

Reaction of Ten Cultivars of Watermelon (*Citrullus lanatus*) to a Puerto Rican population of *Meloidogyne incognita*

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Abstract: Ten cultivars of watermelon were evaluated for their response to a Puerto Rican population of *Meloidogyne incognita* under greenhouse conditions in a 2-year study (1989 and 1990). Ten-day-old seedlings were planted in steam-sterilized soil in 15-cm-d plastic pots. The nematode inoculum consisted of 10,000 eggs and (or) second-stage juveniles (J2)/plant. The cultivars were Sugar Baby, Charleston Gray, Seedless, Prince Charles, Charleston 76, Jubilee, Florida Giant, Royal Charleston, Royal Sweet, and Royal Jubilee, with tomato cv. Rutgers included as a susceptible check. A completely randomized design with 10 replications was used. Fifty-five days after soil infestation, root-gall indices, numbers of nematode eggs per root system, and J2 per 250 cm³ of soil were recorded. All cultivars were susceptible. Sugar Baby had the lowest root-gall index, egg and J2 numbers, and a reproductive factor (Rf) of 2.89. Rf differed ($P \leq 0.05$) among cultivars and ranged up to 7.36. Sugar Baby, Seedless, and Florida Giant showed the lowest susceptibility to *M. incognita*, whereas Charleston 76 and Charleston Gray were the most susceptible.

Key words: *Citrullus lanatus*, fruits, host status, *Meloidogyne incognita*, nematode, Puerto Rico, root-knot nematode, susceptibility, vegetables, watermelon.

Vegetables, fruits, and legumes are extensively cultivated in the southern region of Puerto Rico where root-knot nematodes also exist. The demand for high-quality fresh fruit and vegetables has been steadily increasing and has not been satisfied due to plant diseases (9,23). Nematodes are among the most common causes of diseases limiting quality and yield of vegetable crops, especially among the Cucurbitaceae (13,15). The southern root-knot nematode, *Meloidogyne incognita*, is a major pathogen of watermelon, although *M. arenaria* and *M. javanica* are very important in many countries (10). *Meloidogyne incognita* is well documented as having a wide host range (12,14,16). Few vegetable cultivars show resistance to the major species of root-knot nematode (4,7,10,19). Reports on the tolerance levels of watermelon, *Citrullus lanatus*, to root-knot nematodes are few (10). Observations of root-knot nematode injury and significant losses in water-

melon have been reported (8,10,11,17,21, 22).

Effective nematode control can be obtained with soil applications of chemical nematicides (1,11), but in many cases these chemicals are expensive, environmentally incompatible, and effective only over a short period of time. The problems associated with chemical control of nematodes in Puerto Rico have prompted the search for new disease-management strategies that are consistent with sustainable agriculture.

Despite the progress made in developing resistance to root-knot nematodes in several vegetable cultivars (3,15), there are no reported sources of resistance to *M. incognita* in *C. lanatus*. Watermelon is a poor host of *Meloidogyne hapla* (5,18). Because of potential differences among geographically isolated populations of *M. incognita*, evaluation of watermelon cultivar performance in Puerto Rico could differentiate a tolerant cultivar. In our study, 10 watermelon cultivars were evaluated under greenhouse conditions for susceptibility to *M. incognita* in order to identify the most tolerant entries that could be used in breeding programs.

MATERIALS AND METHODS

Two experiments were conducted in a greenhouse from September to November

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1989 and 1990 to evaluate the susceptibility of 10 watermelon cultivars to the root knot nematode, *M. incognita*. The cultivars were Sugar Baby, Charleston Gray, Seedless, Prince Charles, Charleston 76, Jubilee, Florida Giant, Royal Charleston, Royal Sweet, and Royal Jubilee, with tomato (*Lycopersicon esculentum*) cv. Rutgers included as a control. Seeds of each cultivar were sown in vermiculite. Ten-day-old seedlings were transplanted, 1/pot, to 15-cm-d plastic pots containing ca. 1,500 cm³ of a 1:1:1 (v:v:v) sand:peat moss:muck mix (pH 6.3), which was steam sterilized at 0.101 MPa for 60 min.

Meloidogyne incognita was obtained from watermelon and was cultured for 45 days on tomato cv. Rutgers in a greenhouse at 28 ± 4 C. The nematode eggs and second-stage juveniles (J2) were extracted from tomato roots with a NaOCl solution (6). The inoculum consisted of ca. 10,000 *M. incognita* eggs and (or) J2 suspended in 10 ml sterile distilled water, which was pipetted into the soil medium near the roots of each plant at transplanting.

There were 10 replications of each cultivar, with Rutgers tomato included as a susceptible check. Treatments were arranged in a completely randomized design. Plants were maintained at 28 ± 4 C in the greenhouse, watered as necessary, and

supplemented biweekly with 25 ml 20-20-20 (N-P-K) liquid fertilizer.

