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Survey of Entomopathogenic Nematodes on Golf Courses in Ontario and Québec, Canada

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Introduction

In Canada, new legislation on pesticide use forces the implementation of integrated pest management (IPM) and development of new alternative methods to control turfgrass pests. In Québec, all golf courses must submit a pesticide reduction plan to the Québec Ministry of Environment in 2006 (1). Currently, the golf course industry in Ontario is launching a new IPM Accreditation Program (2).

With this new reality for turfgrass managers, biological control agents such as entomopathogenic nematodes provide a potential alternative for reducing some well-targeted insect pests. In Canada, only few indigenous entomopathogenic nematode species were isolated: Bélair *et al.* (1984) (3) found *Steinernema carpocapsae* in Québec; Mracek and Webster (1993) (4) isolated *Steinernema feltiae* in British Columbia, Alberta and Yukon; Stock *et al.* (2000) (5) found *Steinernema kraussei* in British Columbia and Alberta.

Objective

Survey for indigenous entomopathogenic nematodes on golf courses in Ontario and Québec.

Material and Methods

A survey of 38 golf courses (19 in Ontario; 19 in Québec) located in different agroclimatic areas was carried out during Fall 2002 and 2003 in Québec and Ontario, respectively (Figure 3). Three holes (greens, fairways and roughs) were selected based on their historic insect damage on each golf course. Soil samples were collected using a soil probe to a depth of 0-15 cm on greens, fairways and roughs (Figure 1).

Entomopathogenic nematodes were isolated from soil (greens, fairways and roughs in Québec; roughs in Ontario) by using greater wax moth, *Galleria mellonella* L. (Lepidoptera: Pyralidae) larvae as bait according to the method of Bélair *et al.* (2001) (6) (Figure 2). In addition, soil samples from greens and fairways in Québec were screened with late instar of carrot weevil *Listronotus oregonensis* LeConte (Coleoptera: Curculionidae). For this screening, five plastic Solo Cup containers (30 cm³) were prepared by adding one carrot weevil larva and 15 cm³ of soil. Containers were then closed and placed in the dark at 24°C during 10 days. Emerging nematodes were identified with both morphological and molecular criteria.

On golf course



Figure 1. Soil sampling

In laboratory



Figure 2. 'Galleria trap' bioassay

Results and Discussion

ONTARIO			
Golf course	Location	Latitude / Longitude	
1	Melrose Lakes Golf & CC	45°21'N, 77°24'W	
2	Geil CC	43°23'N, 80°30'W	
3	Pearson Golf & CC	43°28'N, 79°22'W	
4	Renfrew Golf Club	43°58'N, 80°26'W	
5	Weston Golf & CC	43°57'N, 80°39'W	
6	St. Thomas Golf & CC	42°46'N, 81°29'W	
7	Dundasville Golf Club	42°52'N, 80°28'W	
8	The Bains Golf Club	44°18'N, 78°28'W	
9	Big Red Pines Golf & CC	44°17'N, 79°28'W	
10	Jevel of the North Golf Resort	44°23'N, 78°16'W	
11	Homes Point Golf Club	42°58'N, 81°01'W	
12	Eric Simons Golf & CC	42°52'N, 82°30'W	
QUÉBEC			
13	St-Hyacinthe Golf & CC	45°54'N, 70°54'W	
14	Napoleon-Mathieu Golf Club	Napoleon-on-the-lake	45°15'N, 70°34'W
15	St-James Golf & CC	45°15'N, 72°02'W	
16	Pearsonville Golf & CC	Pearsonville	44°17'N, 76°19'W
17	St-Jean Golf Club	Quebec	46°53'N, 71°22'W
18	Lafontaine Golf Club	Massachusetts	43°54'N, 70°30'W
19	St-Liguori Golf & CC	St-Liguori	46°52'N, 70°52'W
Isolated			
20	Bic Golf Club	Bic	46°22'N, 67°46'W
21	Picton Golf Club	Picton	45°23'N, 77°24'W
22	Chicoutimi Golf Club	Chicoutimi	48°23'N, 71°06'W
23	Yamélie Golf & CC	Yamélie	45°23'N, 69°28'W
24	Intervale Golf Club	Laval	45°23'N, 71°45'W
25	Léves Golf Club	Léves	45°48'N, 67°11'W
26	Louisa Golf Club	Louisa	45°15'N, 72°50'W
27	Montréal CC	St-Lambert	45°33'N, 73°31'W
28	Farnham Montebello Golf Club	Montebello	45°39'N, 74°05'W
29	Pointe-aux-Lacs Golf Club	Pointe-aux-Lacs	45°33'N, 73°51'W
30	La Pêcheuse Golf Club	St-Hyacinthe	45°23'N, 72°50'W
31	Royal D'Assomption Golf Club	Châteauguay	45°15'N, 71°50'W
32	St-Jovite Golf Club	St-Jovite	45°42'N, 71°54'W
Not Isolated			
33	St-James Golf Club	St-James	45°33'N, 74°03'W
34	Montebello Golf Club	Montebello	45°39'N, 74°05'W
35	St-Michel Golf Club	St-Michel	46°23'N, 67°53'W
36	Wellesley Golf & CC	Wellesley	45°27'N, 74°05'W



Figure 3. Distribution of the 38 golf courses

- ★ *S. kraussei* was isolated for the first time in eastern Canada (Ile Bizard, Québec).
- ★ *S. feltiae* (4 isolates) was isolated for the first time in Québec (Bic and St-Liguori) and Ontario (Toronto and Renfrew).
- ★ *S. carpocapsae* (6 isolates) was isolated in Québec (St-Hyacinthe) and for the first time in Ontario (Toronto, Picton, Weston and Collingwood).
- ★ All indigenous nematodes were found on roughs of golf courses in Québec and Ontario.

No nematodes were isolated from greens and fairways in Québec when using a lepidoptera (*G. mellonella*) and a coleoptera (*L. oregonensis*) as bait. However, 4 and 6 indigenous nematodes were found on roughs of golf courses in Québec and Ontario, respectively. Our results suggest that habitats with a low pesticide input, as implemented in the rough areas, could harbor a greater biodiversity. A survey of other soil microorganisms such as fungi, bacteria, free-living and phytoparasitic nematodes on roughs, fairways and greens would be needed to support this hypothesis.

These indigenous isolates could be more adapted to climatic conditions prevailing on golf courses in eastern Canada. Ecological studies have demonstrated the importance of speciation and coevolution of organisms in relation to the potential of host infection. We are currently performing bioassays on different turfgrass insect pests.

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