Root lesion and root-knot nematodes associated with crops grown in rotation with carrots on Prince Edward Island

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Population levels of root lesion nematodes (primarily *Pratylenchus penetrans*) and northern root-knot nematodes (*Meloidogyne hapla*) were examined in crops that precede or are grown in rotation with carrots on Prince Edward Island. Root lesion nematodes were most prevalent in red clover, hay (red clover-timothy mixture) and potato fields. The largest populations of northern root-knot nematodes were found in carrot fields. The effect of *P. penetrans* on carrots grown on Prince Edward Island has not been investigated, but *M. hapla* can be a serious problem and continuous cultivation of carrots should be avoided. In addition, crops such as barley, wheat, or annual ryegrass, that are not hosts for *M. hapla*, should be included in the rotation.

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On a examiné des populations de nématodes radicicoles (essentiellement *Pratylenchus penetrans*) et de nématodes cécidogènes (*Meloidogyne hapla*) dans des cultures qui précèdent ou sont utilisées en rotation avec les carottes dans l'Île-du-Prince-Édouard. Les nématodes radicicoles dominent dans les champs de trèfle rouge, de foin (mélange de trèfle rouge et de fléole) et de pommes de terre. Les populations les plus nombreuses de nématodes cécidogènes se rencontrent dans les champs de carottes. On n'a pas étudié l'effet de *P. penetrans* sur les carottes cultivées dans l'Île-du-Prince-Édouard, mais *M. hapla* peut poser un problème grave de sorte qu'il faut éviter la culture continue. En outre, on devrait inclure dans la rotation des cultures comme l'orge, le blé ou l'ivraie multiflore qui ne constituent pas des hôtes pour *M. hapla*.

Introduction

Both the root lesion nematode, *Pratylenchus penetrans* (Cobb) and the northern root-knot nematode, *Meloidogyne hapla* Chitwood, have been associated with damage to carrots (*Daucus carota* L.) in eastern Canada (8,9). Carrots in particular, are very susceptible to the northern root-knot nematode (4). On Prince Edward Island, injury to carrots by *P. penetrans* or *M. hapla* has not been prevalent. However, during the 1988 growing season, an infestation of *M. hapla* was detected in a carrot field, 12 ha in size, in the western part of the province. The yield loss was estimated to be about 40%, with many carrots exhibiting unmarketable characteristics such as proliferation of fine roots and malformed or fork-shaped tap roots. Two other fields in the same region of the province had signs of minor damage due to *M. hapla*. The cause of the large build up of northern root-knot nematodes in these isolated locations is unknown. However, it has been shown that the previous crop in a sequence can influence nematode population levels and plant yields in the next crop (1). Therefore, we examined population levels of root lesion and northern root-knot nematodes in crops that often precede or are grown in rotation with carrots on Prince Edward Island.

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Materials and methods

Soil and root samples were collected from fields intended for carrot production in the following year. Twenty-four fields were sampled during October-November 1988 and 16 fields were sampled in October 1989. Soil samples for nematode determination were collected as outlined by Gallant (2). Each sample was mixed thoroughly and passed through a screen with 2-mm openings to remove root and other debris. A 50-g sub-sample of soil was placed in a modified Baermann funnel (7), and up to 10 g of fresh roots from each sample were set in a mist chamber (3) at 20-25°C. After 7 days nematodes that had emerged from soil and roots were identified and counted using a stereomicroscope at 70×.

Results and discussion

Pratylenchus spp. was the dominant genus recovered from soil and root samples (Table 1). The majority were *Pratylenchus penetrans* and the remainder were *P. crenatus* Loof. Red clover (*Trifolium pratense* L.), hay, which is usually a mixture of red clover and timothy (*Phleum pratense* L.), and potato (*Solanum tuberosum* L.) harbored large root populations of root lesion nematodes. In Quebec, *Pratylenchus penetrans* has delayed maturity and caused the development of abnormal taproots in carrots (9). To date, on Prince Edward Island, observations in the field have not indicated that root lesion nematodes are a serious problem. The highest numbers of *Meloidogyne hapla* were found in carrot roots. This nematode species was recovered from 42% and 25% of all soil and root samples, respectively in 1988, and from 11% and 22% of the soil and root samples, respectively in 1989

Table 1. Root lesion and northern root-knot nematodes in soil and roots of crops grown in rotation with carrots on Prince Edward Island

Crops	No. of nematodes /kg of soil			No. of nematodes/g of root		
	No. of fields	*P. penetrans*	*M. hapla*	No. of* fields	*P. penetrans*	*M. hapla*
1988						
Barley	1	2550†	0	1	410	0
Cereal§	5	2150 (5)	30 (1)	0		
Carrot	4	2500 (4)	1360 (3)	1	0	18790
Clover#	6	5600 (6)	1000 (4)	2	5640 (2)	0
Hay ‖	1	7100	0	1	27600	0
Ryegrass	1	1240	0	0		
Potato	4	8570 (4)	40 (2)	1	18630	0
Rutabaga	2	2200 (2)	0	2	70 (1)	20 (1)
1989						
Barley	7	470 (6)	60 (1)	6	1650 (6)	0
Cereal	1	1800	0	1	440	0
Carrot	3	1360 (3)	60 (1)	3	3560 (3)	3930 (2)
Clover	2	5400 (2)	0	2	3280 (2)	0
Hay	3	3400 (3)	0	3	6320 (3)	0

* Root samples were not taken from all fields where soil was obtained.

† Arithmetic means include zero values from fields where nematodes were not detected. Parentheses indicate number of fields in which nematodes were found.

§ Mixture of oats and barley; some clover also present.

\# Primarily red clover.

‖ Primarily red clover and timothy.

(average of data from all crops shown in Table 1). These frequencies indicate the potential for economic yield reductions in carrots for the province, since even light infestations by *M. hapla* can cause yield losses (8).

Spiral (*Helicotylenchus* spp.), pin (*Paratylenchus* spp.) and stunt (*Merlinius* spp. and *Tylenchorhynchus* spp.) were recovered from many of the soil samples. The effect of these ectoparasitic nematodes on carrots is not well documented (5), but their impact on yields in the Maritime region appears to be minor.

High populations of root lesion nematodes were recovered from hay or potato crops, and could cause problems in the next carrot crop. Annual ryegrass (*Lolium multiflorum* Lam.) tends to harbor lower numbers of root lesion nematodes than red clover or timothy (6), and could be rotated with carrots if *P. penetrans* were a problem. The information in this survey also indicated that planting carrots two years in a row could increase the probability of damage from *M. hapla*. Avoidance of continuous carrot crops, and inclusion in the rotation of non-hosts for *M. hapla*, such as barley (*Hordeum vulgare* L.), wheat (*Triticum destivum* L.), timothy and annual ryegrass, and elimination of forage legumes would reduce the chances of root-knot nematode damage to carrots. Finally, the prevalence of root lesion and northern root-knot nematodes in fields where carrots were to be cultivated illustrated the need for a diagnostic service that would help growers to avoid fields with high nematode populations.

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