# Differential Sporulation of Pathotypes of *Peronosclerospora sorghi* on Inoculated Sorghum

JEWEUS CRAIG, Research Plant Pathologist, Agricultural Research Service, U.S. Department of Agriculture, Plant Sciences Department, Texas A&M University, College Station 77843, and R. A. FREDERIKSEN, Professor, Plant Sciences Department, Texas A&M University, College Station 77843

**ABSTRACT**

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A system was devised for differentiating pathotypes of *Peronosclerospora sorghi* according to their ability to sporulate on inoculated leaves of differential sorghum (*Sorghum bicolor*) genotypes. In 1980, a new pathotype (pathotype 3) was discovered in Texas among populations of *P. sorghi* that sporulates on lines Tx412, Tx430, and CS3541 but not on QL3.

Additional key words: sorghum downy mildew

Vertical pathotypes (6) of *Peronosclerospora sorghi* (Weston & Uppal) C. G. Shaw, the causal agent of sorghum (*Sorghum bicolor* (L.) Moench) downy mildew (SDM), were found in Texas in 1979 (2). Pathotypes 1 and 2 of *P. sorghi* were differentiated according to their ability to induce the systemic phase of SDM in the sorghum inbred line CS3541.

Jones (4) reported that symptoms appeared on sorghum leaves 4 days after inoculation with conidia of *P. sorghi* and that sporulation occurred on infected leaves 6 days after inoculation. Other researchers (3,7) found that sorghum cultivars differed in the type of lesions that developed on leaves inoculated with conidia and that susceptibility to severe leaf damage from conidial inoculation was positively correlated with susceptibility to SDM.

During studies of reactions of inoculated leaves, we discovered that incompatible interactions of *P. sorghi* and sorghum genotypes were characterized by the failure of the pathogen to sporulate on inoculated leaves. This paper reports the identification of three pathotypes of *P. sorghi* by differential sporulation on leaves of selected sorghum inbred lines.

## MATERIALS AND METHODS

Three Texas populations (A, B, and C) of *P. sorghi* of unknown pathotypes collected in 1980 were compared with known pathotypes 1 and 2 for differences in ability to sporulate on the inoculated leaves of the differential sorghum inbred lines Tx412, Tx430, CS3541, and QL3. The three populations of *P. sorghi* were produced by inoculating (5) sorghum seedlings with conidia from diseased plants of three sorghum genotypes that had appeared resistant to SDM in earlier trials. In each case, the diseased plants were taken from a field where the incidence of SDM was unusually high for the genotype concerned.

The three populations of inoculated plants were grown in the greenhouse and used as sources of inoculum for pathotype tests. Plants of the differential sorghum inbred lines were grown in the greenhouse at 23–35 C and inoculated with conidia (1) when the second leaf had unrolled enough to allow the leaf tip to flatten. Fifteen or more plants of each inbred line were inoculated with conidia of each population of *P. sorghi*.

The inoculated plants were grown in the greenhouse at 23–35 C for 6 days after inoculation. On the evening of the sixth day, the inoculated plants were placed in a chamber with an environment of darkness, 100% relative humidity, and 20 ± 3 C. The plants were removed from the chamber after 16 hr. The abaxial surface of the second leaf of each plant was examined macroscopically for sporulation by *P. sorghi*. This sporulation produced a macroscopic, white, downy growth composed of masses of conidia and conidiophores (Fig. 1).

The combinations of host genotype and pathotype that resulted in sporulation were classed as compatible interactions; those that did not produce sporulation were classed as incompatible. The populations of *P. sorghi* were tested two or more times.

