Host Preference of *Radopholus citrophilus* from Hawaiian Anthurium among Selected Tropical Ornamentals

M.Y.C. Goo and B.S. Sipes

Department of Plant Pathology, University of Hawaii at Manoa, Honolulu, HI 96822-2279

Additional index words. *Aglaonema commutatum*, *Anthurium trifidum*, *Calathea variegata*, *Caryota mitis*, *Chamaedorea neathebella*, *Chamaedorea seifrizii*, *Cycas revoluta*, *Dracaena deremensis*, *Howea forsteriana*, *Neodopsis decaryii*, *Phoenix roebellinii*, *Ravenea* spp., *Rhapis excelsa*, *Spathiphyllum wallisii*

Abstract. Fourteen tropical ornamental plants were evaluated for their host status to a population of *Radopholus citrophilus* isolated from anthurium. No nematodes were recovered from the roots of *Aglaonema commutatum*, *Caryota mitis*, *Cycas revoluta*, *Dracaena deremensis*, *Neodopsis decaryii*, *Ravenea* spp., or *Spathiphyllum wallisii* 5 months after inoculation, making these plants nonhosts. Low numbers of *R. citrophilus* were recovered from the roots of *Phoenix roebellinii*, *Rhapis excelsa*, and *Howea forsteriana*, suggesting that they were poor hosts to this nematode population. *Anthurium trifidum*, *Chamaedorea neathebella*, *Chamaedorea seifrizii*, and *Calathea variegata* were hosts for the nematode, allowing population increases of 2.47 to 29.92 times the inoculation density. *C. seifrizii* and *C. variegata* represent new hosts of *R. citrophilus*.

Burrowing nematodes, *Radopholus* spp., are quarantined pests in several states (Arizona, California, Louisiana, New Mexico, Texas) in the United States and in Bermuda, Chile, the European Economic Community, Japan, and Mexico. The quarantines exist to protect susceptible crops, such as citrus, by prohibiting the introduction of the nematode into noninfested areas. The detection of burrowing nematodes in plants destined for export can result in complete destruction of the infested shipment or a loss in value because the rejected plants are often relegated to local markets.

Radopholus citrophilus was identified on anthurium in Hawaii (Huettel et al., 1986). Anthurium is often cultivated near tropical foliage plants destined for export. The Plant Quarantine Division of the Hawaii Dept. of Agriculture (HDOA) recovered burrowing nematode in 1.5% of samples processed from certified nurseries between 1994 and 1996 (C. Kiriara, HDOA, personal communication). Dissemination of *R. citrophilus* from infected anthurium may contribute to contamination in certified burrowing-nematode-free tropical foliage nurseries. The objective of this research was to determine the host status of selected tropical foliage plants to a population of *R. citrophilus* *senso stricto* isolated from anthurium.

Received for publication 30 Sept. 1996. Accepted for publication 3 Mar. 1997. This is a contribution from the Hawaii Institute of Tropical Agriculture and Human Resources, Univ. of Hawaii, Honolulu, journal series no. 4234. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

Materials and Methods

Fourteen tropical ornamental plants [*Aglaonema commutatum* Schott. cv. Emerald Beauty, *Anthurium trifidum* Oliver, *Calathea variegata* (K. Koch) Körn., *Caryota mitis* Lour., *Chamaedorea neathebella* Wendl., *C. seifrizii* Burret, *Cycas revoluta* Thunb., *Dracaena deremensis* L. cv. Warneckii, *Howea forsteriana* (Moore and Muell.) Becc., *Neodopsis decaryii* Baillon, *Phoenix roebellinii* O'Brien, *Ravenea* spp., *Rhapis excelsa* Thunb., and *Spathiphyllum wallisii* Reg. cv. Snow White] commonly grown in Hawaii were evaluated for host status to *R. citrophilus*. All test plants were obtained from certified burrowing-nematode-free nurseries in Hawaii and repotted into 15-cm-diameter clay pots containing 1.5 L of a mixture of 1 volcanic black

cinders (9.5–19 mm in diameter) : 1 Sunshine mix no. 1 (Fisons Horticulture, Bellevue, Wash.). During transplanting, a 5-g root portion was collected from each plant, assayed for plant-parasitic nematodes by mist chamber extraction (Barker, 1985), and found to be free of nematodes. All plants were grown in a glasshouse under 60% shade cloth with air temperatures ranging from 16 to 37 °C with soil temperatures typically 5 °C lower. A randomized complete-block design experiment was conducted using time as blocks and three (block 1) or four (block 2) plants per treatment per block.

Radopholus citrophilus, originally isolated from anthurium on the island of Hawaii and carrying the DK#1 Sequence Characterized Amplification Region (SCAR) (Kaplan et al., 1996; D.T. Kaplan, personal communication), had been maintained on alfalfa callus cultures (Ko et al., 1996). Inoculum was obtained by placing callus tissue on Baermann funnels for 72 h. The inoculum, adjusted to 500 mixed-life stages in 5-mL aliquots, was pipetted 9.5 cm deep, 1.5 cm from the base of each plant. Blocks were inoculated 6 weeks apart to facilitate processing and counting.

