Sterility in Soybeans Caused by Asynapsis

Henry H. Hadley and W. J. Starnes

The sudden occurrence of sterile plants in a commercial crop species attracts the attention of most plant breeders. Sterile plants may reveal the presence of undesirable environmental factors or cytogenetic abnormalities. On the other hand, such plants may result from heritable systems which can be useful to the breeder. Thus, in 1958, the authors became interested in two lines of soybeans, Glycine max (L.) Merr., which segregated for sterility. The objective of the present paper is to describe the sterility in these lines and to report its probable cause and manner of inheritance.

MATERIALS AND METHODS

Both of the lines in this study are now represented in the soybean genetic Type Collection maintained by the Soybean Regional Laboratory at Urbana, Illinois. One line apparently arose as a mutation in a strain (554-1714) having the varieties 'Lincoln', 'Richland', and 'CNS' as its parentage. This line will be referred to by its type number T241. The other was found in a strain (AX 54-118-3) derived from a cross between the varieties 'Blackhawk' and 'Harosoy'. This line will be referred to as T242. T242 blooms several days earlier than T241 and has purple flowers whereas T241 has white flowers. No other difference between the two lines appears to be pertinent to the study here reported.

Well known and commonly practiced techniques of progeny testing and chi-square analyses were used in inheritance studies. Pollen mother cells were fixed in a solution of 70 parts absolute ethanol and 30 parts glacial acetic acid. Aceto-carmine squashes were studied for chromosome behavior. Pollen was stained in a solution made up of one part aceto-carmine and one part glycerin. The diameters of individual grains were measured with the aid of an ocular micrometer.

RESULTS AND DISCUSSION

In 1958 a total of 125 fertile and 41 sterile plants were observed in segregating progenies from line T242. The fertile plants were harvested individually and 117 were progeny tested in 1962. Five of the F2's had only fertile plants while 16 segregated. The 16 segregating F2's were divided into 2 groups on the basis of chi-square values (Table 1). In the group which appeared to represent a 3:1 population the ratio was 266 fertile to 88 sterile with a pooled chi-square of 0.00 and a homogeneity chi-square of 6.37 (7 d.f.). In the group which appeared to represent a 9:7 population the ratio was 188 fertile to 135 sterile. In this case the pooled chi-square was 0.50 and the homogeneity chi-square was 4.94 (7 d.f.). These results agree with the hypothesis that the recessive gene in T241 differentiates from the gene in T242 and that each locus must have at least one dominant gene to produce the fertile phenotype.

Fertile plants in 4 of the F2's (383, 388, 488 and 582) which appeared to represent a 3:1 population were progeny tested in 1963. The observed ratio of 87 segregating to 39 non-segregating lines is in agreement with the hypothesis that 2 loci are involved such that T241 may be AaBB and T242 AaBb.

The authors wish to thank A. H. Probst and L. F. Williams of the Department of Agronomy, Illinois Agricultural Experiment Station, Urbana, Illinois, for supplying the lines used in this investigation.

---

1. Sterility in Soybeans Caused by Asynapsis
2. Henry H. Hadley and W. J. Starnes
3. Contribution from the Department of Agronomy, Illinois Agricultural Experiment Station, Urbana, Illinois. Received for publication Feb. 13, 1964.
4. Professor of Plant Genetics and Graduate Assistant, respectively.
5. The authors wish to thank A. H. Probst and L. F. Williams of the Crop Research Division, USDA, for supplying the lines used in this investigation.