Identification of Sources of Resistance in Sorghum to *Peronosclerospora sorghi*

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ABSTRACT

The main objective of this work was to identify sources of resistance in sorghum (*Sorghum bicolor*) to *Peronosclerospora sorghi*, the causal agent of downy mildew, through the evaluation of 42 sorghum genotypes under natural infection in the field. Genotypes were planted in single row plots between two rows of the susceptible line SC283, planted 30 days before, to act as spreader rows, in two separate nurseries. The experimental design was a completely randomized block design with three replications. Sorghum genotypes CMSXS156, CMSXS157, CMSXS243, TxARG-1, 8902, 9902054, 9910032, 9910296, Tx430, QL-3, SC170-6-17, CMSXS762 and BR304 were classified as highly resistant in both nurseries. Among these, SC170-6-17 and 9910296 showed 0% systemic infection. Results indicated the possible occurrence of different pathotypes of *P. sorghi* in the two nurseries.

Additional keywords: *Sorghum bicolor*, diseases, genetic resistance, downy mildew.

RESUMO

Identificação de fontes de resistência de sorgo a *Peronosclerospora sorghi*

Este trabalho foi realizado com o objetivo de se identificar fontes de resistência ao míldio do sorgo (*Sorghum bicolor*), causado pelo patógeno *Peronosclerospora sorghi*, pela avaliação de 42 genótipos de sorgo sob condições de infecção natural. Os genótipos foram semeados em parcelas de uma fileira, entre duas fileiras da cultivar suscetível SC283, semeada com 30 dias de antecedência para atuar como fonte de inóculo. Foram conduzidos dois ensaios no delineamento experimental de blocos ao acaso com três repetições. Os genótipos CMSXS156, CMSXS157, CMSXS243, TxARG-1, 8902, 9902054, 9910032, 9910296, Tx430, QL-3, SC170-6-17, CMSXS762 e BR304 foram classificados como altamente resistente nos dois ensaios. Entre estes as linhagens SC170-6-17 e 9910296 apresentarm-se 0% de infecção sistêmica. Os resultados indicaram a provável ocorrência de diferentes patótipos de *P. sorghi* nos dois ensaios.

Palavras-chave adicionais: *Sorghum bicolor*, doenças, resistência genética, míldio.

Sorghum [*Sorghum bicolor* (L.) Merril] downy mildew caused by *Peronosclerospora sorghi* [Weston & Uppal (Shaw)] has been a major problem to sorghum, both in seed and commercial production fields of southern and southeastern Brazil, where losses in grain yield can reach up to 80% depending upon the cultivar and the severity of epidemics. Genetic resistance has been the most efficient and environmentally sound way to control the disease (Frederiksen & Renfro, 1977; Craig & Odvody, 1992). A limited number of resistant lines, however, is available to be used in sorghum breeding programs, which makes sorghum crop vulnerable to the disease in brazilian conditions.

The concept of downy mildew resistance is based on the incidence of systemic infection in a population of plants. Generally, plants become more resistant as they mature and plants that are known to be resistant in the field develop resistance to infection faster than those known to be susceptible (Yeh & Frederiksen, 1980). Pathogenic variability exists in *P. sorghi*. Changes in the pathogen population were already monitored (Craig & Frederiksen, 1980, 1983) and three pathotypes were reported in Texas. In 1982, a new pathotype of *P. sorghi* was found in Brazil, based on the high incidence of the disease on the previously resistant cultivar BR501 (Brandes) (Fernandes & Schaffert, 1983). Isolates of *P. sorghi* from India and Africa showed a higher range of virulence compared with those from the Americas (Pawar, 1986).

The main objective of this work was to identify sources of resistance to *P. sorghi*, through the evaluation of 42 sorghum genotypes under natural infection in two field nurseries in the experimental area of Embrapa Maize and Sorghum in Sete Lagoas, MG.

Sorghum genotypes were planted in two separate nurseries, from now on referred to as field nurseries A and B, in a completely randomized block design with three replications. Genotypes were planted in single row plots, separated by two rows of the susceptible line SC283, planted 30 days before, to act as spreader rows. Evaluations of disease incidence were performed 60 days after planting by counting the number of plants which developed systemic infection. Sorghum genotypes were placed in one of four categories: highly resistant, moderately resistant, moderately susceptible and susceptible. All genotypes with less than 6% downy mildew incidence were classified as highly resistant, those in the 6-10% range were considered as moderately resistant, lines with 11-20% were classified as moderately susceptible, and those with more than 20% incidence were classified as susceptible (Frederiksen, 1980).

