PREVALENCE, DISTRIBUTION, AND IMPORTANCE OF DWARF BUNT OF WINTER WHEAT IN ONTARIO 1970-71[1]

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Abstract

Field surveys in southwestern Ontario in 1970 and 1971 showed that dwarf bunt caused by Tilletia controversa was present primarily in Huron County. Disease incidence was low: less than 1%of the plants in affected fields showed symptoms of the disease. T. controversa was detected in samples of pedigreed seed produced in Ontario each year from 1960 to 1971.

Dwarf bunt caused by Tilletia controversa Kuhn was first detected in Ontario in 19 (2,5). The disease caused immediate concern to growers of winter wheat in Ontario because the causal fungus is soil-borne as well as seed-borne. Concern was expressed that seed lots infected with the organism would infect fields formerly free of the organism, resulting eventually in the general distribution of the pathogen in winter wheat soils throughout the province.

Research during 1952-55 revealed that the fungus was present in soils of at least 16 counties in the western part of the province, but was most prevalent in the counties bordering or adjacent to Lake Huron (1). The level of field infection was low, with most fields having only a few bunted heads; however an occasional field was found to have as high as 25% of the heads affected. Although dwarf bunt was not observed in the field in several of the counties bordering Lake Erie, namely Essex, Kent, Elgin, Oxford, Norfolk, and Haldimand, spores of the fungus were detected in seed samples that had originated from fields in these counties. Approximately 2,500 seed samples were examined from 1953 to 1955 and spores of T. controversa were present in samples from counties where the disease had not been observed in the field. Although only the better grades of seed were examined, at least 10% of the samples were contaminated with T. controversa (1).

Following the discovery of dwarf bunt and the initial field and seed surveys for the disease, laboratory and field research revealed that for severe infections of dwarf bunt to occur an unusual combination of climatic factors is necessary. A correlation was shown to exist between temperature. light, and soil moisture and the severity of soil-borne dwarf bunt in field plots (1).

Wagner (6) in Germany using a pentachloronitrobenzene preparation indicated that dwarf bunt could be largely eliminated from field soil, and Holton and Jackson in USA (4) found that soil applications of Anticari, a chlorobenzene dust, significantly reduced dwarf bunt in the field. Fushtey (3) conducted extensive tests in Ontario on the control of both seed- and soil-borne inoculum of the pathogen. Tests over the period 1954-58 showed that mercury and chlorobenzene seed treatments were ineffective for the control of soil-borne inoculum but that chlorobenzene treatments were effective against seed-borne inoculum.

The use of effective seed treatment fungicides eliminated the danger of spread of the fungus from contaminated seed lots to fields free of dwarf bunt, and regulations for the treatment of pedigreed seed stocks were established. The disease was reported sporadically during .the early 1960's in western Ontario and although no organized surveys for the disease were conducted it was thought to be of minor importance. In 1967, a number of samples of pedigreed winter wheat seed from the Hensall, Ont., area adjacent to Lake Huron were found to be infested with T. controversa. Again in 1968 and in 1969 samples of pedigreed seed from the same area were found to be infested with T. controversa.

The work reported here was the result of a preliminary survey and loss assessment conducted in 1970 in the Hensall area and a more extensive survey and loss assessment conducted in 1971 in southwestern Ontario. Although dwarf bunt surveys were made previously, no disease-loss evaluations had been attempted (1). A summary of dwarf bunt incidence in samples of winter wheat seed over the period 1960-1971 is also presented.

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Methods

In 1970, 25 fields of winter wheat ranging from 10 to 20 acres were selected at random within a 5-mile radius of Hensall, Ontario. Hensall is located approximately 30 miles north of London. Each field was surveyed for the presence of dwarf bunt in the following manner. Initially each field was inspected until dwarf bunt was discovered or until 25% of the field was inspected. If dwarf bunt was found, the incidence of the disease was assessed by examining plants at 10 sites along a diagonal of the field. Each site consisted of a 30 ft length of row containing an average of approximately 750 heads. In this manner approximately 7,500 heads were examined per field.

In 1971, 53 fields were selected at random throughout the winter wheat growing areas of southwestern Ontario (Fig. 1). Survey and assessment procedures were similar to those used in 1970 except that when dwarf bunt was located, six sites along a diagonal of the field were assessed for dwarf bunt. Each site was 30 ft long and 4 rows wide. Approximately 3,000 heads were scanned at each site for a total of 18,000 heads per field. In Select plots and small fields the number of heads assessed at each site was reduced to 1,000.

