RESEARCH NOTE

Journal of Nematology 17(1):77–79. 1985.

Host Suitability and Reaction of Bean and Pea Cultivars to *Meloidogyne chitwoodi* and *M. hapla*[1]

G. S. SANTO AND R. P. PONTI[2]

Key words: Phaseolus vulgaris, Pisum sativum, Columbia root-knot nematode, northern root-knot nematode.

The Columbia (*Meloidogyne chitwoodi* Golden et al.) and northern (*M. hapla* Chitwood) root-knot nematodes are of economic importance to several crops, especially potatoes (*Solanum tuberosum* L.) in the Pacific Northwest (4). Crops commonly grown in rotation with potato are alfalfa (*Medicago sativa* L.), wheat (*Triticum aestivum* L.), and corn (*Zea mays* L.). Beans (*Phaseolus vulgaris* L.) and peas (*Pisum sativum* L.) are frequently included in rotations with both potato and its rotational crops. Alfalfa is a good host for *M. hapla* but a poor host for *M. chitwoodi*; however, a population of *M. chitwoodi* that attacks alfalfa recently was found (7). Wheat and corn are good hosts for *M. chitwoodi* but are not hosts for *M. hapla* (5). Host range studies have shown that bean and pea cultivars vary in their host suitability to *M. chitwoodi* and *M. hapla* (1,2,5). Six of nine bean cultivars were reported to be highly susceptible to *M. hapla,* two were moderately susceptible, and one slightly susceptible; two pea cultivars were slightly and highly susceptible (1). In another study, 'Apollo' bean was a moderate host for *M. chitwoodi* and five pea cultivars were rated as moderate hosts and one a poor host (5). Host suitability of seven common bean cultivars to *M. hapla* was reported to range from very resistant to susceptible, and garden pea 'Wando' was moderately resistant (2).

The first objective of our research was to determine host suitability of bean and pea cultivars grown in the Pacific Northwest to *M. chitwoodi* and *M. hapla.* The second objective was to determine any adverse effect these nematodes might have on bean and pea growth.

Meloidogyne chitwoodi isolated from potato tubers and *M. hapla* from alfalfa were increased on tomato (*Lycopersicon esculentum* Mill. 'Columbian') in a greenhouse maintained at 22–26 C. Nematode eggs for inocula were extracted by shaking infected tomato roots in 0.5% NaOCl for 4 minutes (3).

Two seeds of each of the bean cultivars Pinto UI-114, Rufus, and Viva Pink, and pea cultivars Small Sieve Alaska, Venus, Early Perfection 8221, Bolero, Dark Skin Perfection, and Puget were planted into 10-cm-d plastic pots containing 400 ml methyl bromide-fumigated loamy sand (82% sand, 15% silt, 3% clay). After 1 week plants were thinned to one per pot and inoculated with 500 or 5,000 eggs of *M. chitwoodi* or *M. hapla* suspended in 25 ml of water and poured around the exposed roots. Control pots received only water. Pots were arranged in 10 randomized blocks on benches in a greenhouse maintained at 22–26 C. Plants were watered daily and fertilized once during the experiment. The experiment was terminated 60 days after inoculation. Plant tops were cut at the ground line, oven dried, and weighed. Eggs and second-stage juveniles of *M. chitwoodi* and *M. hapla* were extracted from roots by shaking roots in 1% NaOCl for 4 minutes (3). All roots including con-

Received for publication 28 May 1984.

[1] Washington State University College of Agriculture and Home Economics, Pullman, Scientific Paper No. 6841, Project 0650.

[2] Associate Professor of Nematology and Agricultural Research Technologist III, Washington State University, Irrigated Agriculture Research and Extension Center, Prosser, WA 99350.

Mention of a trade name, warranty, proprietary product, or vendor does not constitute a guarantee of a product by Washington State University and does not imply its approval to the exclusion of other products or vendors that may also be suitable.

TABLE 1. Effect of *Meloidogyne chitwoodi* (Mc) and *M. hapla* (Mh) on dry weights of *Phaseolus vulgaris* and *Pisum sativum* cultivars, and nematode reproduction after 60 days.

