TURF GRASS HOSTS OF THREE SPECIES OF NEMATODES ASSOCIATED WITH FORAGE CROPS

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Abstract

A turf grass host range of three nematodes commonly associated with forage crops and turf grasses was determined by examining soil from plots in a turf grass trial containing 73 cultivars in 14 species of grasses. Ten, 10, and 12 species of turf grass were hosts of Pratylenchus neglectus, Paratylenchus projectus, and Helicotylenchus digonicus respectively. Most of the cultivars in the two major grass species tested, Festuca rubra and Poa pratensis, were hosts of these nematodes. The greatest numbers of P. neglectus were found under P. pratensis cv. Delta (14,000/0.45 kg of soil), of P. projectus under L. perenne cv. Kent (65,000), and of H. digonicus under P. pratensis cv. S.21 (27,200). Two of the nematodes, P. projectus and H. digonicus are being reared in a greenhouse on Lolium perenne cv. Kent and P. pratensis cv. Fusa, respectively.

Résumé

Une classe de gazon hôte de trois nématodes associés communément avec les cultures de fourrage et d'herbe de gazons fut identifiée en examinant le sol aes parcelles d'un essais d'herbe de gazons comprenant 73 variétés et 14 espéces d'herbe. Dix, 10, et 12 espéces de gazon sont respectivement les hôtes de Pratylenchus neglectus, Paratylenchus projectus, et Helicotylenchus digonicus. La plupart des variétés des deux majeures espéces d'herbe, Festuca rubra and Poa pratensis sont les hôtes de ces nematodes. Le plus grand nombre de P. neglectus fut trouvé sous P. pratensis va Delta à la densité de 14,000/0.45 kg de sol, de P. projectus sous perenne va Kent à la densité de 65,000 et de H. digonicus sous P. pratensis va S.21 à la densité de 27,200. Deux nematodes P. projectus et H digonicus sont présentement élevés en serre respectivement sur Lolium perenne va Kent et P. pratensis va Fusa.

Introduction

In a forage program at Vineland Station, Ontario, large monospecific populations of root-lesion, pin, and spiral nematodes in natural field soil were required for studies in the greenhouse. Handpicking the nematodes and subsequently increasing the population of each in soil is a tedious and time consuming method of acquiring such monospecific populations in large volumes of soil. Consequently, dominance of one species of nematode over the others in infested field soils was promoted by using preferential dicotyledonous plants. However the presence of the northern root-knot nematode, Meloidogyne hapla, (4) made the use of dicotyledonous plants impractical as this nematode soon overwhelmed the others. Since grasses are not hosts of M. hapla (1) and since the above parasitic nematodes have been observed in turf grass soils in the province, the use of turf grasses to rear these parasitic nematodes in field soils was considered.

This paper presents the results of a turf grass host range study of these three forage nematodes: an evaluation of the ability of each host to support soil populations of each of the genera over an extended period and a recommendation of the grasses considered suitable for the most successful rearing of pure populations of each of the nematodes in tne greenhouse.

Materials and methods

A grass host range of the three nematodes, Pratylenchus neglectus (Rensch), Paratylenchus projectus Jenkins, and Helicotylenchus digonicus Perry, was determined by sampling soil from the 3-yr-old turf grass cultivar trials at the

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Table 1. Turfgrass hosts of four species of plant parasitic nematodes

