MOVEMENT OF *PRATYLENCHUS PENETRANS* AND THE MOISTURE CHARACTERISTICS OF THREE ONTARIO SOILS ¹)

BY

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The movement and survival of *Pratylenchus penetrans* were studied in three soils, Fox loamy sand, Jeddo loam, and Vineland silt loam that had marked differences in particle-size distribution, moisture retention, aeration, and pore size.

Nematodes on paper disks were placed on the surface of soil cores that had been packed to two bulk densities and equilibrated at eight moisture regimes. After seven days the cores were partitioned, the nematodes extracted and counted.

At low bulk density, a percentage of 4th and adult stages moved 4 cm in Fox between 10 and 3000 cm H₂O moisture tension and in Jeddo and Vineland between 30 and 300 cm H₂O; a percentage of 2nd and 3rd stages moved 4 cm in Fox between 10 and 100 cm H₂O moisture tension and in Jeddo and Vineland at 30 and 100 cm H₂O. However all stages moved only an average of 2.0 cm in Fox at 10 cm H₂O moisture tension and in Jeddo and Vineland at 100 cm H₂O.

At high bulk density, a smaller percentage of all stages moved 4 cm only in Fox at 30 and 100 cm H₂O moisture tension and in Jeddo at 100 cm H₂O. Moreover 4th and adult stages moved only an average of 1.0 cm in Fox, 1.3 cm in Jeddo and 0.5 cm in Vineland at 100 cm H₂O moisture tension in each soil; 2nd and 3rd stages moved an average of 1.0 cm in Fox and 0.5 cm in Jeddo at 100 cm H₂O in both soils. In Vineland 2nd and 3rd stages did not move.

Eight to 12 percent of the soil volume was occupied by air when movement of all stages peaked in each soil.

It is suggested that the relatively large sand grains in the Fox soil provided pore sizes and moisture characteristics more suitable for nematode movement.

The root-lesion nematode, *Pratylenchus penetrans* (Cobb) in southwestern Ontario is associated with orchard replant problems (Mountain & Boyce, 1958), brown root rot of tobacco (Mountain, 1954), black root rot of strawberry (Townshend, 1962), and rusty root of celery (Townshend, 1962). These problems are more severe on sandy loams than on clay and silt loams. In Essex County stone fruits are grown on Fox loamy sand whereas in the Niagara Peninsula they are grown on Jeddo and Vineland loams. Tree failures are more frequent in the former area than in the latter—50% vs. 9% (Mountain & Boyce, 1958).

To gain a host, *P. penetrans* must move and survive in these soils before penetrating a host root. Movement of nematodes depends upon moisture, particle and pore size, aeration, and length and activity of the nematode. The principles of nematode movement were determined originally with particles of uniform size

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(Wallace, 1956, 1958 a-c, 1960 and 1966). However, field soils are not uniformly particulate, but contain a wide range of particle and aggregate sizes. Fox loamy sand is coarse-textured and so its pore-size distribution and moisture retention properties will be different from that of the fine-textured Jeddo and Vineland loams. This paper will demonstrate the effects of these differences on movement and survival of P. penetrans.

MATERIALS AND METHODS

A Fox loamy sand, a Vineland silt loam, and a Jeddo loam were air-dried and passed through a sieve with openings of 1.68 mm. The particle-size distribution of each soil was determined by the pipette method (Kilmer & Alexander, 1949).

Cores of soil 4 cm deep and 1.9 cm in diameter were prepared in plastic cylinders which were composed of five rings 1.0 cm deep and were closed at one end by bonded fiberglass cloth. With vibration and mechanical pressure two bulk densities were obtained for each soil; Fox (1.36 and 1.70), and both Vineland and Jeddo (1.06 and 1.36). The low densities are encountered at planting and the high densities in established plantings and orchards. A sufficient number of cores were prepared to give a three-fold replication of all treatments plus additional cores for moisture determinations.

All cores were saturated with water and then sets of cores for nematode inoculation and moisture determination were equilibrated at eight pressures. Water columns were used for pressures less than 100 cm H₂O and porous ceramic plates in chambers of predetermined gauge pressures were used for pressures greater than 100 cm H₂O (Richards, 1947).

Migratory stages of P. penetrans were obtained by submerging infested celery roots in an aerated antiseptic solution for 4 days (Townshend, 1963). Nematodes were concentrated to 1000/0.5 ml by centrifugation and aerated another 18 hours at 4.5°C. One thousand nematodes in 0.5 ml of suspension were pipetted onto thick disks of absorbent paper which were placed face down on the upper surface of the equilibrated cores.

The length and width of 100 nematodes of each of the four migratory stages were determined from each of ten aliquots that had been set aside during inoculation.

The basic experiment consisted of three soils, two bulk densities, eight moistures, and three replications. The latter were done in time because of the physical limitations of the experiment. Nematodes were allowed to move in the cores for 7 days at 21°C. Then the nematodes were recovered from the five segments of each core by a Baermann pan method (Townshend, 1964). Second and third, and fourth and adult stages were counted as two separate groups. The distance (D) that a nematode moved was determined by the formula:

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D = \frac{(\text{No. on disk } \times 0) + (\text{No. in } 1 \text{ cm } \times 1) + (\text{No. in } 2 \text{ cm } \times 2) + (\text{No. in } 3 \text{ cm } \times 3) + (\text{No. in } 4 \text{ cm } \times 4)}{\text{Total No. recovered}}
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