Host Range Studies of *Meloidogyne hapla* in Taiwan

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ABSTRACT

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Vegetables, grasses, and ornamental plants belonging to 17 families, 51 genera, 83 species, 40 cultivars, and 14 breeding lines were tested as hosts of *Meloidogyne hapla*. Fifty-four species and 39 cultivars or breeding lines from 15 families were susceptible; 15 species were resistant, and 29 were immune. Twenty-four plant species were previously unrecorded hosts of *M. hapla*.

Widespread occurrence of the northern root knot nematode (*Meloidogyne hapla* Chitwood) among plant species is well documented (2,3,9,11). Goodey's 1965 catalog (4), which contains host records to 1963, lists 577 flowering plant species affected by this nematode.

Losses to *M. hapla* have been estimated, by crop and percentage, as: alfalfa, 36; peanut, 70; carrot, 50; potato, 46; onion, 64 (1); cabbage, 9; cauliflower, 24 (7); beets, 22; lettuce, 81; and spinach, 13 (8).

Taiwan practices multiple cropping and this is being introduced for evaluation in other countries (12). Success of any cropping scheme depends on basic knowledge of life histories and host ranges of soil pathogens (6). A program in Taiwan uses upland areas for crop production to increase arable acreage. Because *M. hapla* exists in tropical and subtropical regions, chiefly at higher altitudes (1), and because it has a wide host range, it could become an economically important pest.

This report covers studies to investigate the host range of this pest at the Asian Vegetable Research and Development Center, Taiwan, between September 1978 and November 1979.

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MATERIALS AND METHODS

Egg masses of *M. hapla* were multiplied using tomato (*Lycopersicon esculentum* cv. TK70) as the host in the greenhouse. Twenty-five stock cultures were established, and from these, four to six egg masses and 1 or 2 g of galled roots were taken to inoculate test plants, each with three replications and one or two subplant samples per replication. Plants were inoculated 3 wk after germination by digging close to the roots with a small trowel; inoculum was placed evenly on or around roots.

Table 1. New host records of *Meloidogyne hapla*

Host	Horticultural designation	Susceptibility rating[a]	Root count[b]		
			Nematode	Gall	Egg mass
Amaranthaceae					
Amaranthus mangustanus (edible amaranth)	X[c]	2.5	22.0	17.0	14.0
Compositae					
Chrysanthemum coronarium (garland chrysanthemum)	X	5.0	980.0	800.0	339.0
Convolvulaceae					
Ipomoea aquatica (water convolvulus)	X	5.0	150.3	139.0	139.0
Cucurbitaceae					
Cucumis melo var. *conomon* (oriental pickling melon)	X	4.0	26.0	24.7	20.0
Cucurbita ficifolia (Malabar gourd)	Cucumber stock	5.0	247.3	240.0	17.7
Luffa cylindrica (vegetable sponge)	X	5.0	73.0	57.0	53.0
Momordica charantia (balsam pear)	Known You No. 1	3.0	24.7	22.6	16.7
Trichosanthes anguina (snake gourd)	X	3.5	45.2	41.0	36.0
Euphorbiaceae					
Manihot esculenta (cassava)	X	4.0	52.0	36.0	30.0

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Table 1. *(continued from preceding page)*