The experiment was terminated 55 days after soil infestation. Plants were removed from pots and roots were washed free of soil. The total number of galls per root system was recorded. Root galling was rated on a scale of 0 to 5, where 0 = no galls, 1 = 1-2, 2 = 3-10, 3 = 11-30, 4 = 31-100, and 5 = >100 galls per root system (20). After the root gall index was recorded, the roots were cut into 1-cm pieces and treated with NaOCl to extract the nematode eggs (6). The number of J2 per 250 cm³ soil was estimated after extraction by a combined sieving-Baermann funnel method (2). A reproductive factor [Rf = (final number of eggs + J2 in soil) ÷ 10,000 eggs] was calculated for each cultivar.

A combined analysis of variance of the data from both experiments was done with MSTAT-C 1990 Version 1.4 software (Michigan State University, MI). Means were separated by Duncan's multiple-range test at *P* ≤ 0.05.

RESULTS

All watermelon cultivars evaluated were susceptible, but they differed (*P* ≤ 0.05) in root-gall indices and ability to support *M. incognita* reproduction (Table 1). Sugar

TABLE 1. Gall index, numbers of *Meloidogyne incognita* second-stage juveniles (J2) and eggs, and nematode reproductive factor (Rf) on watermelon cultivars 55 days after soil infestation.†

Cultivar	Root-gall index‡	J2/250 cm ³ soil	Eggs (×10 ⁴) on roots	Rf*
Sugar Baby	3.3 d	113 f	3 d	2.89 d
Charleston Gray	5.0 a	1815 a	7 c	7.06 c
Seedless	4.6 b	165 f	4 d	3.65 d
Prince Charles	5.0 a	636 cd	7 c	7.14 c
Charleston 76	4.9 a	368 e	10 b	9.61 b
Jubilee	4.9 a	232 ef	7 c	6.83 c
Florida Giant	4.4 c	178 ef	4 d	3.59 d
Royal Charleston	4.4 c	729 c	7 c	7.40 c
Royal Sweet	4.7 b	314 e	7 c	6.60 c
Royal Jubilee	4.6 b	516 d	7 c	7.36 c
Tomato cv. Rutgers	5.0 a	1303 b	25 a	24.83 a

† A combined analysis of the data from two experiments (1989 and 1990) was conducted. Data are means of 20 replications. Means in each column followed by the same letter do not differ at *P* ≤ 0.05 according to Duncan's multiple-range test.

‡ Gall index rating scale: 0 to 5, where 0 = no galls, 1 = 1-2, 2 = 3-10, 3 = 11-30, 4 = 31-100, and 5 >100 galls per root system (20).

* Rf = (final number of eggs + J2 in soil) ÷ 10,000 eggs.

Baby had the lowest root gall index (3.3), number of J2 (113/250 cm³ soil), number of eggs (3×10^4), and Rf (2.89) (with standard errors of 0.04, 46.03, 3.687×10^3 , and 0.49 respectively). Florida Giant and Seedless supported population densities of *M. incognita* similar to those on Sugar Baby; however, Sugar Baby had a significantly lower gall index. Based on high gall indices and Rf, Charleston 76, Royal Charleston, Royal Jubilee, Prince Charles, Charleston Grey, Jubilee, and Royal Sweet were most susceptible to *M. incognita* (Table 1).

DISCUSSION

All watermelon cultivars evaluated were susceptible to the Puerto Rico population of *M. incognita*. The results were consistent with those reported by others (19,22). The cultivars that we showed to be the least susceptible to *M. incognita*, viz. Sugar Baby, Florida Giant, and Seedless, have attractive agronomic characteristics (high sugar content and yield), which give them tremendous commercial potential (9).

Few options are available in Puerto Rico for management of root-knot nematodes on vegetables and fruits. If nematicides must be used, use of Sugar Baby, Florida Giant, and Seedless might require lower application rates than would the other cultivars used in this study (Table 1). The use of nematicides in the United States is being restricted and may not be an option for disease management in the future. Because of the environmental incompatibility of nematicides, identification of sufficiently tolerant cultivars has become a major concern for watermelon growers in Puerto Rico. Crop rotation, an effective nematode management strategy, is not readily adopted by vegetable growers because most of the recommended nonhost crops available for cultivation under conditions in Puerto Rico are not economically attractive.

Our results showed that Sugar Baby, Florida Giant, and Seedless, although susceptible, gave the best response to *M. in-*

cognita among the 10 watermelon cultivars evaluated. We suggest that these three cultivars be used as standards for testing in large-scale field trials in root-knot nematode infested soils in Puerto Rico.

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