DISTRIBUTION OF PARATYLENCHUS PROJECTUS IN CENTRAL AND NORTHERN ALBERTA

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Abstract

A survey was conducted during the summers of 1970 and 1971 to determine the distribution of Paratylenchus projectus in the central and the Peace River areas of Alberta. A total of 91 locations were sampled. Counts in the Peace River were low with only 25% of the samples showing greater than 1000 and only 4% with more than 10,000 per kilogram of soil. In contrast, an area in central Alberta had 56% of the counts greater than 1,000 and 20% greater than 10,000 per kilogram of soil. Counts were not related to soil parameters or cropping history.

Introduction

The reason for conducting the nematode survey is discussed in detail in a previous paper (4). In brief the senior author has been studying an alfalfa disorder called "alfalfa sickness" for a number of years. Particular interest in nematodes of the genus Paratylenchus Micoletzky was stimulated by the late W.R. Orchard, Nematologist, Canada Department of Agriculture, Saanichton, British Columbia. From 1962 to 1969 he examined alfalfa roots and their rhizosphere soil and consistently found appreciably higher counts of Paratylenchus in soils collected from areas of poor growth in the field as compared to adjacent areas of good growth. The relationship indicated that the nematode was at least partially responsible for the disorder. He recommended that a survey be conducted to determine the magnitude of the infestation in central and northern Alberta. The results of this survey, which was conducted during the summers of 1970 and 1971, are presented herein.

Materials and methods

Several District Agriculturists within the central and the Peace River areas of Alberta were asked to provide, for each of their respective districts, a list of 10 farmers who were currently growing alfalfa. Fields selected at random from these lists together with a number of experimental plots gave a total of 91 locations from widely distributed areas. During sampling, the vigor of growth was described as good, medium, or poor and such areas were sampled separately. In addition, the cropping history of each field was recorded.

In most cases sampling was done by two techniques. One involved removing three plants from a given area together with the soil adhering to the roots. The excess soil was trimmed away leaving approximately 1000 g (field moist basis) of rhizosphere soil. The other technique consisted of compositing 15 to 20 soil cores taken at random throughout the sampling area by inserting an auger to a depth of 20 cm close to the crowns of the plants.

In the laboratory, approximately 300 g (field moist) of composite soil or of soil washed from the roots were placed in 6 liters of water. A representative sample was dried at 105.C so the counts could he expressed on an oven dry weight basis. The soil suspension was allowed to settle for about 30 seconds and the supernatant passed through a 60–mesh Endecott sieve. The material on the sieve was rinsed and the entire supernatant passed through 100, 200, 325, and 400–mesh sieves and screenings from the latter two were placed in Baermann funnels for roughly 16 h (1). In 1971 a rapid centrifugal flotation technique (2) was used. The supernatant was prepared in the same manner, then placed in 50 ml conical centrifuge tubes, spun for 5 minutes at approximately 400 x g, liquid decanted, about 40 ml sugar solution added to the residue, slurried, centrifuged for 1 minute and the supernatant immediately poured onto a 400–mesh sieve and the sugar solution washed through with water. The nematodes remaining on the sieve were rinsed off into small beakers to be relaxed and counted. Counts of Paratylenchus projectus Jenkins were based on morpholnqical characteristics (3). The presence of parasitic nematodes other than P. projectus was recorded also.

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Chemical analyses of the soils were conducted by the Alberta Soil and Feed Testing Laboratory. Available nitrogen was estimated as nitrate-nitrogen extracted with 0.02 N $CuSO_4$ solution, extractable phosphorus was extracted with 0.03 N NH_4F - 0.03 N H_2SO_4, exchangeable potassium was extracted with 1 N NH_4OAC, manganese and aluminum were extracted with 0.01 M $CaCl_2$, and pH was determined in a 1:1 soil-water mixture.

Results and discussion

Counts of Paratylenchus projectus varied widely from field to field covering a range from undetectable numbers to approximately 40,000 per kilogram of rhizosphere soil for alfalfa and approximately 80,000 for alsike and red clover. There was a tendency, based on a limited number of observations, for the rhizosphere soil from clover plants to have higher counts than rhizosphere soil from alfalfa growing in close proximity.

The two methods of sampling (composite and rhizosphere) produced similar count distribution patterns (Table 1) indicating that they were equally good. The composite method has the advantage that only one sample is required to represent an area whereas for the rhizosphere technique, soil from at least three plants must be analyzed to obtain a representative count.

Table 1. Comparison of Paratylenchus projectus counts obtained by the composite and rhizosphere methods expressed as a percentage of the samples analyzed by each method

Count range	Soil composite[1]	soil rhizosphere[2]
0	17.4	14.2
1 - 500	35.8	38.4
500 - 1,000	12.1	5.3
1,000 - 2,000	13.2	8.9
2,000 - 4,000	7.4	8.9
4,000 - 6,000	3.1	8.3
6,000 - 8,000	2.1	1.8
8,000 - 10,000	0.5	3.0
10,000 - 15,000	5.2	5.3
15,000 - 20,000	1.6	1.8
20,000 - +	1.6	4.1

[1] 190 soil composite samples (15 to 20 cores 3.0 x 20 cm).

[2] 169 soil rhizosphere samples (average of 3 plants).