Sorghum genotypes CMSXS156, CMSXS157, CMSXS243, TxARG-1, 8902, 9902054, 9910032, 9910296, Tx430, QL-3, SC170-6-17, CMSXS762 and BR304 were classified as highly resistant in both nurseries; among these, SC170-6-17 and 9910296 showed 0% systemic infection. Genotypes CMSXS205 and BR501 (Brandes), showed no systemic infection in nursery A and, respectively, 19.78% and 24.14% incidence in nursery B. Genotypes IS10317, CMSXS761, and 9817029 also showed less incidence in nursery A in relation to nursery B. Genotypes CMSXS217, CMSXS231, CMSXS232, CMSXS233, and CMSXS378, with incidence between 40 and 61%, were the most susceptible in both nurseries (Table 1).

According to regulations of the Ministry of Agriculture of Brazil, a 0% incidence is fixed as standard for sorghum seed production fields, which indicates the importance of the selection and development of sorghum lines totally resistant to *P. sorghi*. Lines such as SC170-6-17 and 9910296 are, therefore, highly desirable for sorghum breeding programs of Brazil. The resistance of SC170-6-17 and QL-3 are in agreement with previously reported results (Frederiksen & Rosenow, 1979; Gimenes-Fernandes *et al*., 1984; Pawar, 1986). The development of genetic resistance to *P. sorghi*, must take into account the possibility of the breakdown of resistance due to development of new races, considering that, as already mentioned there are reports of occurrence of races in populations of this pathogen. The resistance exhibited by sorghum line Tx430 in both nurseries is an indication of the non-occurrence of pathotype 3 of *P. sorghi*, as Tx430 is the differential line for this pathotype in

TABLE 1 - Reaction of sorghum (*Sorghum bicolor*) genotypes to systemic infection by *Peronosclerospora sorghi* in two field nurseries

Sorghum genotype*	Systemic infection (%)		Sorghum Genotype*	Systemic infection (%)	
	Nurs ery A	Nursery B		Nursery A	Nursery B
9910296 [1,1]	0	0	CMSXS205 [1,3]	0	19,78
SC170 -6-17 [1,1]	0	0	BR501 [1,4]	0	24,14
CMSXS234 [1,1]	0	0,27	CMSXS761 [1,4]	4,72	33,29
QL3 [1,1]	0	0,33	IS10317 [2,4]	7,66	36,32
CMSXS156 [1,1]	0	0,36	9817029 [2,4]	6,73	27,73
CMSXS157 [1,1]	0	0,32	Tx611 [3,4]	22,63	15,52
TX430 [1,1]	0,48	0	Tx635 [3,4]	18,59	35,73
B8902 [1,1]	0	0,51	0025530 [3,4]	17,02	37,69
9902054 [1,1]	0	0,51	9817020 [4,3]	29,82	15,58
TxARG -1B [1,1]	0	0,54	CMSXS222 [4,4]	24,35	24,97
9910032 [1,1]	1,23	2,33	CMSXS230 [4,4]	32,6	26,58
CMSXS762 [1,1]	0,73	5,16	0009033 [4,4]	21,53	20,15
BR304 [1,1]	3,93	5,2	CMSXS180 [4,4]	26,77	45,13
CMSXS206 [1,2]	1,27	6,76	CMSXS232 [4,4]	30,85	35,94
BR012 [1,2]	4,89	8,1	0025178 [4,4]	34,83	30,56
BR307 [1,2]	4,22	9,03	BRS610 [4,4]	24,9	38,24
BR001 [1,2]	9,93	5,77	CMSXS217 [4,4]	40,21	52,94
9929044 [2,2]	8,98	9,73	CM SXS231 [4,4]	42,13	60,1
9817011 [2,3]	7,73	15,49	CMSXS232 [4,4]	48,72	56,93
CMSXS182 [3,3]	10,21	18,98	CMSXS233 [4,4]	56,8	47,02
0009055 [3,3]	13,17	15,97	0025378 [4,4]	53,76	49,27

* Reaction, respectively, in nurseries A and B:1 = highly resistant; 2 = moderately resistant; 3 = moderately susceptible; 4 = susceptible

Texas (Craig & Frederiksen, 1983). On the other hand, the susceptibility of BR501 indicated the possible presence of pathotype 4 in nursery B. This pathotype was identified for the first time based on field observations in downy mildew nurseries in Palotina (PR) in 1982 (Fernandes & Schaffert, 1983). Information on the variability present in the population of *P. sorghi* is needed as the basis for development of durable and stable resistance to this pathogen in Brazil. Studies involving isolates of *P. sorghi* from different areas of occurrence of downy mildew have been developed by Embrapa Maize and Sorghum to provide initial information on occurrence and distribution of races of the pathogen in the main sorghum areas of the country.

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03168