THE OAT CYST NEMATODE, HETERODERA AVENAE WOLLENWEBER, ON CORN, ZEA MAYS, IN ONTARIO

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Abstract

Observations on field material and results of laboratory experiments are presented to establish the fact that Heterodera avenae Wollepweber invades roots of corn plants and is capable of causing appreciable damage to this crop in the province of Ontario.

Introduction

A report by Putnam and Chapman (4) constitutes the earliest record of the oat cyst nematode in North America. Since that time this nematode has frequently been observed causing serious injury to oat crops in parts of central and southwestern Ontario. Baker and Chapman (1) described the distribution of this nematode as the central part of the southern areas, ranging between the cities of Waterloo and Peterborough. Laughland (3) listed 16 counties in this general area in which oat nematode damage on grain had been observed. These reports described the nematode as attacking oats, barley and wheat, in that order of preference, but with serious damage occurring in oats only.

Studies on the oat cyst nematode were resumed at the Ontario Agricultural College in 1962 when facilities for research and instruction in plant nematology were established in the Department of Botany. Through the cooperation of the agricultural representatives for York and Ontario counties the author was able to assess the importance of this parasite by observing the extensive damage to oat crops in several parts of these two counties. Of particular significance to the present report is a comment that was made by Mr. H. L. Fair, Agricultural Representative for Ontario county, during a survey of some affected oat fields in the spring of 1963. Mr. Fair stated that he had observed corn crops, planted after oats which had been severely damaged by the oat cyst nematode, to be unthrifty and growth particularly retarded in roughly the same areas of the fields in which damage to oats had been most severe the previous year. Thus, he suspected that corn was being attacked by the nematode but he could not find support for this theory because corn was not listed as one of the hosts for Heterodera avenae.

Field observations

In early August, 1965, a sample of unthrifty corn plants was received from a farmer near Bowmanville. The primary root systems of these plants were stunted and stubby in appearance although healthy-looking adventitious roots were beginning to develop in abundance. When representative samples of these root systems were processed and examined microscopically the primary root and some of the secondary roots were found to contain numerous larvae of Heterodera in various stages of development. No nematodes could be found in any of the adventitious roots. Analysis of the soil received with the plants yielded an average of 54 cysts of H. avenae per 100 gm of soil, a relatively high level of infestation.

The field from which these plants had been taken was visited in mid-August and was found to resemble the condition which would be expected in an oat field heavily infested with H. avenae. The corn plants were stunted in irregular patches ranging from a few feet to 10 yards or more in diameter. Affected plants were only 2 to 3 feet tall and showed no signs of flower development whereas healthy plants in the same field were at least 6 feet tall with tassels fully formed. A second corn field with similar symptoms was located a few miles distant. Laboratory analysis of root and soil samples taken from this second field yielded results similar to those from the original field.

These fields were revisited 2 weeks later and it was surprising to note that the affected areas were difficult to recognize from a distance because the height of the corn plants in the affected areas was nearly equal to that of the healthy plants. Closer examination showed that the affected plants were thinner than healthy plants and were just beginning to tassel whereas the healthy plants had already been in full tassel for 2 weeks. Thus, development of corn plants in affected areas was retarded by an estimated period of 3 weeks.

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Discussion and conclusions

The observations described provide strong evidence that H. avenae attacks corn and is capable of causing appreciable damage to a corn crop. This field evidence is confirmed by the recent work of Johnson (2) who, in controlled laboratory infection experiments during 1964-65, demonstrated that H. avenae, hatched from cysts produced on oat roots, freely invaded roots of corn plants and developed within them.

Swarup, Prasad and Raski (5) reported that in India, "numerous cysts of H. avenae and white females were observed on the roots of some maize plants" and when these cysts were used to inoculate maize seedlings a full life cycle was completed within 2 months. Present observations confirm their view that maize is a new host for H. avenae but differ in the details which lead to this conclusion. Thorough examination of infected corn roots taken from the field and of roots from Johnson's artificially inoculated corn plants failed to reveal any mature cysts or white females developing on the surface of the roots. Johnson observed mature males and mature-looking females within the root tissue but the females showed no signs of emerging from the tissue and there was no egg formation within their bodies even after 10 weeks' development. In oat roots the enlarged females show egg formation and begin to emerge to the surface of the root in 5 to 6 weeks from the time of original entry into the root.

This study is being continued to determine whether or not H. avenae will actually reproduce on corn or whether it is a terminal host as is Tagetes for species of Pratylenchus.

Literature cited

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