Grass species and cultivar	No. of nematodes/0.45 kg (lb) soil and host rating*			
	Pratylenchus neglectus	Paratylenchus projectus	Helicotylenchus digonicus	Meloidogyne sp.
Agrostis alba				
Red Top	100 (p)*	350 (p)	50 (n)	350 (p)
Agrostis palustris				
Penncross	1,600 (m)	650 (m)	0 (n)	200 (p)
Smarged	0 (n)	0 (n)	280 (p)	0 (n)
Agrostis tenuis				
Exeter	50 (n)	150 (p)	50 (n)	0 (n)
Highland	0 (n)	100 (p)	300 (p)	0 (n)
Dactylis *glomerata*				
Tardus II	100 (p)	0 (n)	2,900 (m)	0 (n)
Festuca arundinacea				
Backafall	50 (n)	0 (n)	400 (p)	0 (n)
Kentucky 31	1,300 (m)	300 (p)	1,830 (m)	0 (n)
Manade	1,400 (m)	1,400 (m)	400 (p)	0 (n)
S-70	60 (p)	0 (n)	2,400 (m)	0 (n)
Festuca *ovina*				
Duriuscula Durar	0 (n)	0 (n)	950 (m)	0 (n)
Festuca rubra				
Arctared	0 (n)	7,800 (g)	15,400 (g)	0 (n)
Barfalla	700 (m)	350 (p)	4,500 (m)	900 (m)
Boreal	0 (n)	150 (p)	7,200 (g)	0 (n)
Dawson	300 (m)	1,600 (m)	7,100 (q)	100 (p)
Duraturf	0 (n)	0 (n)	4,400 (m)	0 (n)
Echo	0 (n)	600 (m)	3,000 (m)	0 (n)
Elco	800 (m)	1,200 (m)	3,400 (m)	300 (p)
Erika	800 (m)	0 (n)	9,200 (g)	0 (n)
Golfrood	800 (m)	4,400 (m)	7,200 (g)	0 (n)
Highlight	50 (n)	10,000 (g)	7,100 (g)	0 (n)
Illahee	0 (n)	2,900 (m)	4,100 (m)	0 (n)
NFG	50 (n)	2,700 (m)	3,400 (m)	0 (n)
Oasis	0 (n)	1,800 (m)	10,600 (g)	0 (n)
Olds	50 (n)	0 (n)	5,300 (g)	1,200 (m)
Oregon	200 (p)	3,800 (m)	9,300 (g)	0 (n)
Pennlawn	200 (p)	3,000 (m)	4,400 (m)	1,300 (m)
Polar	500 (p)	10,000 (g)	15,000 (g)	0 (n)
Polo	0 (n)	4,000 (m)	4,000 (m)	0 (n)
Ruby	50 (n)	300 (p)	1,600 (m)	0 (n)
Sceempter	0 (n)	100 (p)	2,100 (m)	0 (n)
s-59	0 (n)	3,200 (m)	11,600 (g)	0 (n)
Turf	600 (m)	2,000 (m)	1,000 (m)	0 (n)
42-14	100 (p)	6,600 (g)	7,800 (g)	0 (n)

Table 1. (cont'd)