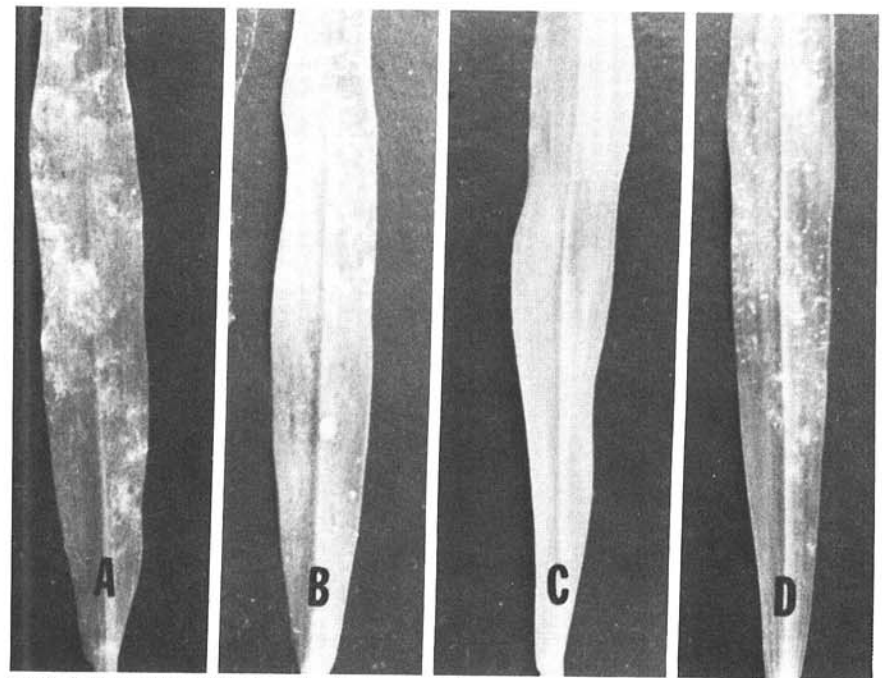


**Fig. 1.** Differential sporulation of pathotypes of *Peronosclerospora sorghi* on abaxial surfaces of leaves of sorghum inbred lines. **(A)** Pathotype 1: Tx412, sporulation. **(B)** Pathotype 3: Tx412, sporulation. **(C)** Pathotype 1: Tx430, no sporulation. **(D)** Pathotype 3: Tx430, sporulation.

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**Table 1.** Identification of pathotypes of populations of *Peronosclerospora sorghi* by sporulation on differential sorghum inbred lines

| *P. sorghi* population | Incidence (%) of sporulation in sorghum inbreds[a] | | | | Pathotype identity[b] |
|---|---|---|---|---|---|
| | Tx412 | Tx430 | CS3541 | QL3 | |
| Standards | | | | | |
| Pathotype 1 | 100 | 0 | 2 | 7 | 1 |
| Pathotype 2 | 100 | 0 | 88 | 0 | 2 |
| Unknown[c] | | | | | |
| A | 100 | 4 | 9 | 10 | 1 |
| B | 100 | 4 | 2 | 3 | 1 |
| C | 100 | 99 | 100 | 11 | 3 |

[a] Percentage of inoculated plants that exhibited sporulation of *P. sorghi*.
[b] *P. sorghi* pathotype identified by the incidence of sporulation on sorghum differential lines.
[c] Populations of *P. sorghi* with unknown pathotypes.

## RESULTS AND DISCUSSION

Three pathotype populations of *P. sorghi* were identified as pathotypes 1 or 3 by their differential interaction with the sorghum lines CS3541 and Tx430 (Table 1). Pathotype 1 does not sporulate on either line, pathotype 2 sporulates only on CS3541, and pathotype 3 sporulates on both lines.

Differences in density of sporulation were noted among the compatible host-pathotype combinations. Sporulation of the three pathotypes was much denser on Tx412 than that of pathotypes 2 and 3 on CS3541 or pathotype 3 on Tx430. The differences in density of sporulation among these compatible interactions were interpreted to be related to differences in degree of compatibility.

Although pathotype identification was based on the presence or absence of sporulation on inoculated leaves, similar relationships were found for the ability to induce systemic SDM. In a test for pathogenicity to Tx430, pathotype 3 induced SDM in 47% of the inoculated plants as compared with 0% for pathotypes 1 and 2. The systemic phase of SDM occurs when the pathogen progresses from the point of entry to the meristematic foliage of the host (8). Incompatible host-pathotype interactions that severely restrict colonization of host tissue confer resistance to SDM (8). Compatible host-pathotype interactions at the invasion site, however, do not necessarily result in SDM. Other factors, such as the distance of the penetration site from meristematic foliage, rate of progress of the pathogen through host tissue, and rate of maturation of host tissue, determine whether or not a compatible interaction results in SDM.

The results of this study demonstrated that pathotypes of *P. sorghi* could be identified by differences in their ability to sporulate on sorghum differentials. This method of differentiation was as precise as earlier methods based on differences in ability to induce systemic SDM and required less time (1 versus 3 wk). In addition to differentiating pathotypes of *P. sorghi*, this technique can be used to determine the frequencies of plants resistant to SDM in segregating sorghum populations.

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