A METHOD FOR DETECTION AND STUDY OF THE SUGAR-BEET NEMATODE IN SOIL

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Introduction

A method, based on Comstock's (1) and Streu's (3) root cage, was developed for assaying soil for viable cysts of Heterodera schachtii Schmidt, the sugar-beet nematode.

Materials and methods

Narrow soil chambers (Fig. 1-A) were constructed by separating two 2.5- x 35.5-cm sheets of window glass with 0.6-cm frost-shield gasket (Richardson Manufacturing Company Limited, Winnipeg, Manitoba). Each open-topped chamber had three 2.5-cm gaps cut in the bottom gasket to provide for subirrigation. Time tape (Professional Tape Company Incorporated, 355 Burlington Avenue, Riverside, Illinois), 3.8-cm wide, was used to bind the sides of the chambers together. Sieved, air-dry soil was poured into each chamber and compacted by gentle tapping. The bottom of each chamber was immersed in water until the soil was completely moistened by capillary action.

Seeds or seedlings were placed in the moist soil at the top of each chamber which was then enclosed in black plastic to occlude light and prevent growth of algae.

The chambers were set at an angle of 30° in a combination rack and watering tray (Fig. 1-B) which forced the plant roots to grow along the lower soil-glass interface (Fig. 1-C). Water was put into the tray as required.

Results and discussion

Hatching of H. schachtii eggs is ,stimulated in the rhizospheres of host plants (4). After four weeks' incubation the white-cyst stage could be seen on the roots with the aid of a stereoscopic microscope (Fig. 1-D). Fully developed cysts were visible to the naked eye. The entire exposed root system was examined by drawing a grid on the glass and examining each square.

Seedlings of the following Cruciferae were transplanted to chambers filled with H. schachtii-infested soil: flixweed (Descurainia sophia (L.) Webb), stinkweed (Thlaspi arvense L.), rape (Brassica napus L.), and commercial yellow mustard (Brassica hirta Moench). The following weeds of the family Chenopodiaceae were also tested: redroot pigweed (Amaranthus retroflexus L.), A. powellii S. Wats., and kochia (Kochia scoparia (L.) Schrad.).

After four weeks' incubation in the greenhouse at 21-25°C cysts were found on the roots of stinkweed, rape, and yellow mustard. Stinkweed and rape have previously been reported as hosts for H. schachtii by Jones (2). Thus, results obtained by this method confirm the susceptibility of stinkweed, one of our more common weeds, and show the need for eradication in crop rotations that include the sugar beet and cultivated Cruciferae.

Yellow mustard proved satisfactory as a bioassay plant because of its susceptibility to H. schachtii and the rapid ramification of its roots through the soil in observation chambers. In a series of tests infestations as low as two viable cysts per 453.6 gm of soil were detected. This method is, therefore, practical for detecting infestations of H. schachtii in field soil.

Both male and female larvae of H. schachtii enter the young roots of the host near their growing tips. After approximately three weeks the males emerge from the third larval skin and leave the root to seek out and fertilize the females. Swarms of nematodes were frequently observed near the white cysts in the chambers (Fig. 1-D, a and b). Samples taken from these swarms contained only males of H. schachtii.

literature cited

1. Comstock, J.H. 1888. N. Y. Cornell Agr. Exp. Sta. Bull. 3, 25-30.
2. Jones, F. G. W. 1950. Observations on the beet eelworm and other cyst-forming species of Heterodera. Ann. Appl. Biol. 37, 407-440.
3. Streu, H. T. 1960. Observations of plant parasitic nematodes on roots of living plants using a glass-sided root observation box. Phytopathology 50, 573 (Abstr.).
4. Winslow, R. D. 1955. The hatching responses of some root eelworms of the genus Heterodera. Ann. Appl. Biol. 43, 19-36.