Grass species and cultivar	No. of nematodes/0.45 kg (lb) soil and host rating*			
	Pratylenchus neglectus	*Paratylenchus projectus*	*Helicotylenchus digonicus*	*Meloidogyne* sp.
Lolium perenne				
Brabantia	500 (p)	0 (n)	3,000 (m)	0 (n)
E-10	100 (p)	5,100 (g)	2,400 (m)	0 (p)
Kent	**2,500 (m)**	65,000 (g)	3,500 (m)	150 (p)
NK-100	300 (p)	8,500 (g)	6,300 (g)	0 (n)
Norlea	2,600 (m)	1,000 (m)	5,300 (g)	50 (n)
RVP	1,800 (m)	4,500 (m)	2,000 (m)	0 (n)
Viris	250 (p)	7,800 (g)	800 (m)	0 (n)
Phleum nodosum				
S-50	100 (p)	30,000 (g)	1,000 (m)	0 (n)
Poa compressa				
commercial Ont.	**5,500 (g)**	100 (p)	1,600 (m)	0 (n)
Commercial U.S.	0 (n)	0 (n)	500 (p)	0 (n)
Poa glaucantha				
Draylar	0 (n)	0 (n)	10,000 (g)	0 (n)
Poa pratensis				
Aristata	5,200 (g)	1,100 (m)	2,500 (m)	150 (p)
Atlas	8,900 (g)	100 (p)	6,600 (g)	0 (n)
Baron	7,000 (g)	4,000 (m)	1,600 (m)	300 (p)
Captan	11,000 (g)	0 (n)	8,000 (g)	350 (p)
Couger	0 (n)	3,200 (m)	4,500 (m)	0 (n)
Delft	2,900 (m)	700 (m)	300 (p)	1,300 (m)
Delta	14,000 (g)	0 (n)	24,000 (g)	0 (n)
Fusa	0 (n)	0 (n)	14,000 (g)	0 (n)
Fylking 0217	5,800 (g)	2,400 (m)	5,900 (g)	0 (n)
Geary	2,000 (m)	1,500 (m)	1,400 (m)	0 (n)
Golf	1,000 (m)	450 (p)	2,200 (m)	1,100 (m)
Hunsbella Soma S-644	850 (m)	0 (n)	4,500 (m)	0 (n)
Merion	3,000 (m)	2,100 (m)	300 (p)	0 (n)
Merion Dutch	3,900 (m)	4,800 (m)	12,000 (g)	0 (n)
Nike	5,000 (m)	100 (p)	8,000 (g)	100 (p)
Nuggett	7,100 (g)	50 (n)	8,500 (g)	0 (n)
Park	180 (p)	200 (p)	14,000 (g)	50 (n)
Primo	3,000 (m)	400 (p)	12,300 (g)	0 (n)
Prato	1,600 (m)	400 (p)	6,500 (g)	0 (n)
Skandia II	2,700 (m)	1,000 (m)	10,000 (g)	0 (n)
Skrzeszowice SK-46	2,000 (m)	1,300 (m)	9,600 (g)	0 (n)
Spaths	2,000 (m)	1,000 (m)	10,000 (g)	0 (n)
Steinacher	0 (n)	2,700 (m)	6,900 (g)	0 (n)
Sydsport	6,100 (g)	0 (n)	4,000 (m)	100 (p)
s.21	2,200 (m)	0 (n)	27,200 (g)	0 (n)
Windsor	600 (m)	0 (n)	1,500 (m)	0 (n)
Poa trivialis				
Dasas S-64	1,000 (m)	41,500 (g)	9,000 (g)	0 (n)
Ino	3,000 (m)	400 (p)	3,200 (m)	0 (n)

* Host rating: n - non-host, 0-50; p - poor host, >50; m - moderate host, >500; g - good host, >5000 nematodes/0.45 kg soil.

Horticultural Research Station, University of Guelph, Preston, Ontario. These plots, located on a sandy loam, contained 73 cultivars in 14 species of grass (Table 1). Soil cores (2.5 x 20 cm) were taken from replicated plots during the summer of 1971. Care was taken to avoid sampling in areas of plots in which clover and dicotyledonous weeds had encroached.

Each 1–2 kg soil sample was screened to remove roots, thoroughly mixed, and a 50-g subsample accumulated from 50 aliquots of soil taken at random. Nematodes were extracted for 1 week from each subsample by the Baermann pan method (4). They were identified to species, and each species was counted, if necessary in diluted suspension, and recorded as the number per 0.45 kg (1 lb) of moist soil. Since the nematode populations had likely stabilized under the 3–yr–old cultivars, they were rated as non-host 0–50, poor host >50, moderate host >500, or good host >5000 nematodes/0.45 kg of moist soil. Nematode extractions were not made from roots because the pin and spiral nematodes are ectoparasites and the root-lesion nematode is a migratory nematode being both in the soil and in the root.

Results

The only plant parasitic nematodes extracted in the Preston turf plots were Pratylenchus neglectus, Paratylenchus projectus, and Helicotylenchus digonicus. A root-knot nematode, not M. hapla, was present but not identified.

Ten of the 13 species of turf grass were hosts of Pratylenchus neglectus. In the two major species of grass tested, 13 of the 23 cultivars of Festuca rubra L. and 3 of the 26 cultivars of Poa pratensis L. were not hosts. Only cultivars of P. pratensis were considered to be good hosts of P. neglectus, particularly P. pratensis cv. Captan and cv. Delta, each of which supported over 10.000 nematodes/0.45 kg of soil.

Ten of the 13 species of grass were hosts of Paratylenchus projectus. Three cultivars of Festuca arundinacea Schreb.; 3 of F. rubra, 1 of Lolium perenne L., and 8 of P. pratensis were not hosts. Among the good hosts Festuca rubra cv. Highlight and cv. Polar, L. perenne cv. Kent, and P. trivialis cv. Dasas S-64 were outstanding, supporting 10,000 or more nematodes/0.45 kg of soil.