Nematode reproduction was determined 5 months after inoculation. Roots were gently removed from the growing medium, clipped from the shoots, and weighed. Nematodes were extracted from a 3- to 4-g root subsample and a 100-cm³ soil subsample placed separately in the mist chamber for 3 d. After extraction, the roots were oven-dried and weighed. The number of *R. citrophilus* per plant was calculated by adding the number of nematodes in the root (nematodes per gram root × total root mass) to the number of nematodes recovered from the media (nematodes per 100 cm³ × 15). A reproductive factor (R_F) was calculated for each pot by dividing the total number of *R. citrophilus* recovered by initial inoculum level and host status evaluated (Seinhorst, 1967). Analysis of variance showed no differences between blocks; consequently, data were combined for calculation of least significant differences (LSD) of R_F values among treatments.

Table 1. Numbers and reproduction of *Radopholus citrophilus*, originally isolated from anthurium in Hawaii, on 14 ornamental tropical foliage plants.

Host plant		Number of <i>Radopholus</i> ^a		
Scientific name	Common name	g dry root	Media	R_F ^b
<i>Chamaedorea seifrizii</i>	Bamboo palm	664	1476	29.92
<i>Anthurium trifidum</i>	Tulip anthurium	1165	1731	15.34
<i>Chamaedorea neathebella</i>	Parlor palm	255	1895	11.84
<i>Calathea variegata</i>	Calathea	20	564	2.47
<i>Phoenix roebellinii</i>	Date palm	3	64	0.25
<i>Rhapis excelsa</i>	Lady palm	17	18	0.23
<i>Caryota mitis</i>	Fish tail palm	0	41	0.09
<i>Howea forsteriana</i>	Kentia palm	8	9	0.03
<i>Cycas revoluta</i>	Sago palm	0	3	0.01
<i>Ravenea</i> spp.	Majesty palm	0	1	0.01
<i>Aglaonema commutatum</i>	Aglaonema 'Emerald Beauty'	0	0	0
<i>Dracaena deremensis</i>	Dracaena	0	0	0
<i>Neodopsis decaryii</i>	Triangle palm	0	0	0
<i>Spathiphyllum wallisii</i>	Spathiphyllum 'Snow White'	0	0	0

^aMeans of seven replications.

^b R_F values (final population/initial population); LSD (0.05) = 13.57. 0 represents nonhost plants; 0 < R_F ≤ 1 are poor hosts; and R_F > 1 are host plants.

Results and Discussion

The ornamental plants ranged from nonhosts to excellent hosts for this population of *R. citrophilus* (Table 1). Low numbers of nematodes were recovered from the roots of *P. roebellinii*, *R. excelsa*, and *H. forsteriana*, suggesting that a low level of nematode reproduction may have occurred on these plants, but that they were poor hosts. A few nematodes were recovered from the media in *C. mitis*, *C. revoluta*, and *Ravenia* spp., but not from the roots of these plants. These nematodes may have been survivors from the inoculation, so these palms were considered nonhosts or very poor hosts. *Aglaonema*, *D. deremensis*, *N. decaryii*, and *Spathiphyllum* were nonhosts for this population of *R. citrophilus*. *Chamaedorea* and *Calathea* have been reported to be hosts to *R. similis* (Holdeman, 1986), but *C. seifrizii* and *C. variegata* represent new hosts of *R. citrophilus*.

The establishment of *R. citrophilus* from anthurium into tropical foliage plants is pos-

sible since some were hosts of the nematode. Additionally, several foliage plants, i.e., *Aglaonema*, *Dracaena*, *Rhapis*, and *Spathiphyllum*, were hosts of *R. similis*, a sibling species of *R. citrophilus*. Because these sibling species are morphologically indistinguishable and subjected to the zero-tolerance level of quarantines, *Radopholus* must not be introduced into certified foliage nurseries. Proper cultural practices, such as sanitation of growing media, pots, and the use of raised benches, can minimize burrowing nematode contamination in certified nursery operations (Ko et al., 1997).

Literature Cited

- Barker, K.R. 1985. Nematode extraction and bioassay, p. 19–35. In: K.R. Barker, C.C. Carter, and J.N. Sasser (eds.). An advanced treatise on *Meloidogyne*. North Carolina State Univ. Graphics, Raleigh.
- Holdeman, Q.L. 1986. The burrowing nematode *Radopholus similis*, *sensu lato*. California Dept. Food and Agriculture, Div. of Plant Industry, Sacramento.
- Huettel, R.N., D.T. Kaplan, and D.W. Dickson. 1986. Characterization of a new burrowing nematode population, *Radopholus citrophilus*, from Hawaii. *J. Nematol.* 18:50–54.
- Kaplan, D.T., M.C. Vanderspool, C. Garrett, S. Chang, and C.H. Opperman. 1996. Molecular polymorphisms associated with host range in the highly conserved genomes of burrowing nematodes, *Radopholus* spp. *Mol. Plant-Microbe Interact.* 9:32–38.
- Ko, M.P., D.P. Schmitt, and M. Saxby. 1997. Effect of container bases on the spread of *Meloidogyne incognita* in a Hawaiian ornamental nursery. *Plant Dis.* 81:607–613.
- Ko, M.P., D.P. Schmitt, and B.S. Sipes. 1996. Axenizing and culturing endomigratory plant-parasitic nematodes using Pluronic® F127, including its effects on population dynamics of *Pratylenchus penetrans*. *J. Nematol.* 28:115–123.
- Seinhorst, J.W. 1967. The relationship between population increase and population density in plant parasitic nematodes. *Nematologica* 15:429–442.