musa paradisiaca L. (banana)	—	3	16.8 ± 1.53	S
Petroselinum crispum (Mill.) A. W. Hill (relish)	Comum	0	0	R
Pisum sativum L. (pea)	Progresso 9	4	27.7 ± 5.69	S
	Rondo	3	9.6 ± 3.16	S
Raphanus sativus L. (radish)	Redondo Escarlate	4	0	R[z]
	Semi-longo Escarlate	4	0	R[z]
Solanum melongena L. (egg plant)	Aubergine	0	0	R
Solanum tuberosum L. (potato)	Désirée	0	0	R

[w]GI = gall index (0-5): 0 = no galls; 1 = 1-2 galls; 2 = 3-10 galls; 3 = 11-30 galls; 4 = 31-100 galls; 5 = >100 galls per root system.
[x]Pf = final population density (J2 + eggs). Data are means of five replicates ± standard deviation.
[y]Host status categories: R = Resistant; S = Susceptible.
[z]Hypersensitive response.

ble check. Pots were arranged in a completely randomized design in a growth room, at an ambient temperature ranging from 20 to 28°C and a 14-hr photoperiod. Plants were watered daily and fertilized weekly with Hyponex®, a water-soluble fertilizer (7% N, 6% P, 19% K).

Experiments were terminated 60 days after inoculation. Roots were washed free of soil, and egg masses were stained with Phloxine B (Hartman, 1982). Galls per plant root system were rated and an index of 0-5 was assigned (0 = no galls, 1 = 1-2, 2 = 3-10, 3 = 11-30, 4 = 31-100, and 5 = >100 galls per root system) (Taylor and Sasser, 1978). Eggs were then extracted from each root system and counted to determine final population density for each plant. Assessment of host suitability was based on gall indices and reproduction, according to the modified scheme of Canto-Saenz (Sasser *et al.*, 1984). After root ratings were completed, root systems with galls, but few or no egg masses, were stained with acid fuchsin (Byrd *et al.*, 1983). Numbers of juveniles, females, and males were recorded.

RESULTS AND DISCUSSION

Plant species and cultivars varied in their host status for *M. megadora* (Table 1). Cultivars within plant species, except from *Brassica oleracea*, did not vary in their response to the nematode. *Meloidogyne megadora* infected, developed, and reproduced (Pf/Pi > 1) on roots of nine species or cultivars of plants. The three cucumber cultivars and the banana cv. Grande Anã were the most susceptible hosts with heavy galling and Pf/Pi > 10. The banana cv. Hybrid Williams and *M. paradisiaca*, sweet potato, and one pea cultivar were also susceptible hosts with Pf/Pi values between 3 and 6. The other pea cultivar was susceptible with a Pf/Pi value near 2. However, since Pf is a function of time (Araya and Caswell-Chen, 1994), other experiments should be conducted to determine whether 60 days after inoculation is sufficient time to detect important differences in nematode reproduction.

Twelve plants were considered resistant (Table 1); in only one of these, dwarf balsam, were galls formed and nematode reproduction observed. Resistant plants showing neither nematode reproduction nor root galling will be the safest to grow, since damage is not expected with plants of this type.

Four cultivars of cabbage, two of turnip, one of beet, one of cantaloupe, one of soybean, and the two of radish appeared to be hypersensitive, showing significant damage (gall index > 2), but with Pf and Pf/Pi values of 0 or near 0. Several empty necrotic galls were found in all hypersensitive plants, except *Beta vulgaris*, *Brassica napus* cv. Roxo Comprido, and *Glycine max*, in which galls contained a few swollen and deteriorated J2. Sixty days after inoculation, nematodes were found in most of the hypersensitive plants but development was delayed (Table 2). Females producing eggs were found in roots of only two of these plants, *Brassica napus* cv. Roxo Comprido and *Cucumis melo* cv. Pele de Sapo. More males than females occurred in roots of *G. max* and *Raphanus sativus* cv. Redondo Escarlate, and only males were found in roots of *Beta vulgaris*. It appears that *M. megadora* could induce galls on the roots of these hypersensitive plants but often could not reproduce. The nematodes either died in the root tissues or mobile stages (J2 or adult males) migrated into the soil. Plants designated as hypersensitive may suffer significant damage but the nematode population increase will be small.

In Democratic Republic of S. Tomé and Príncipe, *M. megadora* has been found in only a few fields, but its ability to attack

Table 2. Developmental stages of *Meloidogyne megadora* present in roots of hypersensitive plants, 60 days after inoculation with 5 000 juveniles (J2) + eggs per plant.

Plant species (cultivar)	Number per root system[z] J2	Females without egg masses	Females with egg masses	Males
Beta vulgaris (Vauriac)	5.2	—	—	2.0
Brassica napus (Sessenta Dias)	6.2	—	—	—
(Roxo Comprido)	9.2	—	2.0	—
Brassica oleracea (Virtudes)	12.0	4.0	—	—
(Coração de Boi)	7.0	13.6	—	—
(Bacalan)	—	—	—	—
(Holanda)	7.0	5.0	—	—
Cucumis melo (Pele de Sapo)	—	68.0	4.0	—
Glycine max (FT-Cristalina)	12.0	25.6	—	68.0
Raphanus sativus (Redondo Escarlate)	20.0	9.2	—	12.7
(Semi-longo Escarlate)	—	—	—	—

[z]Data are means of five replicates.

several of these plant species and cultivars, in addition to the few hosts already known, makes it a potential threat to several crops. However, our results also suggest that resistant plants are available which could be used in cropping sequences to maintain nematode populations at low levels.

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