Host	Horticultural designation	Susceptibility rating[a]	Root count[b]		
			Nematode	Gall	Egg mass
Gramineae					
Zizania latifolia (co ba)	X	2.0	6.0	4.5	2.0
Leguminosae					
Dolichos lablab (hyacinth bean)	Four Seasons	3.0	20.0	18.7	16.0
Glycine clandestina (soybean)	AVRDC G5163	3.0	34.0	21.4	14.6
G. tabacina (wild soybean)	AVRDC G5164	2.0	8.0	6.5	4.0
G. tomentella (wild soybean)	AVRDC G5166	2.0	7.8	6.5	3.5
G. tomentosa (Nagaba yabu mame Jpn. name)	AVRDC G5133	3.0	12.0	11.0	9.0
Pachyrrhizus erosus (yam bean)	X	4.0	41.0	30.7	9.0
Psophocarpus tetragonolobus (asparagus pea)	Indonesia 20	1.5	3.2	3.0	3.0
Vigna aconitifolia (moth bean)	TC 1986	3.0	21.0	20.3	11.0
V. angularis (adjuki bean)	X	3.0	47.0	35.7	32.3
V. radiata var. *sublobata* (mungbean ancestor)	TC 1965	2.0	6.8	4.8	2.6
V. umbellata (rice bean)	TC 1972	2.0	5.0	4.3	2.7
V. unguiculata ssp. *sesquipedalis* (yardlong bean)	Green Pod Kaohsiung	3.0	15.0	11.7	9.7
Tropaeolaceae					
Nasturtium majus (garden nasturtium)	X	2.0	8.3	7.0	5.0
Umbelliferae					
Coriandrum sativum (coriander)	X	5.0	1,290.0	1,274.0	600.0

[a] 0 = no galls or egg masses, 1 = 1 or 2, 2 = 3–10, 3 = 11–30, 4 = 31–100, 5 = more than 100 galls or egg masses.
[b] Numbers are means of three replications with one or two plant subsamples.
[c] Unknown variety.

Test plants, except white potato, were grown from seed and planted in pots (20 cm in diameter, 17 cm high) in sterilized silt loam, compost, sand, and rice hull (5:3:1:1). Plants were grown outside the greenhouse on raised bricks or wooden supports to prevent contamination from ground soil. Plants were watered twice daily and fertilized with N-P-K (40-80-40 kg/ha) once every 2 wk. Air temperatures ranged from 18.6 to 28.4 C.

The reaction of plants to nematodes was evaluated 2 mo after inoculation. Each plant was carefully uprooted; roots were washed free of soil and prepared for nematode, egg mass, and gall counting as described by Taylor (10). Susceptibility was rated on a 0–5 scale: 0 = no galls or egg masses, 1 = 1 or 2, 2 = 3–10, 3 = 11–30, 4 = 31–100, 5 = >100. Plants that were not infested after the first trial were retested. In the greenhouse where stock cultures of *M. hapla* were maintained, mean ambient temperature could reach 32 C during the summer.

Eighty-three species, 40 cultivars, and 14 breeding lines representing 51 genera and 17 families were tested. These were mostly vegetables, with some grasses and ornamentals.

RESULTS AND DISCUSSION

Fifty-four plant species, 25 cultivars, and 14 breeding lines from 15 familes were susceptible (ratings of 2–5), 15 species were resistant (rating of 1), and 29 were not infected. Only new records of resistance or susceptibility are given (Table 1). Almost all of the Gramineae, except *Zizania latifolia*, and almost all of the Amaryllidaceae, except onion, demonstrated resistance or were not hosts to *M. hapla*.

Most species in Cruciferae, Cucurbitaceae, Solanaceae, and Umbelliferae were susceptible to the nematode. Those that were not susceptible (Chinese cabbage cv. Green Petiole, cauliflower, muskmelon cv. Sunrise, watermelon cv. Sugar Baby, tobacco, and celery) have been reported as hosts elsewhere (4); I found that some species such as pumpkin, cucumber and okra were susceptible although they had been reported as resistant (9). Contradictory findings were also seen with garden dahlia, French marigold (5), papaya, taro, and amaranth. Disparity in results in all cases could be a function of pathotype and varietal difference. All tomatoes tested were highly susceptible.

The susceptibility of species in the Leguminosae and Compositae varied greatly. By both visual ratings and microscopic study of roots, this variable susceptibility is at the species level and among varieties and breeding lines. Peanut, soybean, rice bean, mungbean, mothbean, and asparagus pea clearly demonstrate this phenomenon.

Twenty-four plants listed in Table 1 are considered new hosts for *M. hapla*.

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