2. Studies on the inheritance of resistance to corn leaf rust, Puccinia sorghi Schw.

Genetic investigations on the inheritance of resistance to corn leaf rust, Puccinia sorghi Schw. were initiated at the Iowa State College in 1953. A rather heavy infection of rust that summer gave an opportunity to rate approximately 1700 inbred progenies and introductions of corn for field reaction to the fungus. Greenhouse seedling inoculations on 165 lines showing field resistance revealed that 25 strains possessed protoplasmic resistance to one or more biotypes of the pathogen. Subsequent tests of single cross combinations involving many of these lines have shown that 13 carry dominant genes for resistance and 12 have recessive genes. In addition to these, 13 strains show evidence for resistance but such resistance is incomplete or is modified by environmental conditions. (Studies at the University of Wisconsin have found resistance in 39 Mexican and South American types of which 23 have been shown to carry dominant genes for resistance and 2 appear to have recessive genes. These factors are being studied further in our program.)

Each gene conditioning resistance to rust is being transferred to inbred B14 by the backcross method. This will serve three main purposes: (1) establish a set of sub-lines, or nearly "isogenic" lines, of B 14 which can be used in genetic studies of the pathogen; (2) the various genes conditioning resistance will be located in a stock which can be easily handled in the corn belt; (3) the sub-lines of B14 will be used as a series of differential hosts for the identification of races within a pathogen. It will be desirable to add to the collection of resistant stocks any additional sources of protoplasmic resistance which other corn workers may have. Since interest will be only in the genes affecting host reaction to the fungus, such sources may be in various forms such as inbred lines, open pollinated varieties or hybrid combinations.

The relationships among the various genes for resistance are being determined by studies involving F_1 and F_2 progenies from single crosses among the resistant sources. Also, studies of F_1, F_2 and backcross progenies involving resistant and susceptible strains are giving information on the number of factors reacting in a cross for a specific rust culture and whether or not these factors are dominant or recessive in behavior. At this time limited data are available, some of which are shown in the following table:

Cross	Number of Plants Observed		Theoretical Ratio	X^2 Value	P Value
	Res.	Susc.			
1 (K148 x B14) F_2	131	47	3:1	0.187	.50-.70
2 (K148 x B14) B14	130	161	1:1	3.302	.05-.10
3 (GG208 x B14) F_2	64	31	3:1	2.951	.05-.10
4 (GG208 x B14) B14	102	86	1:1	1.362	.20-.30
5 (Cuzco x B14) F_2	64	29	3:1	1.896	.10-.20
6 (Cuzco x B14) B14	96	102	1:1	0.182	.50-.70
7 (Mex.83 x B37) F_2	79	20	3:1	1.215	.20-.30
8 (Mex.83 x B37) B37	140	154	1:1	0.667	.30-.50

9 (B38 x W22) F_2	74	22	3:1	0.222	.50-.70
10 (B38 x W22) W22	17	22	1:1	0.641	.30-.50
11 (P.I.193906 x B14) F_2	11	53	1:3	2.083	.10-.20
12 (P.I.193906 x B37) F_2	15	59	1:3	0.883	.30-.50
13 (Pop 35 x W32) F_2	8	90	1:15	0.612	.30-.50
14 (Pop 35 x B14) F_2	11	161	1:15	0.006	.90-.95
15 (Pop 36 x B14) F_2	9	85	1:15	1.773	.10-.20

These results indicate three types of gene interaction. In crosses 1 to 10 observed numbers show satisfactory fit to 3:1 for F_2 or 1:1 for backcrosses with resistance being dominant. Crosses 11 to 12 suggest that F.I.193906 carries one factor which is recessive in its behavior. In progenies 14-15 the data support a duplicate factor hypothesis in which both factors must be present in the homozygous recessive phase for resistance to be expressed. Additional F_2, backcross and F_3 progenies will be studied to verify these results.

Inbred B38 is resistant to 37 of 42 rust cultures with which it has been tested; K148 carries resistance to 36 of these same cultures. Cuzco has been resistant to 40 cultures to which it has been tested. GG208 has shown resistance to 37 of 38 cultures studied. Based on their reactions to the various cultures studied, these four sources appear to have different genotypes for resistance to corn rust. The other sources of resistance have been tested with varying numbers of rust cultures but none has shown resistance to as many cultures as the four listed above. Several of the sources studied appear to possess resistance to only one or a few of the rust cultures.

With the transfer of A. L. Hooker to the University of Wisconsin in December, 1954, this has become a cooperative project between the two institutions.

W. A. Russell
A. L. Hooker