Inheritance of the Blasting Reaction of Sorghum to Physiologic Race 1 of
Sphacelotheca Sorghi

A. J. Casady

COVERED kernel smut is a disease of sorghum (Sorghum vulgare Pers.) caused by the fungus Sphacelotheca sorghi (Link) Clinton. Replacement of the kernels by sori, with little other conspicuous morphological alteration of the panicle, is considered the normal reaction of susceptible varieties to race 1 of S. sorghi. Certain varieties, however, do not react normally. Instead, the panicle is partially to completely blasted, with small, poorly developed sori; sometimes present in the partially blasted panicles (Figure 1).

An understanding of the inheritance of the blasting reaction should enhance the breeding of sorghum resistant to race 1 of S. sorghi. Also, knowledge of the genetic relationship of the genes controlling the blasting reaction and the genes controlling other characteristics of sorghum should prove helpful. The genetic nature of the parental material used made it possible to determine the relationship of the genes for blasting and the presence of a testa in the kernel.

REVIEW OF LITERATURE

Marcy (2) recognized and described the blasting reaction of sorghum to race 1 of S. sorghi in Standard feterita, C.I. 182, and feterita, strain 12. Although she recognized the reaction as a pathological condition caused by smut infection, she classified it as a type of resistance, because the normal life cycle of the parasite was not completed and the percentage of infected plants was always low compared with normal smutting.

Marcy (2, 3), studying the inheritance of resistance to physiologic race 1 of S. sorghi, used 5 groups of crosses and their reciprocals: (1) crosses between Dwarf Yellow Milo, C.I. 332, and susceptible varieties; (2) crosses between Standard feterita, C.I. 182, and Dwarf Yellow Milo, C.I. 332; and (3) crosses between the two feteritas, C.I. 182 and strain 12, and susceptible varieties. Results from the F1, F2, F3, and F4 progenies of the crosses between Dwarf Yellow Milo and susceptible varieties showed the resistance of Dwarf Yellow Milo to be dominant and due to a single gene, denoted R. In the Dwarf Yellow Milo-feterita crosses, the factor for blasting, denoted B, came into play, and Marcy concluded that two dominant genes for resistance were involved—one, R, from the milo parent and one, B, from the feterita parent, with R completely epistatic to B. No F1 progenies of the Dwarf Yellow Milo-feterita crosses were grown, and dominance of blasting was based on F2 and subsequent progenies. Although the F2 progenies of feterita-susceptible variety crosses exhibited only normal smutting, Marcy did not consider it as evidence that normal smutting was dominant to blasting. Instead, she believed the reaction of the F2 progenies suggested the dominance of susceptibility, and, from studies of the F3, F4, and F5 progenies, she concluded the susceptible varieties possessed a dominant gene, S, for susceptibility, which was epistatic to B under environmental conditions very favorable for infection and hypostatic to B under conditions less favorable for infection. In summary, Marcy concluded that the genotypes of Dwarf Yellow Milo, Standard feterita, and susceptible varieties were RRbbss, rrBBss, and rrbbSS, respectively.

Casady (1) studied the covered kernel smut reaction of the F1 and F2 progenies of a cross between Spur feterita, K.B. 2540, and Pink kafir. He corroborated the findings of Marcy (2, 3) in regard to resistance to race 1 of S. sorghi except for finding resistance to be incompletely dominant. He suggested using the symbol Rs to denote the gene involved. Evidence presented in this paper confirmed the resistance to race 1 of S. sorghi and the B gene for presence of testa.

Sieglinger (5) showed that in certain sorghum crosses the presence vs. absence of testa in the kernel was controlled by a single pair of alleles, with presence being dominant. He used B as the symbol to denote the gene. Stephens (6) reported a second factor, denoted Bt, for the presence of testa. He demonstrated that B and Bt were complementary genes and that both had to be present in the dominant condition for the presence of testa. Sieglinger (5) reported no evidence of linkage between the gene (Rs) for resistance to race 1 of S. sorghi and the B gene for presence of testa.

MATERIALS AND METHODS

A juicy-stalk selection of Pink kafir was used as the parent that gave the normal smutting reaction to race 1 of S. sorghi. Three F1 lines of Spur feterita X Pink kafir were used as parents that gave the blasting reaction; these lines were designated 58M3097, 58M3098, and 58M3203. Spur feterita, K.B. 2540, was used as a parent in a cross with Pink kafir. From previous studies, Pink kafir

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2 Research Agronomist, Crops Research Division, ARS, USDA, and Kansas State University.
3 C.I. denotes an accession number of the Cereal Crops Research Branch, U. S. Department of Agriculture.

K.B. denotes an accession number of the Department of Botany and Plant Pathology, Kansas State University.

It was assumed from Stephens (6) that B rather than Bt was the gene involved. Evidence presented in this paper confirmed the assumption.

58M3203 exemplifies a numbering system identifying lines developed by the Sorghum Breeding and Testing Project, No. 462, Agronomy Department and Crops Research Division, ARS, USDA, Kansas State University, Manhattan, Kansas.