Twelve species of grass were hosts of H. digonicus. Agrostis alba cv. Red Top, A. palustris Rydb. cv. Penncross, A. tenuis cv. Exeter were not considered hosts. Only F. rubra, L. perenne, and P. pratensis contained cultivars that were good hosts. Poa pratensis cv. Delta and cv. S-21 were outstanding with over 20,000 nematodes/0.45 kg of soil.

Only 5 of the 12 grass species were hosts of an unidentified species of Meloidogyne. Festuca rubra cv. Olds and cv. Pennlawn and P. pratensis cv. Delft and cv. Gulf were only moderate hosts, supporting 1100–1300 nematodes/0.45 kg of soil. Examination of clovers and dicotyledonous weeds in the turf plots did not reveal the northern root–knot nematode, M. hapla.

The best preferential hosts for rearing the pin nematode, P. projectus, were Phleum nodosum (P. bertolonii) cv. S-50 and Lolium perenne cv. Kent. In the greenhouse the latter supported populations of 60,000/0.45 kg of soil in plastic tubs of field soil which initially contained 1 pin nematode per g of soil. Poa pratensis cv. Fusa was selected over other species and cultivars because it did not support the lesion and pin nematodes. A preferential host was not found for rearing the lesion nematode, P. neglectus, because of domination by other nematodes.

Discussion

In North America at least 34 species of plant parasitic nematodes in 18 genera are associated with turf grasses (1). Nine of the genera are quite common and four of them, with a single species in each, were associated with grasses in turf plots at Preston, Ont. These were Pratylenchus neglectus, Paratylenchus projectus, Helicotylenchus digonicus, and a Meloidogyne species which was not the northern root-knot nematode, M. hapla, nor one of the subtropical root-knot species.

The suitability of turf grasses as hosts of each species of nematode was arbitrarily rated though this study involved mixed nematode populations. However the sampling of plots with mixed populations did indicate which nematode species would dominate when attempting to rear the three nematodes in field soils in the greenhouse. Possibly some cultivars would be good hosts if grown on soil infested with a single species of nematode. This rating scheme may be more suitable for P. projectus and H. digonicus than for P. neglectus because the former are found only–in soil whereas the latter occurs in soil and roots. Low soil numbers of P. neglectus would not necessarily indicate a poor host, as possibly the roots might contain numerous nematodes. However this study did indicate that many cultivars were hosts of the four species of nematodes.

Twelve, 10, 10, and 5 of the turf grass species were hosts. of H. digonicus, P. neglectus, P. projectus, and Meloidogyne sp., respectively. At present there is little possibility- of finding turf and forage grasses and forage legumes (5) that do not permit H. digonicus to reproduce. Among the major grass species, however, there is

resistance to the reproduction of P. neglectus and P. projectus; 9 cultivars of F. rubra and 3 cultivars of P. pratensis, were resistant to P. neglectus, and 3 cultivars of F. rubra were resistant to P. projectus. Many of the cultivars of the grass species were derived from a single plant collection from various pasture lands that were further selected in test plots. Apomictic lines were selected in some cultivars of Poa pratensis. One or two cultivars originated with the crossing of established cultivars. However from this background, it was not possible to determine if a single gene or a complex or genes is involved in the resistance.

Correlation of nematode numbers with growth indices was not attempted. Each grass species and cultivar must be considered individually as it is possible that a grass may be sensitive to a small population of a parasitic nematode while another grass may be tolerant to a large population. Though specific problems were not noted in the turf plots, nematodes can be harmful to grasses. In Wisconsin, the spiral nematode, H. digonicus was quite destructive to Kentucky bluegrass (3); in Massachusetts, P. penetrans and T. claytoni were pathogenic to annual rye grass, creeping red fescue and Kentucky bluegrass (6); in Michigan, T. dubius reduced the foliar and root weight of 'Merion' Kentucky bluegrass (2).

The original purpose of this Study was achieved. Suitable hosts were found to rear P. projectus and H. digonicus in the greenhouse, the former on Lolium perenne cv. Kent and the latter on Poa pratensis cv. Fusa.

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