Pythium root rot of barley in southwestern Ontario

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In southwestern Ontario *Pythium* species have been found in all barley fields examined in 1973 and 1974. *Pythium* spp. may cause decay of the root system of barley plants at any stage of development, resulting in significant reductions in yield. The ability of the barley plant to regenerate an adequate new root system varies with the length of time the soil is wet, the developmental stage of the plant, and the fertility of the soil. Barley, spring and winter wheat cultivars, and corn hybrids were susceptible while oats were highly resistant.

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Dans le sud-ouest de l'Ontario, on a decouvert des especes du genre *Pythium* dans tous les champs d'orge etudies en 1973 et 1974. Les *Pythium* spp. peuvent causer la pourriture du systeme radiculaire des plants d'orge à tout stade de developpement, ce qui entraîne des reductions appreciables des rendements. L'aptitude du plant d'orge a regenerer un nouveau systeme radiculaire satisfaisant varie en fonction de la duree de mouillage du sol, du stade de developpement du plant et de la fertilité du sol. L'orge, les cultivars de bles de printemps et d'hiver et les hybrides de mais se sont révélés sensibles, et l'avoine s'est averee tres resistante

Introduction

For many years only small acreages of barley were grown in southwestern Ontario, partly because yields were not satisfactory. During the last 15 to 20 years there has been a greater desire by farmers to grow barley because of a potential increase in productivity of barley resulting from changing agronomic practices, including use of new cultivars, increased use of commercial fertilizer, and tile drainage. As a result, barley has replaced oats in many instances and barley acreage in Ontario between 1962 and 1972 increased from 80,000 to 375,000 acres (5). However, although yields have risen, they are much lower than anticipated by farmers, and hoped for by barley breeders.

Plant pathologists in Ontario have paid little attention to root degeneration of barley. The assumption has been that the root rot problem of barley in Ontario is similar to that of barley grown in the prairie provinces and consequently conclusions and recommendations, frequently, have been copied from or based on reports from western Canada.

Reports in the *Canadian Plant Disease Survey* on root decay of barley indicate that *Cochliobolus sativus,* which causes common root rot, is the major root pathogen. For example, Harper and Piening (3) reported that in 1971 common rot caused an estimated loss of 6.0% in south and central Alberta.

In the last 40 years browning root rot (caused by *Pythium* spp.) of barley has been reported only three times in the *Canadian Plant Disease Survey.* In 1967 (1) it was found in one field at Lethbridge and one at Granum, Alberta; in 1944 (4) in one field at Indian Head, Saskatchewan; and in 1930 (2) in 3 of 98 fields examined in Saskatchewan.

The Field Crop Recommendation of the Ministry of Agriculture and Food in Ontario (6) indicates the consensus of the root rot situation in Ontario when it states *"Helminthosporium* root rot and blight is frequently serious in barley". Browning or *Pythium* decay is not mentioned.

Observations and results

Because I observed the destruction of the root system of barley plants in a few fields during the last 10 years and because barley yields were inconsistent, I examined the roots of barley plants in several fields from Huron, Middlesex, and Perth counties, which have large acreages of barley. Root degeneration occurred during and following emergence, during development, and at maturation if the soil became wet. There was a direct correlation between soil moisture content and the amount of root degeneration. If decay was severe during and prior to emergence, a poor stand resulted (Figure 1). At later stages of development the plants **did** not die but, as a result of loss of a large portion of the root system, the plants were readily pulled from the soil; frequently only a few short stubby roots remained around the seed, and tillering was minimal (Figure 2).

Field observations in Lambton, Oxford, and Elgin counties indicated that the disease situation was similar to that in Middlesex, Huron, and Perth counties.

After the moisture content lowered in soil there was a regeneration of roots unless the plants were very young. Frequently the plants developed an adequate root system and made a striking recovery, especially if the soil had received a generous amount of fertilizer. If the fertility of soil was low the plants became yellowish and stunted. If there was a heavy stand, often the soil **did** not

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Figure 1. A field of young barley; most of the barley plants in the central part of the field have died due to decay of the root system by a species of *Pythium*.

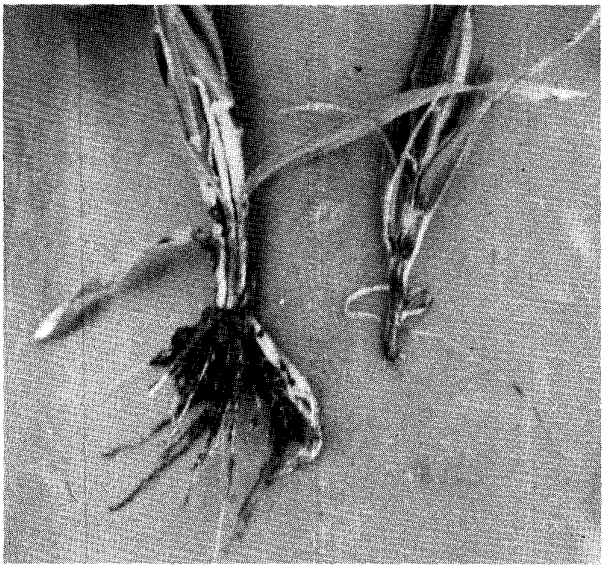

Figure 2. Pythium root rot of barley; the plant from a *Pythium*-affected field (right) has only two tillers and a few stubby roots; the plant from a healthy field (left) has several tillers and a well-developed root system.

dry for a considerable length of time, particularly as the crop approached maturity, and consequently a large root system did not form because the growing roots continued to become necrotic.

Numerous microscopic observations of diseased roots showed that oogonia and sporangia were present in most roots. Isolations on nutrient media proved that species of *Pythium* were present in the necrotic roots. *Fusarium* spp., *Mucor* spp., *Cochliobolus sativus* (Ito and Kurib.), Drechs. ex Dastur, and other fungi were occasionally observed.

Barley plants grown in sterilized soil inoculated with *Pythium* isolates showed the same disease syndrome as the one observed in the field. A heavy inoculum prevented emergence. Root decay occurred at all stages of development. *Pythium* infected barley roots in 3 to 5 hours, sporangia began to form immediately following infection, and zoospores were produced and liberated within 24 hours. The the life cycle is very short.

In the laboratory, spring and fall wheat, and corn were susceptible and oats were resistant to the *Pythium* isolates.

Discussion and conclusions

Pythium spp. appear to be major causes of root rot of barley in southwestern Ontario while in western Canada the most important root pathogen is *C. sativus*. The difference may be due in part to more rainfall and poorer drainage in Ontario.

Barley should be planted on well drained soil with sufficient fertilizer, especially nitrogen, for optimum growth.

Barley varieties resistant to *Pythium* should be sought and a protectant fungicide for the seed should be used. A systemic fungicide effective against *Pythium* would be ideal.

Because *Pythium* species are widely distributed throughout southwestern Ontario and because they cause root degeneration of several commonly grown agricultural plants, the importance of *Pythium* cannot be overemphasized. One may hope that the solution to this barley root rot problem may be as readily corrected as was the browning root rot disease of wheat in western Canada (7).

Literature cited

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