Incidence of root rot and nematodes in barley fields in Prince Edward Island

J. Kimpinski and H.W. Johnston1

A survey was conducted in Prince Edward Island during August 1983 in 45 barley fields to observe the incidence of common root rot and population levels of nematodes. Cultivars included in the survey were Birka, Bruce, Perth, and Volla. The dominant plant-parasitic genera were stunt nematodes, ***Tylenchorhynchus*** spp., and root lesion nematodes, ***Pratylenchus*** spp. The majority of root lesion nematodes were identified as ***P. penetrans,*** and the primary fungal pathogen was ***Bipolaris sorokiniana.*** Population levels of ***Tylenchorhynchus*** spp. in soil were higher in fields of Birka and Perth than in fields of Bruce and Volla. The numbers of ***Pratylenchus*** spp. did not differ significantly among any of the cultivars. The general trend was for the incidence of root rot to be positively correlated with numbers of stunt nematodes in soil, and to be negatively correlated with numbers of root lesion nematodes in soils and roots.

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Un inventaire de 45 champs d'orge a été effectué en août 1983 dans l'Île-du-Prince Edouard afin de determiner l'incidence de la pourriture commune des racines et le niveau des populations de nematodes. Cet inventaire couvre les cultivars d'orge Birka, Bruce, Perth et Volla. Les genres dominants parmi les parasites végétaux s'avbrent être ***Tylenchorhynchus spp.,*** causant le rabougrissement, et ***Pratylenchus*** spp., causant les lesions des racines. La majorité des nematodes causant des lesions racinaires fut identifiée comme ***P. penetrans*** et ***Bipolaris sorokiniana*** comme le pathogbne fongique primaire. Les niveaux de population de ***Tylenchorhynchus spp.*** s'avbrent plus élevés dans le sol des champs d'orge Birka et Perth que dans celui des champs d'orge Bruce et Volla tandis qu'il n'y a pas de difference significative entre les populations de ***Pratylenchus spp.*** dans les différents cultivars. Généralement, l'incidence de pourriture commune des racines semble être en correlation positive avec le nombre de nematodes causant le rabougrissement present dans le sol et en correlation negative avec le nombre de nematodes causant des lesions racinaires present dans le sol et les racines.

Introduction

Diseases periodically cause noticeable yield losses in barley in the Maritime provinces (4). The endemic dysfunction, common root rot, is incited primarily by ***Cochliobolus sativus*** (Ito and Kurib.) Drechsl. ex. Dastur, conidial state ***Helminthosporium sativum*** Pamm. King and Bakke., syn. Bipolaris ***sorokiniana*** (Sacc. in Sorok.), Shoem. (5). The root lesion nematodes, ***Pratylenchus penetrans*** (Cobb) Filipjev and Sch. Stek. 1941 and ***P. crenatus*** Loof, 1960, and stunt nematodes ***(Tylenchorhynchus*** spp.) also occur in cereals in the region (6,7).

Associations between root rot fungi and root lesion or stunt nematodes were observed previously in North America (1,8,11). Powell (10) concluded that these nematodes were important components of the disease in cereals, and it was in this role that they reduced crop yields. The only related study in the Maritime region to date did not detect a relationship between nematodes and fungi in cereals (7). However, the work was conducted at one location only, and the dominant nematode species was ***Pratylenchus crenatus.*** Previous investigations have indicated that ***P. crenatus*** is not as pathogenic as ***P. penetrans*** (2.13).

Therefore, the objectives of this study were to observe the incidence of common root rot and the population levels of root lesion and stunt nematodes in barley fields in Prince Edward Island, and to determine if significant correlations existed between incidences of common root rot and numbers of nematodes.

1 *Research Station, Agriculture Canada, P.O. Box 1210, Charlottetown, Prince Edward Island C1A 7M8.*

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Materials and methods

A survey was conducted in Prince Edward Island during August 1983 in 45 barley fields of different cropping histories. Three sample sites were selected along the longest diagonal of each field. Approximately 10 plants with roots and soil attached were taken from each site. Close attention was paid to recovering as many of the fine roots as possible. Nematodes were extracted from roots by placing at least 5 g of washed root from each sample in a mist chamber (3). Ten soil cores were taken at random in the plant row at each site with a 25-mm diameter soil probe to a depth of 20 cm. Each sample was mixed thoroughly and a 50-g subsample of soil placed in a modified Baermann pan (12). After 7 days at 20-25°C nematodes that had emerged from soil and roots were identified and counted with a microscope. Nematode data were expressed as number per gram of dry root and per kg of dry soil and transformed to logarithms for calculations of mean populations, analysis of variance, and correlation coefficients.

The plant samples at each site were rated for common root rot severity according to the method of Ledingham et al. (9).

Results and discussion

The dominant plant-parasitic nematode genera recovered in the survey were ***Tylenchorhynchus*** spp. and ***Pratylenchus***

Table 1. Incidence of common root rot and population levels of root lesion and stunt nematodes in barley during August 1983 in Prince Edward Island.

Cultivar	No. of Samples[a]	Incidence of root rot (%)	Number of Nematodes[b] Per g of root	Per kg of soil	
			Root lesion	Root lesion	Stunt[c]
Volla	87	73	440	1050	770
Bruce	21	63	390	710	870
Perth	18	85	640	1210	2080
Birka	9	70	560	910	2190

[a] Three samples from each field.
[b] Geometric means.
[c] Stunt nematodes were more numerous in Perth and Birka soil than in soil from Volla and Bruce (P = 0.05). Determined by analysis of variance on data where number of samples per treatment varies.

spp., and the majority of the root lesion nematodes were identified as F?*penetrans. Bipolaris sorokiniana* was identified as the primary fungal pathogen inciting root rot.

The numbers of stunt nematodes in soil were higher in fields of Birka and Perth than in fields of Bruce and Volla (Table 1). The population levels of root lesion nematodes in roots and soil did not differ significantly among the four cultivars. A significant positive correlation between incidence of common root rot and numbers of stunt nematodes in soil, and a significant negative correlation between the incidence of root rot and the numbers of root lesion nematodes in soil were obtained for the cultivar Bruce (Table 2). The general trend was for the occurrence of common root rot severity to be positively correlated with numbers of stunt nematodes in soil, and to be negatively correlated with numbers of root lesion nematodes in soil and roots.

Table 2. Correlation coefficients between incidences of common root rot (rr) in barley and number of root lesion nematodes in roots (RLR) and soil (RLS), and numbers of stunt nematodes in soil (STS) during August 1983 in Prince Edward Island.

Cultivar	Degrees of Freedom	rrxRLR	rrxRLS	rrxSTS
Volla	85	-0.24"*	-0.07	0.01
Bruce	19	-0.27	-0.52""	0.70"""
Perth	16	-0.40"	-0.23	0.40"
Birka	7	-0.29	-0.14	0.32

*, **, *** Significant at P = 0.1, 0.05 and 0.01, respectively.

The existence of a significant negative correlation between numbers of root lesion nematodes and the presence of common root rot in the cultivar Bruce did indicate that the two groups of organisms were antagonistic to each other. Furthermore, the positive correlation between numbers of stunt nematodes and the incidence of common root rot did not confirm a synergistic interaction. More information is necessary, especially in the spring when host plants are at the seedling stage to further characterize the relationship between such disease inciting organisms. In addition, accurate identifications of fungal and nematode species must be completed.

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