# Occurrence of *Septoria nodorum* Blotch and *S. tritici* Blotch in Michigan Winter Wheat

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**ABSTRACT**

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Winter wheat in commercial fields was surveyed in 1982 and 1983 for Septoria blotch disease. Distinct differences in the occurrence of *Mycosphaerella graminicola* and *Leptosphaeria nodorum* were observed between the two years. *M. graminicola* and *L. nodorum* occurred frequently during the early growth stages in 1982, but by heading, *M. graminicola* was rarely observed on the flag leaves. Glume and most flag leaf infections were caused entirely by *L. nodorum* in 1982. In 1983, *M. graminicola* occurred more frequently throughout the growing season than *L. nodorum* and was common on flag leaves. The differences between the occurrence of *M. graminicola* and *L. nodorum* in 1982 and 1983 indicate an important role for the environment as a factor in pathogen selection, infection, and early-season severity.

Leaf and glume blotch of winter wheat (*Triticum aestivum* L.) is caused by *Septoria nodorum* (Berk.) Berk., *S. tritici* Rob. ex Desm., and *S. avenae* Frank f. sp. *triticea* Johns. (conidial stages of *Leptosphaeria nodorum* Müller, *Mycosphaerella graminicola* (Fuckel) Schroeter, and *L. avenaria* f. sp. *triticea* Johns., respectively). Yield reductions can occur when flag leaves and heads are infected (7–12,14). Apparent yield reduction occurs when shrunken grains are eventually lost with the chaff at harvest.

*L. nodorum* and *M. graminicola* have been observed frequently in Michigan, but little is known about the disease complex. In Minnesota, *L. avenaria* f. sp. *triticea* and *L. nodorum* were more prevalent than *S. tritici* on spring wheat, with *L. nodorum* dominating before heading and *S. avenae* f. sp. *triticea* after heading (13). In Indiana, both *M. graminicola* and *L. nodorum* occur, but the former is dominant (G. Shaner, *personal communication*). Winter wheat is more resistant to infection by *L. nodorum* than spring wheat (5); however, Wiese et al (15) reported *L. nodorum* infections occurred more frequently than *S. tritici* infections on Michigan winter wheat varieties. Recently, fungicides have been released with activity against Septoria blotch diseases, new wheat cultivars have been released by Michigan State University (2–4), and a trend toward conservation tillage has dramatically changed wheat production in Michigan. In the 1980–1981 growing season, Septoria blotch on the glumes was severe and many reports of shriveled grain were received (*unpublished*). Therefore, a disease survey was conducted in 1982 and 1983 to determine the occurrence and distribution of *Septoria* diseases in Michigan.

## MATERIALS AND METHODS

Preliminary surveys were made in October of 1981 and 1982 to determine if

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*Septoria* infections occurred in the fall and could act as possible overwintering and primary inoculum sites.

**1982.** Michigan was divided into five regions, southeast (SE), southwest (SW), west (W), north central (NC), and thumb (T) (Fig. 1), based on three criteria: temperature, moisture, and varieties grown. Soft red winter wheat predominates in the warmer and drier southern regions and matures 2–3 wk earlier than wheat in the other regions. Soft white winter wheat is commonly grown in the rest of the state. Counties in the SE and T have the highest yields and counties in the SW have the lowest. Surveys were made in May, June, and July in each region.

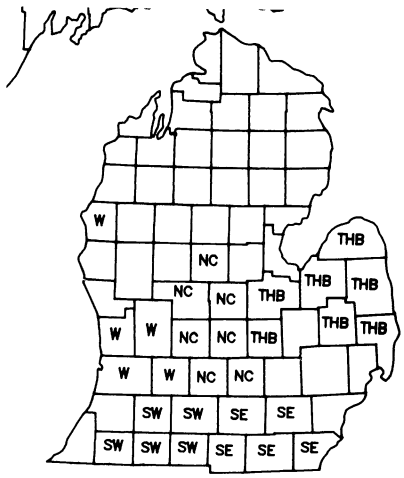


**Fig. 1.** Counties surveyed in Michigan during May, June, and July of 1982, for Septoria leaf and glume blotch. Letters indicate the region surveyed: W = West, SW = Southwest, SE = Southeast, NC = North Central, and THB = Thumb.

Fifty commercial fields in 27 counties were surveyed a total of 107 times. Fifty to 100 plants were examined in each field for *Septoria* lesions (5,12). Leaves or heads of five to 10 plants showing typical *Septoria* lesions were collected in each field to determine the species on the respective tissues. Speciation was determined by the procedure of Shearer and Calpouzos (13). If pycnidia were not present in lesions thought to be infected by a *Septoria* sp., the samples were incubated on moistened filter paper in petri dishes for 2–7 days to favor pycnidial development.

The Romig scale (1) was used to assess the stage of wheat growth during each survey. Survey dates were 7–13 May, 19–26 May, 2–12 June, and 23–29 June in the southern regions, and 10–15 days later in the central and T regions.

