

Additional carbohydrate studies are planned with the gene mutations used in this study and additional mutants. Studies of the effects of these genes alone and in combinations on qualitative and quantitative changes in enzymes known to be associated with carbohydrate synthesis are being initiated. Studies to determine the types of carbohydrates produced in each genotype are presently underway.

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1. A case of cytoplasmic control of susceptibility to Helminthosporium leaf spot in corn.

In the 1962 issue of the News Letter, we reported a case of an apparent relationship between cytoplasmic male sterility involving the T plasmatype derived from PHMT and susceptibility to Helminthosporium leaf spot. A case of cytoplasmic control of susceptibility has been hypothesized in the light of the following observations: (1) the extreme susceptibility to the disease of cyto-sterile inbred lines, single crosses and double crosses in contrast with the apparent resistance of their normal counterparts, and (2) the extreme uniformity in the degree of infection of plants within the population of any line carrying the T-cytoplasm. To provide a more conclusive proof of this hypothesis further studies were conducted using populations of reciprocal crosses which differed only in the cytoplasmic background and this was made possible with the use of a "restored-cyto-sterile" parent. Inbred lines differing in the cytoplasmic background and/or in their genetic constitution for the fertility restoring factor were also included.

Each experiment was grown in three replications and the plants were subjected to very severe natural or artificially induced infestations of the disease. Disease reaction of individual plants in each entry were scored in numerical values ranging from 0 to 5, correspondingly from a very negligible infection to a very severe condition.

Table 1. Reaction to *Helminthosporium* leaf spot of early backcrosses differing in the cytoplasmic background.

Entries		Genotypic Composition of Population for Restoration Factor	Av. Disease Rating	
Cytoplasm:	Pedigree		Veg-	Ma- etative:ture
Normal	(Ph15 N) x (Ph15 ² TRf)	.5 Rf rf + .5 rf rf	0.0	0.0
Cyto-sterile	(Ph15 ² TRf) x (Ph15 N)	.5 Rf rf + .5 rf rf	3.1	5.0
Normal	(Ph3N) x (Ph3 ³ TRf)	.5 Rf rf + .5 rf rf	0.2	0.2
Cyto-sterile	(Ph3 ³ TRf) x (Ph3N)	.5 Rf rf + .5 rf rf	2.9	5.0

Table 2. Disease reaction of three-way crosses differing in the cytoplasmic background.

Entries		Genotypic Composition of Population for Restoration Factor	Av. Disease Rating	
Cytoplasm:	Pedigree		Veg-	Ma- etative:ture
Normal	(Ph3N)(Ph9T x Ph11Rf)	.5 Rf rf + .5 rf rf	0.0	0.0
Cyto-sterile	(Ph9T x Ph11Rf)(Ph3N)	.5 Rf rf + .5 rf rf	2.9	5.0
Normal	(Ph15N)(Ph9T x Ph11Rf)	.5 Rf rf + .5 rf rf	0.0	0.0
Cyto-sterile	(Ph9T x Ph11Rf)(Ph15N)	.5 Rf rf + .5 rf rf	3.2	5.0

Table 3. Disease reaction of F₂ self progeny of cyto-sterile and normal three-way crosses.

Entries		Genotypic Composition of Population for Restoration Factor	Average Disease Rating	
Cytoplasm:	Pedigree		Veg- etative	Ma- ture
Normal	(Ph3N)(Ph9T x Ph11Rf)	3/8 Rf <u> </u> + 5/8 rf rf	0.9	1.5
Cyto-sterile	(Ph9T x Ph11Rf)(Ph3N)	3/4 Rf <u> </u> + 1/4 rf rf	1.7	3.8
Normal	(Ph15N)(Ph9T x Ph11Rf)	3/8 Rf <u> </u> + 5/8 rf rf	0.9	1.9
Cyto-sterile	(Ph9T x Ph11Rf)(Ph15N)	3/4 Rf <u> </u> + 1/4 rf rf	2.0	4.5

Table 4. Disease reaction of sterile, restored-sterile and normal versions of five Philippine inbreds.

Entries	Average Disease Rating	
	Vegetative	Mature
Normal inbreds	0.0	2.3
Sterile versions	1.4	5.0
Restored-sterile versions	1.8	5.0

Table 5. Disease reaction of five normal inbreds and their respective sterile versions at different backcross generations.

Entries	Average Disease Rating	
	Vegetative	Mature
Normal inbreds	1.2	1.7
Sterile versions (BC4)	2.8	4.8
Sterile versions (BC5)	2.8	4.8
Sterile versions (BC6)	2.8	4.8

It is evident from the data just presented that the cyto-sterile lines were contrastingly much more infected with the disease than their normal counterparts. Infection was so severe that the plants of the cyto-sterile lines dried up prematurely. Utmost uniformity in reaction was repeatedly observed among the plants of the cyto-sterile populations. It is interesting to note that the normal Philippine inbreds involved, namely, Ph3, Ph9, Ph11 and Ph15, were remarkably resistant to the disease. It would have been difficult to demonstrate cytoplasmic control of susceptibility if the natural inbreds happened to be equally susceptible.

It could also be gleaned from the data that the fertility restoring gene does not have any influence on the expression of susceptibility.

It is hypothesized that the T-cytoplasm carries a factor which is responsible for the induction of extreme susceptibility to *Helminthosporium* leaf spot. Whether the expression is strictly cytoplasmic or partly controlled by genes, as is the case with cytoplasmic male sterility, is still unknown. With our available inbred lines and 52 open-pollinated varieties so far tested against *Ph4T*, no such "resistance restoring" gene has been found.

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2. The effect of the number of resistant parental inbreds on the reaction of the double cross hybrid to downy mildew disease.

An extensive survey of the reaction of corn inbred lines to downy mildew has shown that resistance can be found only among lines of local origin. All introduced lines, so far tested, were susceptible to the disease. Hybrids of diverse parentage, therefore, can not be produced from the resistant inbreds. If diversity were to be achieved some lines from the susceptible class must be used. Thus it became necessary to know the least number of resistant parental lines in order to produce resistant hybrids.

Several double crosses containing from zero to four resistant parental inbreds were produced in 1961. The reaction of these hybrids to downy mildew was evaluated in 1962 wet season under induced epiphytotics of the disease. The results are presented below.