Cultivar	Treatment: Nematode	Treatment: Inoculum	Top weight (g)	Root weight (g)	Nematodes/g dry root wt. (1,000s)	R*
P. vulgaris						
Rufus	0	0	8.3 a	0.94 b		
	Mc	500	7.6 a	0.86 b	53 b	91 a
	Mc	5,000	7.5 a	0.94 b	454 a	91 a
	Mh	500	6.7 a	0.96 b	74 b	140 a
	Mh	5,000	7.2 a	1.26 a	474 a	118 a
Pinto UI-114	0	0	6.7 a	0.90 a		
	Mc	500	6.8 a	0.81 a	41 b	67 b†
	Mc	5,000	6.6 a	0.80 a	413 a	78 b
	Mh	500	6.6 a	0.97 a	69 b	123 a
	Mh	5,000	5.7 a	1.02 a	585 a	122 a
Viva Pink	0	0	6.6 a	0.97 a		
	Mc	500	6.4 a	0.84 a	55 b	93 b†
	Mc	5,000	6.3 a	0.84 a	507 a	81 b
	Mh	500	6.0 a	0.90 a	125 b	120 a
	Mh	5,000	6.2 a	1.05 a	770 a	155 a
P. sativum						
Small Sieve Alaska	0	0	2.3 a	0.10 b		
	Mc	500	2.3 a	0.10 b	98 c	18 b
	Mc	5,000	2.2 a	0.23 ab	590 ab	31 ab
	Mh	500	2.3 a	0.14 b	503 b	50 a
	Mh	5,000	2.3 a	0.30 a	1,077 a	55 a
Venus	0	0	2.6 a	0.19 b†		
	Mc	500	2.9 a	0.17 b	50 c	17 b†
	Mc	5,000	2.9 a	0.17 b	710 a	25 b
	Mh	500	2.9 a	0.18 b	124 b	40 a
	Mh	5,000	3.1 a	0.24 a	897 a	43 a
Bolero	0	0	3.3 a	0.24 b†		
	Mc	500	3.3 a	0.22 b	102 b	47 b
	Mc	5,000	2.8 a	0.26 ab	1,287 a	66 ab
	Mh	500	3.3 a	0.20 b	163 b	63 ab
	Mh	5,000	3.6 a	0.32 a	1,364 a	82 a
Early Perfection 8221	0	0	3.1 a	0.19 a		
	Mc	500	3.6 a	0.23 a	57 c	28 b
	Mc	5,000	3.1 a	0.26 a	912 a	47 ab
	Mh	500	3.6 a	0.23 a	172 b	75 a
	Mh	5,000	3.2 a	0.29 a	887 a	56 a
Dark Skin Perfection	0	0	4.3 a†	0.41 b		
	Mc	500	3.6 b	0.42 b	71 c	54 b
	Mc	5,000	3.5 b	0.49 ab	530 a	51 b
	Mh	500	4.2 a	0.42 b	104 b	87 a
	Mh	5,000	3.7 ab	0.60 a	733 a	82 a
Puget	0	0	4.6 a	0.30 c		
	Mc	500	5.0 a	0.36 bc	15 a	11 c
	Mc	5,000	5.4 a	0.53 a	264 a	24 b
	Mh	500	4.9 a	0.40 abc	63 b	53 a
	Mh	5,000	4.7 a	0.48 ab	328 a	32 ab

Means of 10 replicates. Values in each column followed by the same letter are not significantly different at $P = 0.01$ according to Duncan's multiple-range test.

* Reproductive factor (R) = final population/initial population.

† Differs at $P = 0.05$.

trols were then oven dried and weighed. The number of eggs and juveniles per gram dry root weight and the reproductive factor (R) were calculated for each cultivar and initial population (Pi) (6).

Meloidogyne hapla had no detrimental effect on any of the cultivars tested (Table 1). Root growth of bean cultivar Rufus and all pea cultivars except Early Perfection 8221 was increased at the high *M. hapla* inoculum level. Root growth of pea cultivar Puget was also increased at the high *M. chitwoodi* inoculum level (Table 1). *Meloidogyne chitwoodi* at both inocula levels reduced top growth of pea cultivar Dark Skin Perfection but did not affect top or root growth of the other pea or bean cultivars (Table 1). All bean and pea cultivars were excellent hosts for both nematode species (Table 1). However, the reproductive factor (R) of *M. hapla* was greater than that of *M. chitwoodi* on bean cultivars Viva Pink and Pinto UI-114 and pea cultivars Dark Skin Perfection, Puget, and Venus.

The bean and pea cultivars we tested were tolerant to *M. chitwoodi* and *M. hapla.* Only the growth of pea cultivar Dark Skin Perfection was adversely affected by *M. chitwoodi.* Thus, growing these cultivars after a root-knot nematode-susceptible crop would not likely cause problems. Because these bean and pea cultivars supported high populations of *M. chitwoodi* and *M. hapla,* they would not be suitable in rotations with root-knot nematode-susceptible crops, especially potatoes. Thus, there is a continuing need to search for rotational crops that will reduce *M. chitwoodi* and *M. hapla* soil populations.

Literature Cited

1. Faulkner, L. R., and F. D. McElroy. 1964. Host range of northern root-knot nematode on irrigated crop plants and weeds in Washington. Plant Disease Reporter 48:190–193.

2. Hadisoeganda, W. W., and J. N. Sasser. 1982. Resistance of tomato, bean, southern pea, and garden pea cultivars to root-knot nematodes based on host suitability. Plant Disease 66:145–150.

3. Hussey, R. S., and K. R. Barker. 1973. A comparison of methods of collecting inocula of *Meloidogyne* spp. including a new technique. Plant Disease Reporter 57:1025–1028.

4. Nyczepir, A. P., J. H. O'Bannon, G. S. Santo, and A. M. Finley. 1982. Incidence and distinguishing characteristics of *Meloidogyne chitwoodi* and *M. hapla* in potato from the northwestern United States. Journal of Nematology 14:347–353.

5. O'Bannon, J. H., and G. S. Santo. 1982. Host range of the Columbia root-knot nematode. Plant Disease 66:1045–1048.

6. Oostenbrink, M. 1966. Major characteristics of the relation between nematodes and plants. Mededelingen Landbouwhogeschool Wageningen 66:1–46.

7. Santo, G. S., and J. H. O'Bannon. 1982. Damage caused by the Columbia root-knot nematode on potato following alfalfa. Spud Topics Vol. 28, No. 12.