

<u>Cross</u>	<u>Fertile plants</u>	<u>Sterile plants</u>
Male sterile x K 55	22	0
Male sterile x T x 127C	92*	0
Male sterile x 41	144	0
(Male sterile x 41) F ₂	43	16
Male sterile x (41 x non-restorers)	58	47

* Six of these plants in an early planting appeared to be only partially fertile.

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1. Studies on the inheritance of resistance to corn leaf rust.

Puccinia sorghi Schw.

It was reported in the 1955 Corn Genetic Newsletter that greenhouse seedling inoculations on 165 lines of corn showing field resistance revealed that 25 strains possessed protoplasmic resistance to one or more biotypes of the pathogen. A table included in the report indicated that resistance in each of B38, K148 Cuzco and GG208 was due to a dominant allele at a single locus. The following table shows the reaction of these strains to 11 cultures of Puccinia sorghi.

Reactions to 11 cultures of Puccinia sorghi

<u>Source of resistance</u>	<u>901@</u>	<u>904</u>	<u>908</u>	<u>917</u>	<u>921</u>	<u>922</u>	<u>926</u>	<u>927</u>	<u>928</u>	<u>929</u>	<u>930</u>
B38	0;	0;	0;	0;	0;	0;	0;	3	0;	0;	0;
K148	1-	1-	3	1-	1-	1-	1-	3	1-	1-	1-
GG208	1-	1-	1-	1-	0;	1-	1-	1-	1-	1-	3
Cuzco	0;	0;	0;	0;	0;	0;	0;	0;	0;	0;	0;

This table shows that these strains have different genotypes for resistance. It is necessary to know how many genes for resistance each source has and the number of loci involved among the four strains. Some

preliminary information on these points has been obtained by studying the reactions of backcrosses and F₂ progenies of various single crosses to relatively pure rust cultures and to mixtures of cultures. The following mixtures were used:

- A - 901a, 904, 917, 921, 922, 926, 928, 929 and 930.
 B - 901a, 904, 908, 917, 921, 922, 926, 928, 929 and 930.
 C - 901a, 904, 908, 917, 922, 926, 927, 928 and 929.
 D - 901a, 904, 908, 917, 922, 926, 928 and 929.
 E - 901a, 904, 917, 922, 926, 928, 929 and 930.
 F - 901a, 904, 908, 917, 921, 922, 926, 927, 928, 929 and 930.

Several of the progenies studied had as one parent inbred line B14 or M14 both of which give a susceptible reaction to all 11 rust cultures listed above. The following table shows the results of the greenhouse seedling inoculations.

Cross	Pathogen	Number of plants		Hypothetical Expectations	χ ² Value	P Value
		Res.	Susc.			
(M14 x K148)F ₂ -1	Mixture A	76	21	3:1	0.581	0.50-0.30
(M14 x K148) x M14-1	"	46	50	1:1	0.167	0.70-0.50
" -2	"	51	42	1:1	0.872	0.50-0.30
" -3	"	49	48	1:1	0.010	0.95-0.90
(B14 x K148)F ₂ -1	"	69	29	3:1	1.102	0.30-0.20
" -2	"	74	21	3:1	0.425	0.70-0.50
(M14 x GG208)F ₂ -1	Mixture C	77	22	3:1	0.407	0.70-0.50
(M14 x GG208) x M14-1	"	49	49	1:1	0	1.00
" -2	"	37	54	1:1	3.176	0.10-0.05
(B14 x GG208)F ₂ -1	"	69	29	3:1	1.102	0.30-0.20
(M14 x GG208)F ₂ -1	Mixture D	77	18	3:1	1.856	0.20-0.10
(M14 x GG208) x M14-3	"	49	46	1:1	0.095	0.80-0.70
(B14 x GG208)F ₂ -2	"	72	26	3:1	0.122	0.80-0.70
(B14 x Cuzco)F ₂ -1	Mixture F	69	23	3:1	0	1.00
(GG208 x Cuzco)F ₂ -1	901a	89	1	all resistant		
" -2	901a	83	0	"	"	
(K148 x GG208)F ₂ -1	901a	101	0	"	"	
" -2	901a	98	0	"	"	
(B38 x K148)F ₂ -1	901a	90	0	"	"	
(K148 x B38)F ₂ -1	901a	92	0	"	"	
(GG208 x B38)F ₂ -1	901a	96	0	"	"	

All progenies involving susceptible and resistant parents have observed counts which fit a one factor pair hypothesis for rust resistance. The F_2 progenies of Kl48 x GG208 and GG208 x Cuzco when inoculated with race 901a gave only resistant reactions. (The one susceptible plant in GG208 x Cuzco may have been due to a seed mixture). This suggests that among these resistant strains the same locus is involved in conditioning resistance to 901a. Also, F_2 progenies of GG208 x B38 and B38 x Kl48 have all plants resistant to 901a thus placing the allele in B38 for resistance to 901a in this same series. The F_2 of Kl48 x B38 inoculated by mixture A gave only resistant reactions so that the resistance to 10 rust cultures by B38 may be due to one factor pair. Since the results of resistant x susceptible progenies indicate that a single gene in each source conditions resistance to several races, it is possible that we have an allelic series of four dominant genes.

Although the results discussed above suggest the presence of an allelic series, other observations create some doubts. The F_2 of Kl48 x GG208 inoculated with culture 908 to which Kl48 is susceptible gave (75) 0; to (24) x type. (The x type is a mixture of 3- and 1- or 0;). If culture 908 was not pure but contained spores to which Kl48 is resistant then this reaction is as expected. The F_2 of Kl48 x GG208 inoculated with mixture C containing 908 and 927 to which Kl48 is susceptible gave (76) 0; and (23) x type. Seedlings carrying alleles from Kl48 would have 1- and 3-type pustules or x type reaction. The F_2 of Kl48 x GG208 inoculated by culture 930 to which GG208 is susceptible gave (53) 0; (25) x mostly 0; and (21) 3-. However, when this same F_2 progeny was inoculated by mixture A containing culture 930 the observations were (57) 0; and (43) 1- with few 3- pustules. The F_2 of B38 x Kl48 with mixture B gave (56) 0; to (42) x and with mixture E gave (64) 0; (27) x mostly 0; and (12) x mostly 3-. It should be emphasized that it is difficult to establish and maintain pure biotypes of the pathogen and to work with mixtures involving many races. Some readings may be due to such things as contamination, failure of some virulent spores to infect, or perhaps spore competition or even antibiosis. It is also possible that modifying factors may be present and/or genotype-environment interactions occur. Several F_3 analyses using single rust cultures recently established as clonal lines from single urediospores are being made either to confirm an allelic series among these four sources of resistance or to determine whether some more complicated segregations which can not be detected in F_2 progenies may be present.

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