HOST STATUS AND RESPONSE OF KENAF (*HIBISCUS CANNABINUS*) TO *MELOIDOGYNE INCOGNITA* RACE 4, *M. JAVANICA, HOPLOLAIMUS MAGNISTYLUS,* AND *ROTYLENCHULUS RENIFORMIS*

G. W. Lawrence[1] and K. S. McLean[2]

Department of Plant Pathology and Weed Science, Mississippi State University, Mississippi State, MS 39762,[1] and Department of Agriculture, Northeast Louisiana University, Monroe, LA 71209, U.S.A.[2]

RESUMEN

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Se estudió la relación parásito hospedador de *Meloidogyne incognita, Meloidogyne javanica, Hoplolaimus magnistylus* y *Rotylenchulus reniformis* en kenaf (*Hibiscus cannabinus*) cv. Tainung 1 bajo condiciones de invernadero. Se inocularon plántulas de kenaf con 1 600 huevos y juveniles de *M. incognita*, 1 300 huevos y juveniles de *M. javanica*, 113 juveniles y adultos de *H. magnistylus* y 3 000 juveniles y adultos vermiformes de *R. reniformis*. Se cosecharon las plantas y se determinaron las poblaciones de nematodos 60 días después de la inoculación. Sólo *M. incognita* redujo la altura de las plantas y los pesos frescos y secos de los tallos. Todos los tratamientos presentaron una reducción en los pesos frescos y secos de las raíces. Las tasas de incremento poblacional (población final/poblacion inicial) de *M. incognita, M. javanica, H. magnistylus* y *R. reniformis* fueron 90.3, 47.4, 11.0 y 12.7, respectivamente. El incremento en las densidades poblacionales de los nematodos, así como la reducción en el crecimiento de las plantas indican que el kenaf es un hospedador susceptible a estas especies de nematodos.

Palabras clave: capacidad hospedador, cultivo de fibras, *Hibiscus cannabinus, Hoplolaimus magnistylus*, kenaf, *Meloidogyne incognita, Meloidogyne javanica, Rotylenchulus reniformis.*

Kenaf (*Hibiscus cannabinus* L.), an annual fiber crop, is a potential source of pulp for high quality newsprint paper. Pulp is made from fibers of the stem. Newsprint made from a blend of kenaf with pine-derived woodpulp is smoother and has better printability (12) than newsprint made from woodpulp alone.

Studies in Florida identified nine species of plant-parasitic nematodes associated with kenaf (3). Root-knot nematodes (*Meloidogyne* spp.) are considered the major nematode pests of kenaf and have been reported on kenaf in every country where kenaf has been grown (3). *Meloidogyne arenaria* (Neal) Chitwood, *M. javanica* (Treub) Chitwood, and *M. incognita* (Kofoid & White) Chitwood often reduce the growth and yield of kenaf (3,7,9,10, 12,13,14). Tests conducted in Texas revealed that all four races of *M. incognita* reproduce on kenaf (14). Symptoms associated with root-knot nematodes include a diminution of plant growth, yellowing of leaves, defoliation, and eventual death of the plants before they reach maturity (3).

In the United States, kenaf production is planned for the Mississippi Delta region on land that is currently used for producing cotton and soybean. The major plant-parasitic nematode pests common to both crops in the Mississippi Delta are *Meloidogyne* spp., *Rotylenchulus reniformis* Linford & Oliveira, and *Hoplolaimus magnistylus* Robbins (6,8,11). Kenaf is taxonomically related to cotton and might be a host for many of the same nematode species as cotton. The rotation of cotton with kenaf could allow

nematode populations to increase, causing economic reductions of fiber yield in both crops. The objectives of this study were to compare reproduction by Mississippi populations of *H. magnistylus, R. reniformis, M. incognita,* and *M. javanica* on a representative kenaf cultivar (Tainung 1) and evaluate their effects on plant growth.

The experiment was conducted in 1990 in the Plant Pathology/Nematology greenhouse at Mississippi State University. Populations of *M. incognita* race 4 and *M. javanica* from Mississippi were increased on tomato (*Lycopersicon esculentum*). Eggs and second-stage juveniles (J2) were extracted from roots by the sodium hypochlorite method (4). Soil containing *H. magnistylus* was collected in a kenaf field near Charleston, Mississippi, and nematodes were extracted by gravity-screening and sucrose centrifugation (1, 5). *Rotylenchulus reniformis* was increased in the greenhouse on cotton (*Gossypium hirsutum*) and juveniles and vermiform adults were extracted from soil by gravity-screening and sucrose centrifugation as described.