**1983.** The *Septoria* disease survey was conducted in the SE and T regions, which represent the two most distinctive and important wheat areas in Michigan. Twelve and 14 fields were surveyed in each region, respectively, at three stages of growth, 22 April, 27 May, and 23 June in the SE region and 12 May, 13 June, and 7 July in the T region. Collection of samples and identification of species was the same as in 1982.

## RESULTS

**1982.** In May, *M. graminicola* and *L. nodorum* were commonly observed in the SE, SW, and W regions (Fig. 2A). Only *M. graminicola* was found in the central region, and the T region was nearly free of Septoria blotch, except for one field with *L. nodorum*. In early May, *L. nodorum* and *M. graminicola* were predominantly on the lower leaves, but by late May, lesions caused by *L. nodorum* were found on leaves higher on the plant than were lesions caused by *M. graminicola* (Table 1). *S. nodorum* blotch and *S. tritici* blotch were found in 68% of the fields surveyed in May.

By early June, most of the wheat had headed and *L. nodorum* was found in every field surveyed except one (Fig. 2B). Lesions were generally on leaves midway up the plant, but some flag leaves and heads were infected (Table 1). *M. graminicola* was observed in only a few fields in the southern counties (Fig. 2B), and these lesions were also on leaves midway up the plant. By late June, wheat was in the milk or later stages. Septoria blotch was found in 65% of the fields surveyed, but *M. graminicola* was found in only one field (Fig. 2C). All but two of the fields had lesions on the flag leaves or heads.

By July, all the fields in the south had matured and only northern counties were surveyed (Fig. 2D). *L. nodorum* was isolated from lesions on the heads in all 20 fields surveyed and *M. graminicola* was not observed (Table 1).

**1983.** Twenty-six fields were surveyed three times each in 1983 to follow the development of *S. nodorum* blotch and *S. tritici* blotch over time in the same location. During the first survey in April and early May, *M. graminicola* was observed in all but one of the 26 fields, but *L. nodorum* was observed in only four fields, three of which were in the T region (Table 2). In the second survey, *L. nodorum* was still limited to one field in the SE region but occurred in seven fields in the T region. *M. graminicola* was observed in 8 of 14 fields and 10 of 12 fields in the SE and T regions, respectively, and both pathogens had progressed from the lower leaves to leaves

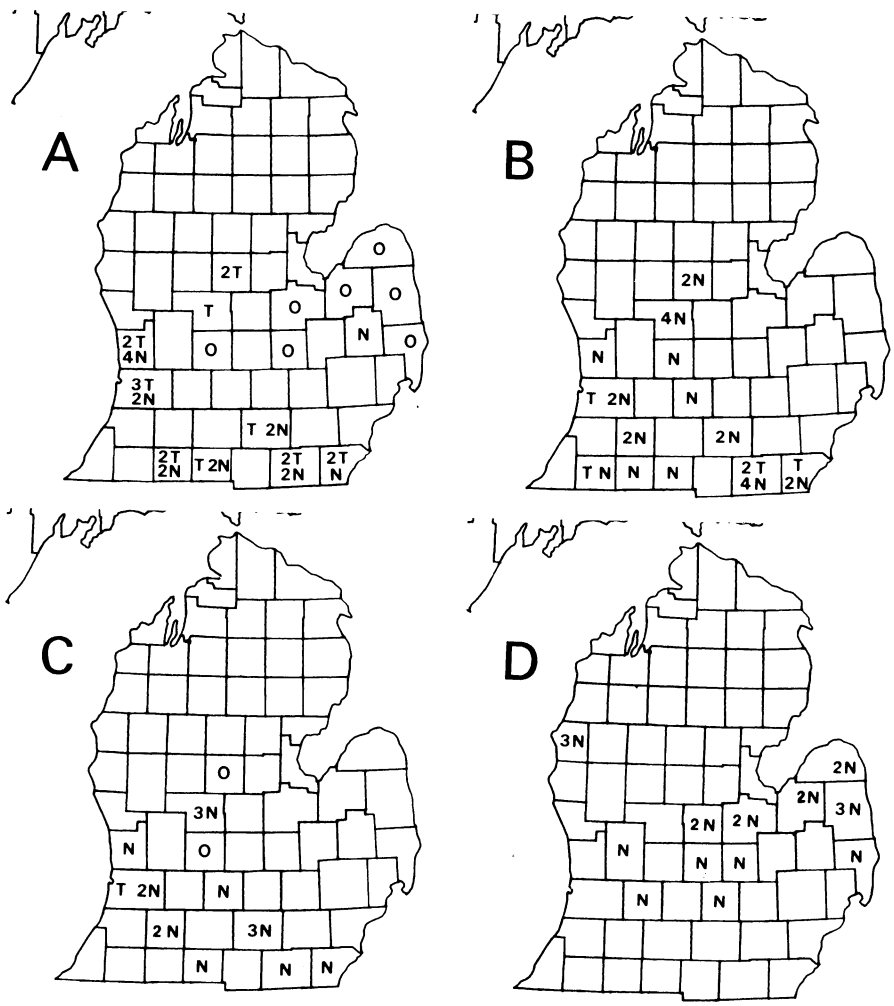


**Fig. 2.** Counties surveyed in Michigan for Septoria leaf and glume blotch during **(A)** May, **(B)** early June, **(C)** late June, and **(D)** July 1982. 0 = Septoria blotch not identified, N = *Leptosphaeria nodorum*, and T = *Mycosphaerella graminicola*. Numbers in front of T or N indicate the number of identifications in that county.

