EFFECTS OF *HOPLOLAIMUS GALEATUS* ON TEN VEGETABLE CROPS IN FLORIDA[1]

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RESUMEN

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En experimentos realizados bajo condiciones de invernadero, no fue posible incrementar una población de *Hoplolaimus galeatus* de Florida en zanahoria (*Daucus carota*), apio (*Apium graveolens*), pepino (*Cucumis sativus*), lechuga (*Lactuca sativa*) y pimentón (*Capsicum annuum*), durante un período de nueve meses. El nematodo se reprodujo en habichuela (*Phaseolus vulgaris*), repollo (*Brassica oleracea*), zapallo (*Cucurbita pepo*) y tomate (*Lycopersicon esculentum*). Sin embargo, cuando se agregaron poblaciones de 5,000 ó 10,000 nematodos a estos cultivos en macetas de 15 cm, hubo una reducción en la población después de 7 meses y no se observó ninguna evidencia de ecto o endoparasitismo. En maiz dulce (*Zea mays*), la reproducción fue rápida y la alimentación del nematodo fue ecto, semi-endo y endoparasítica. Poblaciones sobre 14,000 nematodos en macetas de 15 cm resultaron en una reducción significativa en el crecimiento del maíz dulce.

Palabras claves adicionales: nematodo lanza, cultivos hortícolas, patología de nematodos.

The lance nematode, *Hoplolaimus galeatus* (Cobb) Thorne, has an extensive distribution on a variety of hosts in the United States. It has caused serious injury to cotton (2), pine (8), oak (9), corn (3), and is pathogenic to many turf grasses in Florida (4). The overall host list is extensive (10).

In Florida, *H. galeatus* is widely distributed in sandy soils used for vegetable production. Large populations frequently occur in fields used for sweet corn production and where grasses are used as summer cover crops. High populations are also often found around roots of other important vegetables. Soil fumigants have given good control of this nematode while nonfumigants have not (5,7). However, with or without nematicides, yield effects have been negligible, indicating that this nematode is not a serious pest of vegetables in Florida (6,7). During 1986-87, greenhouse experiments were conducted to determine the host status and the possible pathogenic effect of *H. galeatus* on several commercially important vegetables.

During January 1986, ten of the most commercially important vegetables produced in Florida were seeded in 15-cm- diam plastic pots of steamed Myakka fine sand (92.2% sand, 5.7% silt, and 2.1% clay). Veg-

Table 1. Evaluation of *Hoplolaimus galeatus* as a pathogen of five vegetable crops in Florida.

Treatment	First Planting[x]		Middle Planting		Last Planting			
							Nematodes	
	Plant weight[y]	Nematodes (soil)[z]	Plant weight	Nematodes (soil)	Plant weight	Root weight[y]	Soil	Roots
Snapbean								
Check	78.8	0	87.1	0	91.3	50.2	0	0
5,000 nemas	75.5	4,300	109.6	3,725	86.0	57.9	3,900	3
10,000 "	71.4	11,100	77.8	7,775	95.8	57.7	7,425	39
LSD 0.05	N.S.		N.S.		N.S.	N.S.		
Cabbage								
Check	132.6	0	—	—	124.4	44.2	0	0
5,000 nemas	121.2	3,375	—	—	122.6	50.1	2,975	7
10,000 "	120.4	7,125	—	—	123.4	55.4	4,850	10
LSD 0.05	N.S.				N.S.	N.S.		
Sweet Corn								
Check	101.8	0	51.8	0	98.2	94.6	0	0
5,000 nemas	101.6	14,075	32.8	23,550	42.3	31.4	22,350	1733
10,000 "	88.0	35,125	31.2	28,525	37.7	28.1	30,050	3567
LSD 0.05	N.S.		17.2		18.9	25.0		
Squash								
Check	117.2	0	45.1	0	119.8	16.5	0	0
5,000 nemas	98.4	6,275	46.7	2,800	122.6	16.7	4,125	3
10,000 "	105.4	11,925	53.1	7,750	122.3	18.2	7,750	5
LSD 0.05	N.S.		N.S.		N.S.	N.S.		

Tomato								
Check	94.6	0	—	—	92.8	40.0	0	0
5,000 nemas	94.2	3,975	—	—	94.3	44.0	3,275	6
10,000 "	88.0	7,825	—	—	94.8	39.5	7,900	8
LSD 0.05	N.S.				N.S.	N.S.		

[x]Each planting was grown to maturity then harvested and the pots replanted. Only two plantings of cabbage and tomato were made because of slower maturity.