Seed infestation

In both years, spores from infected heads were examined microscopically to confirm the presence of T. controversa. Forty grams of 0.5 lb sample of seed were shaken for 3 min in 40 ml sterile distilled water containing 0.1% Tween 20. Two 20 ml aliquots of the supernatant were centrifuged for 10 min. The supernatant was discarded, and the pellets were resuspended in 0.1 ml of Shear's fluid and examined under the microscope for the presence of Tilletia controversa.

Results and discussion

The survey conducted in the Hensall area in 1970 demonstrated that dwarf bunt was present throughout the area, but at a level insignificant from a crop loss standpoint. Although 14 of the 25 fields were affected, no field showed an infection higher than 1% of the crop (Table 1).

In the 1971 survey (Table 1), 16 of 53 fields were affected by dwarf bunt. The highest level of field infection was less than 0.5% and most fields contained only trace amounts of the disease. The distribution (Fig. 1) of the disease was primarily confined to the more northerly area between the towns of Clinton and Exeter in Huron County. No infected fields were found in Kent and Elgin counties and only two in the northern part of Middlesex County.

The distribution of dwarf bunt in Ontario indicates that environmental conditions play an important role in the survival of T. controversa. Dwarf bunt is present in areas of western Ontario that receive the most snow, and although contaminated seed has undoubtedly been sown in the noninfested areas over a period of years, the fungus has not survived in soils where snow cover is minimal.

Table 1. Prevalence of dwarf bunt in winter wheat fields in southwestern Ontario in 1970 and 1971

Infection category (% infected heads/field)	No. of fields in each category	
	1970	1971
0	11	37
0.013-0.053	7	13
0.066-0.133	3	1
0.146-0.267	2	1
0.280-0.666	1	1
0.680	1	0

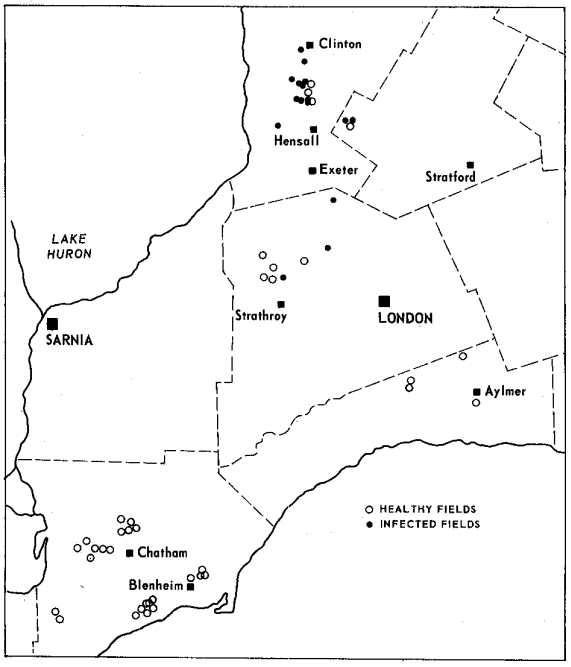

Figure 1. Incidence of dwarf bunt in fields of winter wheat in southwestern Ontario in 1971.

Table 2. Incidence of Tilletia controversa in samples of pedigreed winter wheat seed grown in Ontario, 1960- 1971

Year of production	Number of samples examined	Number of samples infested	% of samples infested
1960	12	12	100
1961	14	11	78
1962	12	4	33
1963	17	9	53
1964	21	5	24
1965	21	9	43
1966	39	6	15
1967	49	11	22
1968	36	11	31
1969	32	6	19
1970	21	8	38
1971	22	8	36

During the period 1960–71 pedigreed seed samples from southwestern Ontario were examined microscopically for spores of T. controversa. Although only a small number of samples were examined each year, the results (Table 2) show that dwarf bunt has been present predominantly in Huron County and to a lesser extent in western Perth and northern Middlesex counties during this period.

Dwarf bunt causes negligible losses to winter wheat crops at the present time. However the appearance of new races of the fungus could change the present situation, and the introduction of new winter wheat varieties with less resistance to dwarf bunt could also affect the severity of the disease. From this standpoint, it would be advantageous to screen breeding material, such as promising selections and varieties, on one or more of the farms where dwarf bunt is now indigenous in the soil.

As hexachlorabenzene seed treatment is effective in controlling seed-borne dwarf bunt (3), seed lots infested with the organism should be treated to prevent the spread of the disease to soils now free of the pathogen.

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