SOME OBSERVATIONS ON THE SURVIVAL AND DEVELOPMENT OF HELICOTYLENCHUS DIGONICUS UNDER ALFALFA

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Abstract

In the laboratory Helicotylenchus digonicus became quiescent at 2 C and survived in soil at -3 C. In the field H. digonicus overwintered in equal numbers in alfalfa plots with and without snow cover. During the growing season the number of H. digonicus increased and declined normally where alfalfa had survived with snow cover but neither increased nor declined where alfalfa had winter-killed without snow cover.

Résumé

En laboratoire Helicotylenchus digonicus est devenu inactif à 2 C et survivèrent dans le sol à -3 C. Sur le terrain H. digonicus hivernèrent en nombre égal dans des parcelles de Medicago sativa recouvertes ou non de neige. Aucours de l'été le nombre de H. digonicus s'accrût et déclina normalement ou le Medicago sativa, recouvert de neige, avait survécu; mais ou la Medicago sativa était mort, n'ayant pas été recouvert de neige, le nombre de nematode ne s'accrût pas ni déclina.

The spiral nematode, Helicotylenchus digonicus Perry, is one of four dominant plant parasitic nematodes associated with forage in Ontario (Townshend et al. 1973). Field and greenhouse studies showed that alfalfa, clover, and timothy were hosts of the spiral nematode (Townshend 1972, Townshend and Potter 1973). This ectoparasitic nematode is able to survive our winters though its host likely provides little or no protection. Some laboratory and field observations on the survival and development of H. digonicus under alfalfa are reported.

Methods

In the laboratory, quiescence and freezing tolerance of H. digonicus were examined. Quiescence was studied by plunging vials containing a water suspension (2 ml) of nematodes into cold water baths at 2, 4, 6, and 8 C for 20, 40, 60, and 180 minutes. Active and inactive nematodes were counted in chilled dishes. The nematodes in this test originated from infested soil stored at 1 C, and were extracted in Baermann pans (Townshend, 1963) at room temperature to obtain nematode suspensions. Freezing tolerance was studied by placing vials of the infested soil in a freezer at -3 C for 2, 4, and 8 days. Each vial contained 400 nematodes in 17 g of soil at 18.5% moisture. Upon thawing, nematodes were extracted for 1 week in Baermann pans and counted. All treatments were replicated 10 times.

In the field, the survival and development of H. digonicus in a London loam were examined in alfalfa management plots maintained by the University of Guelph at Elora, Ontario. Subplots with and without snow cover during the preceding winter were sampled monthly from May to November in 1971. In 1972 a second set of subplots on a new location were sampled every 5 weeks from May to October. A minimum of 9 cores (2.5 x 20 cm) were taken from each subplot at each sampling. Nematodes were extracted from 50-g subsamples and counted as before. Soil temperatures were recorded through each winter.

Results and discussion

In the laboratory, larval and adult nematodes became quiescent within 20 min at 2 C. At higher temperatures, the nematodes remained active but their movements were sluggish and there was a greater tendency for the nematodes to coil. Quiescent nematodes became fully active within 30 min at room temperature. After 8 days in frozen soil at -3 C, the numbers of larvae and adults recovered were not significantly less than those from unfrozen soil.

In the field, the alfalfa plants were killed in those subplots that had no snow cover the preceding winter. In May of each

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vear the number of spiral nematodes (larvae ana adults) in those subplots in which the alfalfa had been killed, was not siqnificantly lower than in those subplots in which the alfalfa had survived (Fig. 1). Furthermore by Auqust or September the number of nematodes had neither declined nor increased significantly in the subplots in which the alfalfa had been winterkilled. However, in the subplots in which alfalfa had survived the number of nematodes had increased significantly during the same period (Fig. 1).