Germinated seeds of kenaf cv. Tainung 1 with a radicle length greater than 1 cm were transplanted into individual 12-cm-diam clay pots containing 500 cm^3 of a 1:1 mixture (v:v) of steam sterilized sand and Marietta silty clay loam soil. Each plant was inoculated with the appropriate nematode population 5 days after planting by pouring an aqueous suspension of nematodes in 5 ml total volume into three 1.5-cm-diam × 3-cm-deep depressions in each pot. The inoculum densities used for *M. incognita* and *M. javanica*, respectively, were 1 600 and 1 300 eggs + J2/500 cm^3 soil. The inoculum densities used for *H. magnistylus* and *R. reniformis* were 120 and 3 000 juveniles + vermiform adults/500 cm^3 soil.

The experimental design was a randomized complete block with 10 replications. Plants were allowed to grow in the greenhouse 60 days prior to harvest.

At harvest, plant heights and the fresh and dry weights of shoots and roots were recorded. Nematodes were extracted from soil by a combined gravity screening and sucrose centrifugation and were counted. Eggs of sedentary species were extracted by the sodium hypochlorite method (4) and counted. Root systems from pots inoculated with *H. magnistylus* were washed to remove adhering soil particles and then stained for 4 min with acid fuchsin (2). *Hoplolaimus magnistylus* within roots were counted using a stereo microscope.

Plant data and nematode population densities were subjected to analysis of variance and means were compared using Fisher's protected least significant difference test. The experiment was repeated once.

Results of the two replicate experiments were similar. Only effects that occurred in both experiments are discussed. The data presented are from the first run. Kenaf cv. Tainung 1 was a good host for all four nematode species. Reproductive factors (Rf = final population/initial population) were 90.3, 47.4, 12.7, and 11.0 for *M. incognita, M. javanica, R. reniformis*, and *H. magnistylus*, respectively (Table 1).

Only plants in the *M. incognita* treatment were shorter ($P \leq 0.05$) than those in the control (Table 1). The average height of control plants was 151.4 cm; plants inoculated with *M. incognita* were 18% shorter than control plants. *Meloidogyne incognita* also reduced the fresh and dry weights of shoots by 23% and 37%, respectively.

The weights of root systems were reduced in all nematode treatments when compared with the roots of plants in the

Table 1. Host status and response of kenaf (*Hibiscus cannabinus*) cv. Tainung 1 to *Hoplolaimus magnistylus*, *Meloidogyne incognita* race 4, *Meloidogyne javanica*, and *Rotylenchulus reniformis* in 500-cm³ greenhouse pots 60 days after inoculation.

Nematode species	Nematode reproduction			Plant growth				
				Height	Shoot wt (g)		Root wt (g)	
	Pi[x]	Pf[y]	Rf[z]	(cm)	Fresh	Dry	Fresh	Dry
H. magnistylus	113	1 238	11.0	149.6	33.2	7.1	26.7	2.8
M. incognita	1 600	143 189	90.3	124.0	27.2	5.2	27.8	3.1
M. javanica	1 300	61 130	47.4	141.2	34.5	8.3	20.8	3.2
R. reniformis	3 000	38 213	12.7	143.3	32.3	7.7	18.1	2.3
Control				151.4	35.4	8.3	55.0	23.4
FLSD ($P \leq 0.05$)	—	51 167	—	15.8	6.4	2.4	19.2	11.2

[x]Pi (initial population) = nematodes per pot at planting.
[y]Pf (final population) = nematodes per pot at harvest.
[z]Rf (reproductive factor) = Pf/Pi.

control (Table 1). Fresh root weights were reduced 50%, 51%, 62%, and 67% in pots inoculated with *M. incognita, H. magnistylus, M. javanica*, and *R. reniformis*, respectively; the corresponding dry root weights were reduced 86%, 87%, 88%, and 96%. There were no differences among nematode species for reductions in fresh or dry root weight.

The initial nematode densities selected for this study were representative of population densities encountered during the growing season in the Mississippi Delta. At those densities, *M. incognita* was pathogenic to kenaf and substantially reduced shoot growth. In kenaf, shoot height and weight are directly related to the amount of fiber produced. *Meloidogyne javanica, H. magnistylus*, and *R. reniformis* did not reduce shoot growth, but they did reduce root growth. Under field conditions, where plants are grown longer than 60 days, reduced root growth could easily result in reduced shoot growth, particularly if soil nutrients or moisture were suboptimal. Therefore, further examination of the effects of all four species on kenaf yield under field conditions in the Mississippi Delta is warranted.

Currently, there are no kenaf cultivars available in the United States with resistance to plant-parasitic nematodes; the producer, therefore, will have to rely on rotations with non-host plants or nematicides, or plant the crop in a field that is not infested with plant-parasitic nematodes at damaging population densities. Additional information is needed to determine the specific nematode population densities that would reduce kenaf yields and economically justify the use of nematicides for nematode management. Efficacy studies are also needed to determine which nematicides can safely be used on kenaf and to examine the benefits in using nematicides to manage plant-parasitic nematodes in kenaf production systems.

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