Plant parasitic nematodes in turfgrass in southern British Columbia

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Turfgrass and soil samples from 12 different sites representing golf greens, bowling greens, and playing fields in the Fraser Valley extending from Chilliwack in the east to and including the city of Vancouver were analysed for the presence of plant parasitic nematodes, and 10 genera were recorded. At most of the sites there was no apparent nematode injury to the grass. At two sites unhealthy turf was associated with extremely high numbers of *Helicotylenchus*. Samples from a third site with a disease problem yielded high numbers of *Criconemoides* and *Tylenchorhynchus*. The results show that certain plant parasitic nematodes occur in sufficiently high numbers to cause appreciable damage to turfgrass and that nematodes as agents of disease should not be overlooked in the diagnosis of turfgrass disease problems in this region.

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Des echantillons de gazon et de sols ont ete preleves en 12 endroits representatifs des parcours de golf, des boulodromes et des terrains de jeux de la vallee du Fraser, de Chilliwack a l'est, jusque et y compris la ville de Vancouver, puis analyses pour y deceler la presence ale nematodes parasitant les plantes. On a ainsi identifie 10 genres de nematodes. Dans la plupart des cas, il ne semble pas que les nematodes aient occasionne de degdts a l'herbe. En deux endroits, toutefois,. on a établi un rapport entre le mauvais etat du gazon et les fortes populations de *Helicotylenchus*. L'analyse des echantillons preleves d'un troisième endroit probleme a revele la presence d'un grand nombre de *Criconernoides* et de *Tylenchorhynchus*. Il ressort de l'etude que les populations de certains nematodes parasites sont assez elevees pour occasionner des degdts importants au gazon et que ces pathogenes ne doivent pas être negliges lors du diagnostic des maladies du gazon dans cette region.

Plant parasitic nematodes are present in all turfgrass soils, sometimes in large numbers, but their importance as a factor in health of turfgrass is not well defined. In warm climates nematodes are known to cause damage to golf greens and other turfgrass areas, and measures for control are recommended: Heald and Perry (1969), Perry et al (1970). However, the importance of the different nematodes is not well defined. Lucas et al. (1974) found high populations of plant parasitic nematodes in turf throughout North Carolina but states that observations did not reveal a distinct relationship of damage with the nematodes present except with *Belonolaimus longicaudatus* in bermudagrass where the nematodes caused poor growth and quality of the grass. They found large numbers of *Trichodorus, Hoplolaimus, Tylenchorhynchus* and *Helicotylenchus* associated with bentgrass turf but no visible damage. On the other hand, Troll and Tarjan (1954) reported populations of *Tylenchorhynchus* and *Rotylenchus* associated with decline in turf in Rhode Island; Perry (1958) reported decline and root injury in Kentucky bluegrass in Wisconsin caused by *Helicotylenchus* spp. and Feldmesser and Gordon (1974) reported chlorosis, stunting and lack of response to water, fertilizer, and insecticide in bluegrass in New York State related to the presence of *Tylenchorhynchus, Criconemoides,* and *Helicotylenchus.*

The present investigation of the nematode situation in tuirfgrass in southwestern B.C. was undertaken for two reasons: 1) Unusually large numbers of spiral nematodes (up to 300,000 per kg soil) were found in bentgrass samples from the Fraser Valley some 2 years ago. 2) In September 1976, similarly high populations of plant parasitic nematodes were found in turfgrass samples from the Vancouver area taken from a golf green which would not respond to treatment with a variety of fungicides for the control of fusarium patch disease. Careful examination of the problem green revealed that the fungus *(Fusarium nivale)* had been suppressed but the grass did not recover from the damage caused by the disease. A small trial with nematicides is being conducted on this problem green to determine whether the nematode population could be reduced and if so whether this would have any measurable effect on turfgrass health. The results from this trial are not yet available.

For purposes of the present study, turfgrass samples were collected from 12 different sites in the Fraser Valley representing golf greens, bowling greens, and playing fields within the area ranging from Chilliwack in the east to and including the city of Vancouver. The object of this paper is to report the results of the survey and to assess the importance of plant parasitic nematodes to health of turfgrass in this region.

Materials and methods

Turf samples were obtained by cutting cores with a cup-cutter (10 cm diam) about 15 cm deep. Where possible, samples were taken from areas with a history of good

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Table 1. Nematode populations (no. per kg soil) in turfgrass in southwestern British Columbia

Nematode	Site number*											
	1	2	3†	4	5	6	7	8†	9	10	11	12
Helicotylenchus	366,650	45,650	500 (A) 189,650 (B)	21,300	350	21,300	**0**	150 (A) 2,200 (B)	**600**	**0**	50	34,500
Criconemoides	**0**	750	0 (A) 0 (B)	0	**0**	**0**	41,050	10 (A) 9,400 (B)	**0**	**0**	5	0
Paratylenchus	**0**	**0**	0 (A) 0 (B)	350	2,550	**0**	100	0 (A) 0 (B)	13,450	**0**	950	0
Tylenchus	2,500	1,800	2,800 (A) 2,100 (B)	50	**0**	2,100	600	2,650 (A) 0 (B)	**0**	**0**	50	0
Pratylenchus	**0**	**0**	0 (A) 0 (B)	150	1,200	0	**0**	0 (A) 0 (B)	**0**	**0**	300	100
Ditylenchus	**0**	**0**	200 (A) 0 (B)	500	200	**0**	**0**	0 (A) 0 (B)	**0**	900	**0**	**0**
Heterodera	**0**	**0**	0 (A) 0 (B)	0	3,500	**0**	**0**	0 (A) 0 (B)	**0**	**0**	**0**	**0**
Tylenchorlynchus	**0**	**0**	0 (A) 0 (B)	0	**0**	**0**	**0**	100 (A) 12,200 (B)	**0**	**0**	**0**	**0**
Longidorus	**0**	**0**	0 (A) 0 (B)	400	**0**	0	**0**	0 (A) 100 (B)	**0**	**0**	**0**	**0**
Aphelenchoides	1,000	**0**	0 (A) 0 (B)	0	**0**	**0**	**0**	0 (A) 0 (B)	**0**	**0**	**0**	**0**