**Table 1.** The number of fields where Septoria blotch was found on various parts of the wheat plant during the 1982 survey in Michigan

| | Area of plant[b] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Lower | | Middle | | Flag leaf | | Head | |
| Date of survey[a] | LN[c] | MG | LN | MG | LN | MG | LN | MG |
| 7–13 May | 5 | 9 | 0 | 0 | – | – | – | – |
| 19–26 May | 7 | 5 | 4 | 1 | – | – | – | – |
| 2–12 June | 1 | 0 | 18 | 5 | 4 | 0 | 2 | 0 |
| 23–29 June | – | – | 2 | 0 | 9 | 1 | 10 | 0 |
| 5–12 July | – | – | – | – | 6 | 0 | 20 | 0 |
| Total LN | 13 | | 24 | | 19 | | 32 | |
| MG | | 14 | | 6 | | 1 | | 0 |

[a] The Romig scale (1) was used to assess the stage of wheat growth during each survey. The stages were 9 (early boot), 12 (heading 25% complete), 16 (beginning of flowering), and 27 (early dough).
[b] Refers to the part of the plant where leaves or heads with Septoria lesions were collected. – = Not examined or tissue not present.

**Table 2.** The number of fields where Septoria blotch was found on various parts of the wheat plant during the 1983 survey in Michigan

| | Area of plant[b] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Lower | | Middle | | Flag leaf | | Head | |
| Date of survey[a] | LN[c] | MG | LN | MG | LN | MG | LN | MG |
| 22 April–12 May | 4 | 25 | – | – | – | – | – | – |
| 27 May–13 June | – | – | 8 | 18 | – | – | – | – |
| 23 June–7 July | – | – | – | – | 7 | 14 | 0 | 0 |
| Total LN | 4 | | 8 | | 7 | | 0 | |
| MG | | 25 | | 18 | | 14 | | 0 |

[a] The Romig scale (1) was used to assess the stage of wheat growth during each survey. The stages were 5 (pseudostem), 10 (boot stage), and 21 (kernels near the middle of the head).
[b] Refers to the part of the plant where leaves or heads with septoria lesions were collected. – = Not examined or tissue not present.
[c] LN = *Leptosphaeria nodorum*, MG = *Mycosphaerella graminicola*.

midway up the plant (Table 2).

By the third survey, *M. graminicola* was found on the flag leaves in eight fields in the SE region and *L. nodorum* in only one field (Table 2). Septoria blotch was not observed in two fields, and one field was plowed up because of barley yellow dwarf virus. In the T region, *L. nodorum* and *M. graminicola* were each found six times on flag leaves and in nine of the 14 fields surveyed. *L. nodorum* occurred on the flag leaves in two fields where it had not been found on the lower or middle leaves, and *M. graminicola* occurred in one field where it had been observed only on the lower leaves previously. No glume infections were observed.

## DISCUSSION

Septoria blotch symptoms on leaves were shown to be caused by *M. graminicola* and *L. nodorum* and glume infections by *L. nodorum* only. *L. avenaria* f. sp. *triticea* has not been reported in Michigan and was not observed in this survey. The differences in the occurrence of *M. graminicola* between 1982 and 1983 probably resulted from the unusual extension of cool weather into late May in 1983. The number of fields with new *M. graminicola* lesions decreased as the season progressed in both years, whereas new *L. nodorum* lesions increased in 1982 and remained relatively constant in 1983. In 1982, however, *L. nodorum* was the prominent pathogen, whereas *M. graminicola* was observed more often in 1983.

Septoria blotch was not observed on wheat in the preliminary surveys in 1981 and 1982, indicating there is no association of fall infections with the occurrence of *L. nodorum* as in California (6). The early occurrence of *L. nodorum* in the SE region in 1982, followed by new infections higher on the plant later in the season, indicates that a high incidence of *L. nodorum* or *M. graminicola* in the spring would provide sufficient inoculum for an epidemic on flag leaves and heads under the appropriate environmental conditions. However, flag-leaf epidemics of *L. nodorum* occurred in 1982 in regions where an early abundance of *L. nodorum* lesions did and did not occur (Fig. 2). Inoculum may have originated in more southern regions in 1982 and moved north as the season progressed. Therefore, whether early disease is necessary to provide inoculum for flag-leaf and head epidemics remains to be answered.

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