

# APPARENT EFFECT OF THE *N* GENE OF SORGHUM ON INCIDENCE OF INFECTION BY A "JOHNSON GRASS" STRAIN OF SUGAR-CANE MOSAIC VIRUS\*

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A "Johnson grass" strain of sugar-cane mosaic virus commonly infects crops of sorghum in New South Wales and Queensland. Infected sorghum plants show one of two types of systemic reaction, either a systemic necrosis or a systemic mosaic. Type of reaction is controlled by a single dominant gene, the *N* gene. The *N*-genotypes condition the necrotic reaction, while *nn* conditions the mosaic reaction (Teakle *et al.* 1970).

The incidence of natural infection in necrotic-reacting and mosaic-reacting cultivars of sorghum has been studied over 3 years at Hermitage, near Warwick in south-eastern Queensland. In 1970 these observations were made in an experiment with 17 varieties and six replications in a randomized block design. In 1969 and 1971 unreplicated experiments were conducted. In each year, single-row plots were used, and differences in numbers of plants per plot occurred because of differences in plant emergence. To assist in obtaining a sufficiently high level of natural infection, plantings were made late in the growing season near older, infected crops of sorghum and maize. Incidence of infection was determined on the basis of symptoms when the plants were about two-thirds grown (1969 and 1970) or were at the heading stage (1971).

Counts of infected and healthy plants made in each of the three years are given in Table 1. Sorghums with the necrotic reaction (*N*-genotypes) had an overall incidence of infection which in 1970 was only about one-half, and in 1969 and 1971 only about one-fifth, that of the sorghums with the mosaic reaction (*nn* genotype). An analysis of variance of the 1970 results was made using the logistic transformation. The *F* test showed that differences in overall incidence of infection between necrotic (*N*-) and mosaic (*nn*) reactors was highly significant [ $F = 31.43$  (1, 14 d.f.)]. There was, however, no significant difference in overall incidence of infection between homozygous (*NN*) and heterozygous (*Nn*) necrotic reactors [ $F = 0.06$  (1, 14 d.f.)]. The variance amongst *nn* and *Nn* genotypes was non-significant, but the variance among *NN* genotypes was highly significant ( $\chi^2 = 28.51$ , 4 d.f.,  $P < 0.001$ ). R180 appears to have less infected plants than the average and R116 more.

\* Manuscript received 4 April 1972.

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An examination of results within experiments showed that only rarely did any sorghum with the mosaic reaction have a lower percentage infection than any sorghum

TABLE 1

INCIDENCE OF THE NECROTIC AND MOSAIC REACTIONS IN 37 CULTIVARS OF SORGHUM FOLLOWING EXPOSURE TO NATURAL INFECTION BY THE "JOHNSON GRASS" STRAIN OF SUGAR-CANE MOSAIC VIRUS

Plant reaction and genotype	Plant designation		1969: No. of plants rated		1970: No. of plants rated		1971: No. of plants rated	
	Queensland	United States of America	Infected	Healthy	Infected	Healthy	Infected	Healthy
Necrotic (NV)	R26	Yellow Shallu SA 7530	1	40	15	89		
	R110	YE Hegari SA 9225	1	36	13	110		
	R116	YEF × SSK Wx SA 8735	2	45	41	126	5	15
	R118	YE Feterita SA 8580	0	43			2	12
	R180	OK Y8	2	54	16	247	0	36
	R225	Woodward Big-head					4	36
	R248	YE Hegari Tx 2527	4	31	20	169		
	R249	YE Hegari Tx 2528	4	43				
	R251	I.S. 3691					13	43
Total			14 (5%)	292 (95%)	105 (12%)	741 (88%)	24 (14%)	142 (86%)
Necrotic (Nn)	B1 × R110				24	226		
	B1 × R116				36	226		
	B1 × R248				39	240		
	B2 × R110				38	240		
	B2 × R116				21	64		
	B2 × R118				32	154		
	B2 × R248				44	260		
Total					234 (14%)	1410 (86%)		
Mosaic (nn)	B1	Combine Kafir 60 Tx 3197	10	40	67	188	45	5
	B1 × R1		10	20				
	B2	Martin Tx 398	18	33	65	208		
	B2 × R1		6	30				
	B3	Redlan Tx 378	9	45				
	B4	Wheatland Tx 399	14	41				
	B70	NB 3395	18	42				
	Q7516	—	15	11				
	R1	Combine 7078	17	38	71	148		
	R3	Tx 09	15	44	78	151		
	R4	Caprock Tx 7000	8	37				
	R13	Hegari	19	41				
	R73	Sugardrip	8	32				
	R86	Tx 414	11	34				
	R96	4 Dw Hegari SA 10300	13	41				
	R117	YEF × SsK SA 8735	15	19				
	R147	Sooner Milo	8	17				
	R161	KS 19	18	33	76	164		
	R232	YE × Kaura	5	54				
	R234	YE × Kaura	10	36				
	R250	YE Feterita Tx 2536	24	29				
Total			271 (27%)	717 (73%)	357 (29%)	859 (71%)	45 (90%)	5 (10%)

with the necrotic reaction. The only instances were, in 1969, R232 (nn) with 8.5% infection compared with R248 (NV) with 11.4% and, in 1970, B2 (nn) with 24%

infection compared with R116 (*NN*) and B2×R116 (*Nn*), both with 25%. These exceptions are possibly a reflection of irregular distribution of infection in the field, and are not considered to negate the general result. As evidence of this, in 1969 B2 (*nn*) had a much higher incidence of infection than R116 (*NN*).

One reason for the lower percentage of infection in necrotic reactors than in mosaic reactors is probably that the necrotic reactors contain a lower concentration of virus than do the mosaic reactors, and consequently aphid vectors transmit virus within plots of necrotic reactors at a proportionately lower rate than within plots of mosaic reactors. It is unlikely, however, that this is the only factor involved, since the same trends were observed early in the growth of the experimental plants when the virus was undoubtedly being introduced from adjacent large areas of infected sorghum and maize. A likely explanation is that the *N* gene is pleiotropic in action, conditioning both the type of reaction to the virus and the incidence of infection. An alternative possibility is that two separate but closely linked gene loci are involved. It would be difficult to determine which of these two latter hypotheses is correct without considerable additional work.

An important practical question relating to the sorghum crop is whether greater losses occur in crops planted to necrotic reactors or in crops planted to mosaic reactors. The necrotic disease is much more severe than the mosaic disease when individual infected plants are considered. However, against this must be balanced the higher incidence of the mosaic disease than of the necrotic disease.

#### *Acknowledgment*

We wish to thank Dr. H. Silverstone, University of Queensland Medical School, for assistance with the statistical analysis.

#### *Reference*

- TEAKLE, D. S., MOORE, R. F., GEORGE, D. L., and BYTH, D. E. (1970).—Inheritance of the necrotic and mosaic reactions in sorghum infected with a "Johnson grass" strain of sugarcane mosaic virus. *Aust. J. agric. Res.* **21**, 549.