RESEARCH NOTES

Alfalfa Root Galls Caused by the Stem and Bulb Nematode

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Ditylenchus dipsaci (Kühn), the stem and bulb nematode, is an obligate parasite of a number of higher plants (4, 5). Symptoms on dicotyledonous host stems are short internodes swelling and blistering; leaves may show petiole and vein curvatures. Infected monocotyledonous hosts, such as rye and oats, produce an excessive number of tillers and have puffy leaf sheaths. Infected daffodil leaves produce small pale-green swellings called 'spickels,' which contain aggregations of nematodes. Underground stems and bulbs are also attacked by this nematode. In all cases the parenchymatous tissues are invaded (3, 5). Infection of roots has not been reported.

This note describes an unusual type of *D. dipsaci* infection in alfalfa grown under greenhouse conditions. Histological changes in the affected tissues are also reported and illustrated.

A large number of plants of alfalfa, *Medicago sativa* L. var. 'Grimm,' growing in pots in the greenhouse, were inoculated with *D. dipsaci* in the manner previously described by Hawn (1). The plants were maintained in the greenhouse to promote disease development. Besides the usual symptoms of stem nematode infection in alfalfa (swollen and discolored crown buds and dwarfed stems), black, gall-like growths girdled the crowns and subcrown portions of tap roots of many of the inoculated plants (Fig. 1a). These unusual symptoms were confined to crown and subcrown areas that were no longer covered with soil—a result of soil erosion caused by improper watering. That the galls were caused by nematodes was shown both by an absence of symptoms in uninfected plants and by the recovery of *D. dipsaci* from crowns and tap roots bearing the galls.

Crowns and subcrowns of tap roots from both healthy and diseased plants were stored in formalin-aceto-alcohol (1:1:18) before being infiltrated and embedded in Tissuemat® (mp 60–62 C) and sectioned at 10 μ. Conant's quadruple stain technique (2) was modified to differentiate between stem nematodes and the tissues in which they were located. Sections were mounted in Permount®.

Longitudinal sections of healthy alfalfa plants showed an orderly array of periderm, cortex, and phloem (Fig. 1b). Below these were sclerenchyma fibers and xylem interspersed with medullary ray cells. Sections through diseased tissues showed destruction of ray parenchyma, cortex, and phloem cells (Fig. 1c and d) with the formation of cavities wherein stem nematodes could be seen in large numbers. Cells proximal to cavities were abnormally large and rounded out, indicating breakdown of the middle lamellae (Fig. 1c).

Histological results confirmed that *D. dipsaci* had infected these subcrown parts of exposed tap roots. Here, as in alfalfa stems (4), parenchymatous tissues were destroyed and thus cavities were formed.

It appears that the nematodes entered the roots through lenticels, which are well developed under moist conditions. Since photosynthates are stored in parenchyma cells in the alfalfa tap root it would seem that such tissues would provide an excellent environment for the growth and reproduction of *D. dipsaci*.

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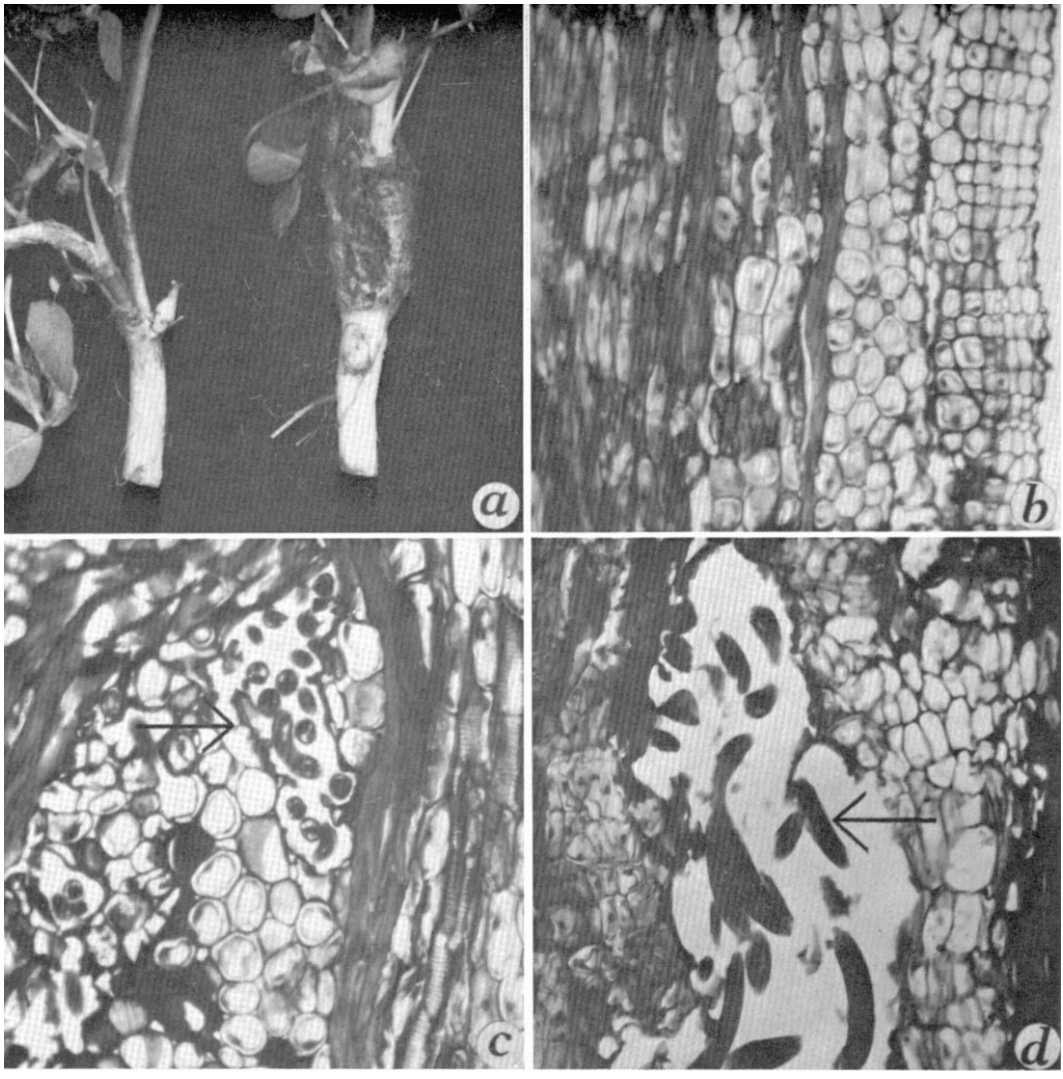

FIG. 1. Alfalfa tap root, healthy and infected by *D. dipsaci*. (a) Healthy (left) and infected tap roots. (b) Longitudinal section of a healthy tap root, × 200. (c) Longitudinal section of a nematode-infected root. Note nema (arrow) within a cavity in ray parenchyma cells, × 200. (d) Longitudinal section of a nematode-infected root. Note nema (arrow) within a cavity in cortex cells, × 200.

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