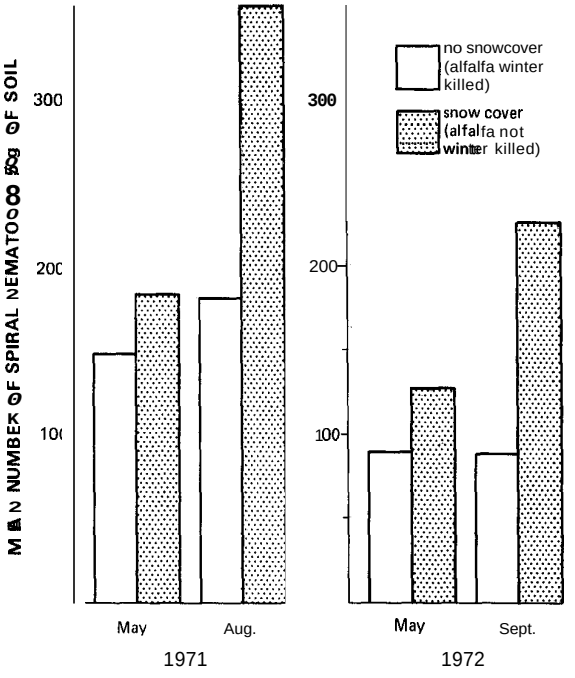

Figure 1. Survival, in May each year, and peak population development (August 1971 and September 1972) of the spiral nemotode in alfalfa plots with and without snow cover. LSD 5% (August 1971) 95; LSD 5% (September 1972) 58.

The spiral nematodes multiplied at different rates in the summers of 1971 and 1972 in subplots with no winterkill. In 1971, the spiral nematode population peaked in August and November and declined from May to June and from August to September (Fig. 2). In 1972, the number of spiral nematodes continued to increase from May through September before declininq in October (Fig. 2). The summer of 1972 was cool relative to that in 1971 but in both summers irrigation was used to maintain suitable moisture levels. Hence the difference in the rate of nematode multiplication in the two summers appears to be mostly the result of temperature.

Helicotylenchus digonicus has the capacity to survive winter and summer soil conditions. In early winter as soil temperatures decline, our laboratory studies suggest that the nematode becomes sluggish and then becomes quiescent before the soil freezes. In this environment many nematodes survive the mid- and late-winter soil temperatures, which average 0 C under snow cover and -4 C with no snow cover. On the basis of Sayre's (1964) study this nematode is "freezing tolerant". During the summer, without a host, the spiral nematode does not decline in numbers, supporting other experimental findings regarding the longevity of spiral nematodes in fallow soil (Golden 1956 and Ferris 1960). Perhaps spiral nematodes are immobilized in the fine-textured London loam and thus are better able to survive (Townshend and Wehber 1971) in the absence of a host than if they were active in a coarse-textured soil.

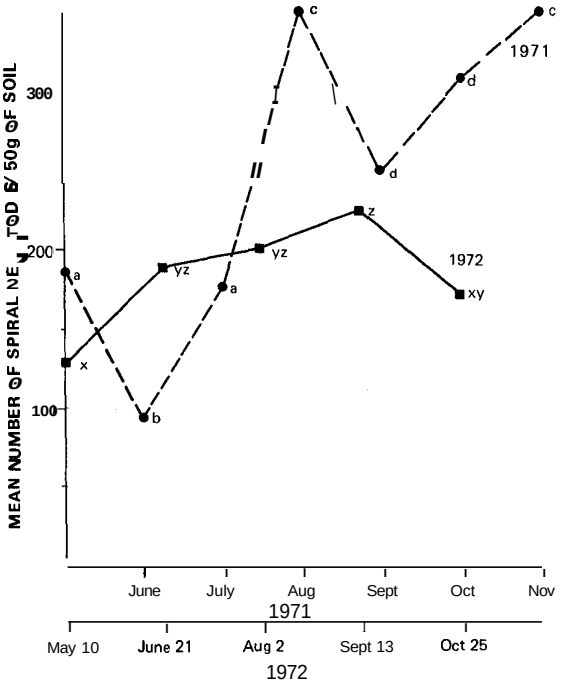

Figure 2. Population development of the spiral nematode in alfalfa plots having 60% or more plant survival in 1971 and 1972. The letter beside each coordinate indicates its significance in a Duncan's Multiple Range test.

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