[y]Average fresh weight in grams per pot. N.S. = LSD value not significant at $P = 0.05$.

[z]Soil populations were the average numbers per pot. Root populations were the average numbers extracted in 1 wk from the roots obtained from each pot.

etable crops were: 'Harvester' snapbean, *Phaseolus vulgaris* L.; 'Rio Verde' cabbage, *Brassica oleracea* L.; 'Hicolor 9' carrot, *Daucus carota* L.; 'Florida 683' celery, *Apium graveolens* L.; 'Gold Cup' sweet corn, *Zea mays* L.; 'Poinsett' cucumber, *Cucumis sativus* L.; 'Great Lakes' lettuce, *Lactuca sativa* L.; 'Keystone Giant' pepper, *Capsicum annuum* L.; 'Dixie Yellow Crookneck' squash, *Cucurbita pepo* L.; and 'Homestead 24' tomato, *Lycopersicon esculentum* Mill. When seedlings had emerged, they were thinned to two per pot, then 100 hand-picked *H. galeatus* were added to each of five pots for each crop. At 2- to 3-mo intervals, the pots were replanted to maintain actively growing plants for the nematodes to feed on. Nine months later, 3 cores of soil 1.9 cm in diameter were removed from each pot to determine which crops had served as hosts for the nematodes. Of the 10 vegetables, high reproduction had occurred only on sweet corn, and root injury symptoms consisting of reduced secondary roots, root darkening, and sloughing of injured tissue were present. No other crop exhibited root injury symptoms, and only traces of nematode populations were found on carrot, celery, cucumber, lettuce, and pepper indicating that these were either non-hosts or poor hosts. Although root injury symptoms were not found on snapbean, cabbage, squash, and tomato, nematode populations increased in sufficient numbers to indicate that these crops, although poor hosts, would probably maintain levels of the nematode that were present at planting time. If these populations were high enough, they may cause injury.

Since carrot, celery, cucumber, lettuce, and pepper had not increased or maintained populations of *H. galeatus,* no further experimentation was done on these vegetables, whereas a pathogenicity test that included initial inoculation levels of 0, 5000, and 10000 nematodes (cultured on sorghum) per 15-cm-diam pot was conducted on snapbean, cabbage, sweet corn, squash, and tomato. This was a randomized block experiment with five replicates conducted in a glasshouse during October 1986 to May 1987. The crops were planted in steamed Myakka fine sand and soon after emergence, the plants were thinned to two per pot, and then aqueous suspensions of the nematodes were added in a 2-3 cm deep hole in the center of the pot. Before adding them to the pots, the nematodes were passed twice through 4-layer pads of laboratory Kimwipe® tissues to remove root fragments and other debris. During the experimental period, the pots were fertilized as needed with a 10-4-10 NPK mixture. Two consecutive crops of cabbage and tomato were grown to normal harvest stage in the pots; the second crop was planted soon after the first harvest. Three crops of snapbean, sweet corn, and squash were grown consecutively with the same procedures. At each harvest, plants were cut and weighed and soil samples were removed as described previously from the pots to determine nematode populations by centrifugal-flotation (1). After the final harvest, roots were removed, weighed, and examined for nematode injury after washing in tap water. Entire root systems were incubated to extract the endoparasitic life stages of the nematode (11).

During the 7-mo period of the experiment, nematode populations declined slightly to moderately on snapbean, cabbage, squash, and tomato and weights of tops and roots were not significantly affected (Table 1). Root injury symptoms were not observed on any of these plants and only a very few nematodes were obtained from the roots indicating little if any root penetration. However, since various juvenile stages were present in the soil populations from all of these crops, it was assumed that some ectoparasitic feeding had occurred.

By the end of the third planting of sweet corn, approximately 5- and 3.5-fold nematode population increases occurred from the 5,000 and 10,000 initial infestation levels, respectively. Top weights of plants grown with both infestation levels were significantly less than those of the uninoculated plants in the second and third plantings. Root weights of inoculated plants were also significantly less than those of inoculated plants and injury symptoms were strongly evident. Examination of the roots revealed that both endoparasitic and semi-endoparasitic activity was extensive and high numbers of nematodes were obtained from the roots. Large populations in the soil indicated that ectoparasitism was important also on corn.

The results of these experiments confirmed earlier reports that high populations of *H. galeatus* are injurious to corn. Since none of the other vegetables were significantly damaged, and very high populations were required to cause significant injury to corn, it would seem that this nematode would seldom be an important factor in commercial production of these vegetable crops in Florida.

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