Genes for Resistance to Rust in Victory Flax

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VICTORY (C.I. 1045), a flax characterized by large brown seeds, white petals, and blue anthers, is widely grown in North Dakota. It was entered in the regional flax nursery for agronomic and disease tests in 1941. When grown on wilt-sick soil at Fargo, N. Dak., it was apparent that Victory was a genetic mixture, not only as to height and maturity but also as to wilt resistance. In order to secure a line more uniform for type and wilt-resistance, 18 of the most thrifty plants were harvested separately in 1942. Seed of these plant selections was increased in 1943.

No more than a trace of rust was reported on Victory at any of the stations growing the regional flax nurseries in the rust epiphytotic years of 1942 and 1943. However, in the latter year, a field of Victory was observed in western North Dakota in which about one-fourth of the plants were heavily rusted. The remaining plants were rust-free. In greenhouse tests, using Victory seed from several sources, approximately 25% of the plants were susceptible to the rust culture secured from this field. Apparently Victory was mixed for rust reaction also.

Methods

Genes conditioning reaction to flax rust, *Melampsora lini* (Pers.) Lév., may be identified by either of two methods, each predicated upon the hypothesis that there is a gene for gene relationship between virulence in the pathogen and resistance in the host (1).

In the first method, the reaction of the variety to the *F₂* cultures of a hybrid between two races of *Melampsora lini*, one of which is virulent and the other avirulent on the variety being studied, is determined. With the exception of the reaction on one variety (Williston Brown), virulence has been inherited as a recessive character (1). If the variety has 1, 2, or 3 genes conditioning resistance to the avirulent race a ratio of virulent to avirulent cultures of 1 to 3, 1 to 15, or 1 to 63, respectively, is obtained. Limiting this method is the fact that resistance to flax rust is dominant, and only those genes effective against the avirulent parent race are differentiated. Because of the work involved it is not practicable to maintain a sufficient number of *F₂* cultures from more than one or two hybrids. These may not have the desired range of pathogenicity.

In the second method utilizing the fact that most of the rust-conditioning genes in flax lie in three allelic or linkage groups. The variety being studied is crossed with a rust-susceptible variety and with varieties whose rust reaction is due to single genes.