THE RELATIONSHIP OF BLACK CHAFF DISEASE OF WHEAT TO CERTAIN PHYSICAL AND PATHOLOGICAL CHARACTERS[1]

BLACK chaff disease of wheat affects various parts of the spike and often the adjacent culm area. The lower portion of the culm is also commonly affected. This bacterial disease, caused by *Bacterium translucens undulosum,* was first described by Erwin F. Smith,[2] and is considered to be seed borne. It is recognized that the disease may, at times, cause serious losses, but quantitative loss estimates are meager.

The writer has recently made studies upon families of the F_3 generation of hybrids secured from crossing the wheat variety Hope with Reward, Florence and with certain Marquis-Kota hybrid selections. Hope is susceptible to black chaff, but has shown essential freedom from stem rust and from bunt, or stinking smut. The Marquis-Kota selections used are resistant to stem rust, but are susceptible to black chaff. Both Reward and Florence show some resistance to black chaff, but are susceptible to stem rust. Data were secured with respect to the relationship of black chaff to weight of grain per one thousand kernels, and to number of fertile stools per plant, and also the relation of amount of black chaff to two other diseases, stem rust and bunt. In each F_3 family, plants were separated into three groups upon the basis of black chaff present. The three groups, A, B and C, were not represented in all families as an effort was made to secure a uniform classification from family to family.

In the nine families studied coming from the two rust resistant parents, stem rust was nearly absent. In these nine families nineteen comparisons are possible between family components. In seventeen of these comparisons the family component with the smaller amount of black chaff had the largest weight of grain per one thousand kernels. In the other two cases, the difference was of no moment. It was possible to compute correlation coefficients using Pearson's bi-serial method. All the nine coefficients were negative, and seven of these nine showed significance. The decrease in weight of grain per one thousand kernels as an average of several families was 10.5 per cent.

The data indicate that the presence of black chaff affects the number of fertile culms per plant. The variability of culms per plant was too great to allow the use of probable errors for the various black chaff components, considering the small differences involved. Minus and plus changes between the components were considered and thirty-five out of the forty-seven possibilities showed a decrease of fertile culms per plant with an increase of black chaff. In comparison with equal possibilities, the odds are 1,350 to 1 against a deviation so great being due to chance alone. If this difference in number of fertile culms is actual, and if no other causal agent is concerned, it is evident that the black chaff disease has a deterrent effect upon the development of the plant from its early stages.

Both rust and black chaff were commonly present in those families derived from the Hope-Florence and Hope-Reward parents. In the seventeen families derived from the Hope-Florence and the Hope-Reward parents, three contained plants carrying essentially no rust and one family had but one black chaff component. It was possible to secure correlation coefficients in twelve families by the bi-serial method. In one family the correlation was essentially zero. In eleven families the correlation was negative and in seven of these cases it was significant. The maximum negative correlation was -0.886 ± 0.035. Rust was light in all family components, the maximum average being 9.0 per cent. This antagonistic relationship seems to be decidedly pronounced in these two crosses.

Only a limited amount of material was harvested upon which data could be secured relative to the relationship of bunt and black chaff. In the majority of cases, families carrying much bunt were not harvested. Bunt was present in only four available families in an amount sufficient to allow correlation coefficients to be determined. These four families trace back to rust resistant parents, Hope x Marquis-Kota hybrids. In one instance, the correlation of bunt and black chaff was essentially zero. With one family, containing 265 plants, the coefficient was -0.677 ± 0.041. In the other case with 72 and with 204 plants, the coefficients were -0.276 ± 0.096, and -0.273 ± 0.061, respectively.

Evidently, it is not possible to conclude, with the data at hand, whether this relationship between black chaff and stem rust and between black chaff and bunt has a physiological or genetic basis. The writer is of the opinion that the evident antagonism is conditioned by physiological relationships. It is evident that in any studies of inheritance of stem rust or bunt, regard must be had to the presence of the black chaff disease when present. Also in greenhouse cultural rust inoculations it is of importance to use plants not infected with black chaff. In rust garden work, it is evident that accurate rust readings or bunt determinations could not be made if the plantings had been infected with black chaff. In uniform rust nurseries rust readings should be made having in mind the amount of black chaff present.

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[1] Paper from the North Dakota Agricultural Experiment Station. Authorized by the director.

[2] "A New Disease of Wheat," *U. S. Dept. Agr., Jour. Agr. Research,* 10: 51–54, 1917.