There were several points of interest in the distribution of P. projectus in central Alberta (agricultural reporting areas 4A, 4B, 5, and 6) and the Peace River (reporting area 7) (Figure 1). The Peace River area (north of TWP 66) generally had low counts with only 25% of the samples showing more than 1,000 and only 4% with counts greater than 10,000 per kilogram of soil. In contrast, a belt in central Alberta an area extending from about 75 miles S.W. of Edmonton to approximately 75 miles north, and including counts in the vicinity of the city, had 56% of the total count greater than 1,000 and 20% greater than 10,000 per kilogram of soil. Soils in this sampled area, with the exception of the Chernozemic soils south of the city, are predominately Luvisolic and Dark Gray Luvisolic and it is in this area of relatively high counts where alfalfa sickness is most prevalent.

Nematode counts by the composite method were correlated with various soil parameters to determine whether there was a significant relationship. The correlation coefficients between counts and the following soil parameters were as follows: nitrate nitrogen - 0.26: extractable manganese - 0.02; extractable aluminum - 0.10; and pH - 0.02. All these coefficients were nonsignificant indicating the counts were not related to the soil parameters. Furthermore, the counts did not appear to be related to cropping history.

The average count (composite method) for the areas designated as vigorous growth was 500 nematodes per kilogram of soil, for areas of medium vigor 2600 and for areas of poor vigor 4900. This is the same relationship that Orchard found from analyses made prior to the survey during the period 1962 to 1969. However, these values do not provide proof that the nematode is responsible for the difference in plant vigor. Detailed studies are underway to determine the effect of adding known populations of the nematode in pure culture and in combination with other organisms on the vigor of alfalfa.

Other genera identified in the soils were Tylenchus Bastian, Aphelenchoides Fischer Tylenchorhynchus [illegible] Dorylaimus [illegible] Metylenchus Filipjev Diphinema Cobb and Hoplolaimus Filipjev These con i species that are suspect or have been shown to be plant parasites. The numbers observed in survey samples were, however, too small to warrant their being considered as significant in the epidemiology of alfalfa sickness.

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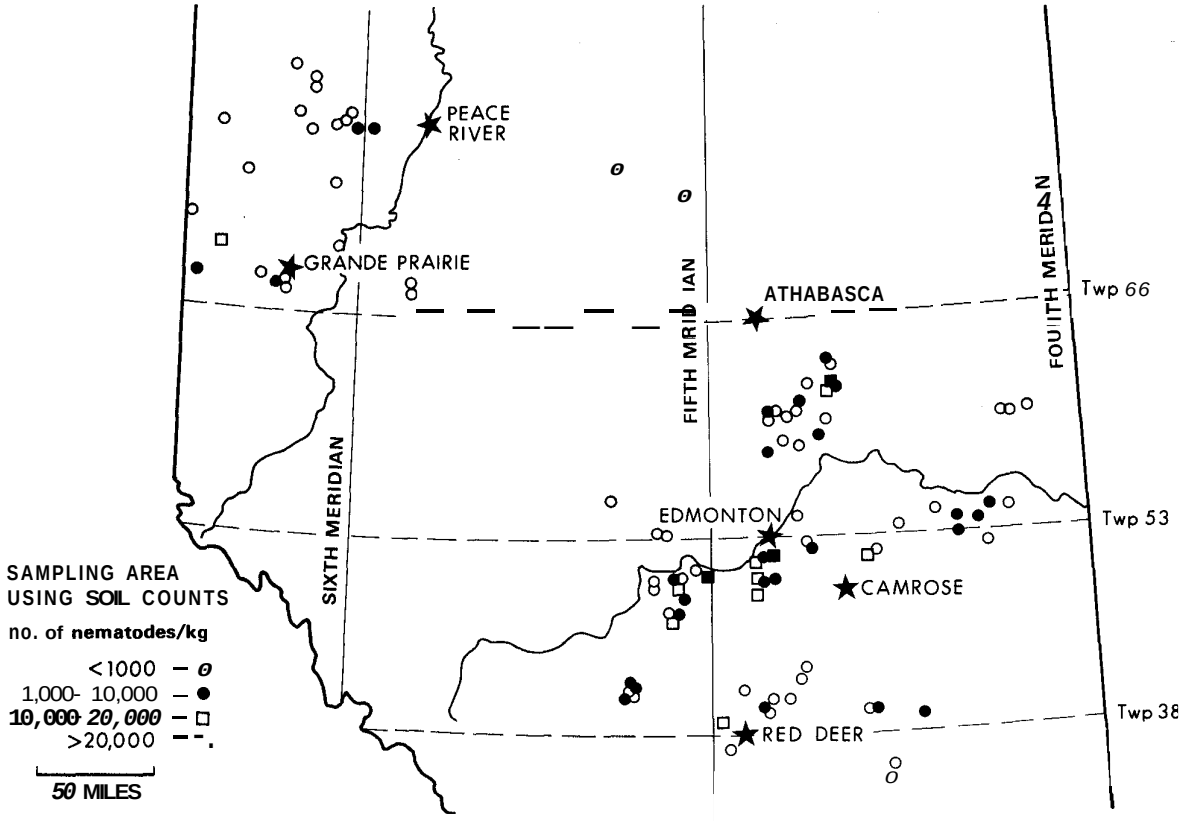

Figure 1. Distribution of *Paratylenchus projectus* in central and northern Alberta, numbers of nematodes per kilogram of soil (composite sample).

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