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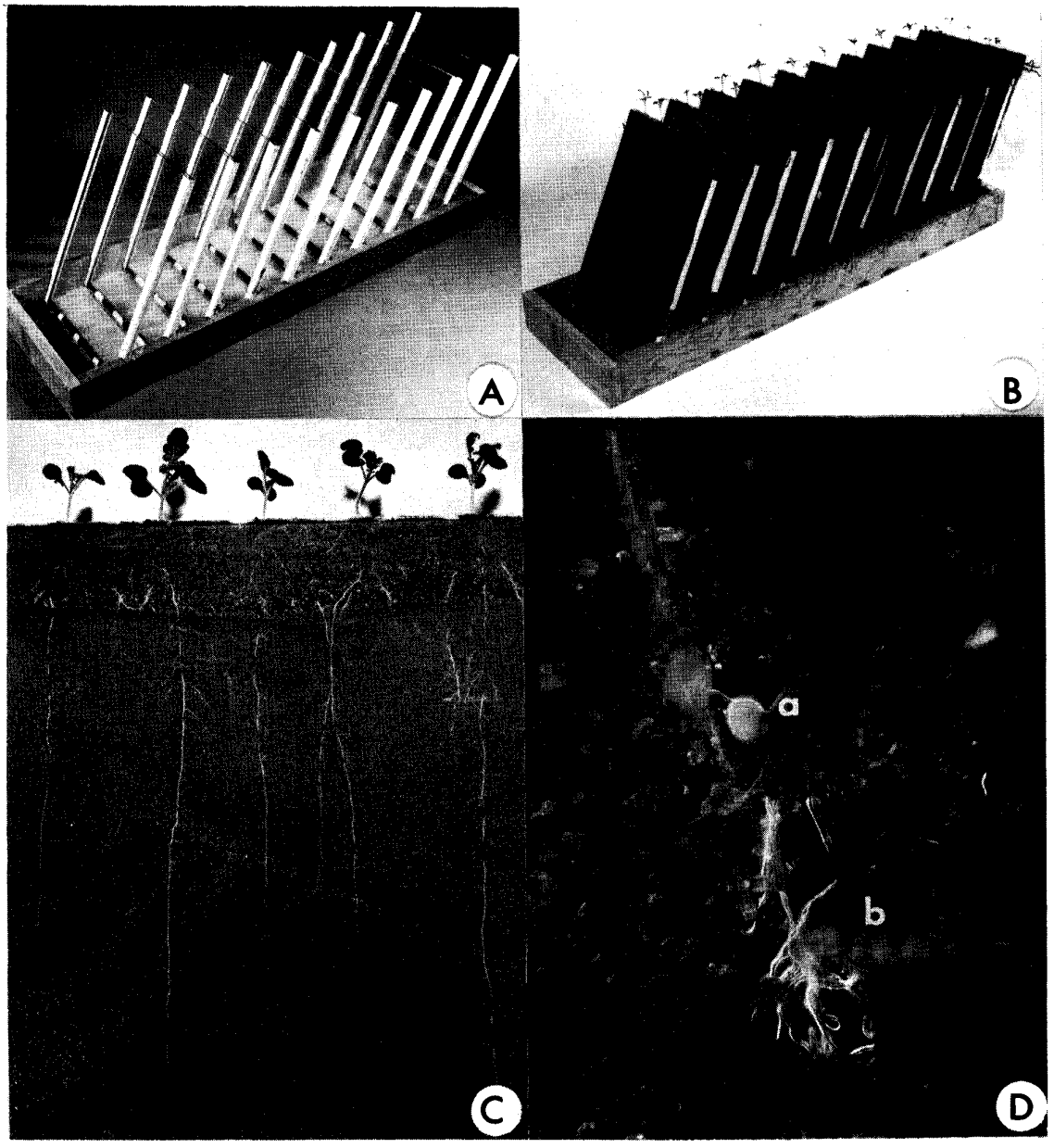

Figure 1. A. Empty chambers in combination rack and watering troy; B. Chambers containing mustard seedlings. Note the black plastic covers.

C. Exposed lower side of a chamber showing root growth along the soil-glass interface;
D. White cyst of *H. schachtii* on mustard root (a) together with a swarm of males (b).