* Site key: bentgrass golf green at 1) Vancouver northwest, 2) Vancouver west, 3) Vancouver southwest, 6) Pitt Meadows, 7) Chilliwack west, 8) Chilliwack east, 11) Surrey, 12) Burnaby Mountain; bentgrass bowling green at 4) Surrey central and 9) Burnaby; bluegrass mix playing field at 5) Delta, and 10) Surrey.

† At site numbers 3 and 8, A represents a sample from an apparently healthy area, and B a sample from an area of sparse, chlorotic grass.

and poor growth for comparative purposes. These were collected in polyethylene bags and delivered to the nematology laboratory at the Vancouver Research Station for processing.

Preliminary tests with several extraction methods showed that highest numbers of nematodes were consistently recovered using a combination of the McElroy method (1972) for large species and the Jenkins centrifugal flotation method (1964) for smaller species. A 200 cc subsample was cut from the original core sample, broken up in water, and the suspension passed through 500-, 250-, and 38-um sieves. The residues from the 250- and 38-urn sieves were then processed by the McElroy and the Jenkins methods respectively.

Results and discussion

Nematode counts for samples from each of 12 sites are given in Table 1. Probably the most striking feature of these results is the extremely high count of *Helicotylenchus* in some of the golf course sites. Site 1 is the golf green, referred to earlier, which failed to respond to treatment with fungicides for control of fusarium patch disease. The roots of grass plants in the damaged areas were badly discolored and the plants failed to produce new growth above ground. Normally recovery from the disease occurs within 1 to 2 weeks after treatment. In this instance, symptoms of the disease persisted for longer than 6 weeks. The high nematode count is a likely explanation. The presence of sufficiently high numbers of *Helicotylenchus* feeding on the grass roots could very well be the reason why the grass plants failed to regenerate top growth in the damaged areas. Vargas and Laughlin (1972) showed an interaction between the fungus *Fusarium roseum* and the nematode *Tylenchorhynchus dubius* in the development of symptoms associated with fusarium blight. The present observation does not suggest the same kind of interaction but one in which the nematodes contributed to the seriousness of the fungal disease by delaying grass recovery. The pathogenic effect of *Helicotylenchus* is also implicated in site 3. Sample 3A was from a relatively healthy golf course green while 38 was from a green on the same course which exhibited symptoms similar to "summer dormancy" as described by Perry et al. (1959). In mid-

summer the plants cease to grow even though they are well supplied with water and nutrients.

Another result which implicates nematodes with unhealthy turf is that for site 8. Sample 8A was taken from a healthy area of a golf green and 8B from an area of the same green in which the grass was sparse and somewhat chlorotic. Comparison of nematode counts for the two samples shows that sample 8A contained few plant parasitic nematodes whereas 8B yielded high numbers of ***Criconemoides*** and ***Tylenchorhynchus,*** both of which have been reported to contribute to turfgrass disease problems. The number of ***Criconemoides*** found in this sample (9,400 per kg soil) could well be high enough to have caused the damage. Safford and Riedel (1976) reported no symptoms in turf samples with fewer than 1000 per 500 ml soil, but chlorosis and dieback in one sample which yielded 8000 ***Criconemoides*** per 500 ml soil.

In summary, the results of this survey show that turfgrass in southwestern B.C. supports a variety of plant parasitic nematodes, most of which cause no apparent damage. A few are present in sufficiently high numbers to be suspect when disease problems arise. These are: ***Helicotylenchus*** (spiral nematode), ***Criconemoides*** (ring nematode), and ***Tylenchorhynchus*** (stunt nematode); the same three that Feldmesser and Golden (1974) reported to be causing chlorosis, stunting, and bare spots in bluegrsss turf in New York State. ***Helicotylenchus*** was found in 10 of the 12 sites and in extremely high numbers at 2 of these sites; up to six times as high as the highest numbers reported by Townshend et al. (1973) for turfgrass in Ontario. ***Criconemoides*** was found at three sites and was associated with an unthrifty condition of the grass in one of these. ***Tylenchorhynchus*** was found at one site only but, along with a high population of ***Criconemoides,*** was associated with unhealthy turf.

More work needs to be done before a reliable statement can be made as to importance of plant parasitic nematodes to the health of turfgrass in this region but the study has shown that at least one nematode, and possibly two others, have contributed to unhealthy turfgrass situations in the sampled areas. This does not mean that nematodes are likely to be a major problem but it does indicate that plant parasitic nematodes should not be overlooked in the diagnosis of turfgrass disease problems in this region.

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