CLASSIFICATION OF S-ALLELES BY THEIR ACTIVITY IN S-HETEROZYGOTES OF BRUSSELS SPROUTS (BRASSICA OLERACEA VAR. GEMMIFERA (DC.) SCHULTZ).

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SUMMARY

Over a period of many years, data on dominance relationships of S-alleles in Brussels sprouts were collected at URL and IVT. The level of activity of S-alleles in heterozygotes was assessed on the basis of the number of pollen tubes that penetrated into the stigma. 209 out of 210 possible combinations between 21 S-alleles were used for this investigation. The S-alleles were grouped separately for activity in pollen and style on the basis of their sensitivity to lose activity in S-heterozygotes. Besides S-allele interaction per se, activity was found to be influenced by environment and genetic background.

Results suggest that in stigma, co-dominance is the normal pattern and that deviations are caused by factors other than S-allele interaction as such.

In pollen, only three truly recessive alleles were found. Besides several combinations with mutual weakening in pollen, examples of independent weakening were found.

INTRODUCTION

The genetics of incompatibility has been the subject of many studies. Hughes (1950) found sporophytically determined incompatibility in Crepis and assumed dominance of some alleles in the pollen. Gerstel (1950) published similar results on Parthenium. Most important were the publications of Bateman (1953), who analysed the self-incompatibility system in Iberis, and of Haruta (1962), who did the same for Brassica and Raphanus. Haruta mentioned four possible dominance relationships between S-alleles and named them type I, II, III and IV. Thompson (1956) studied dominance relationships in Brassica oleracea var. acephala. Thompson & Taylor (1966) published the results of a study on 28 S-alleles. They determined one third of the possible S-allele combinations and the S-alleles were classified into a dominance series, although the dominance relationships were not fully linear. More research into Brassica oleracea was necessary to facilitate the use of this incompatibility system for

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hybrid seed production. OCKENDON (1975) determined the dominance relationships in the stigma of 34 pairs of S-alleles, which comprised 16 different S-alleles and studied the behaviour of a single rare S-allele (1977). JOHNSON & BLYTON-CONWAY (1976) reported on the dominance relationships in the stigma of 14 combinations of S-alleles. LAWSON (1964) mentioned dominance relationships for 24 pairs of S-alleles, which were found in material from the Newcastle Collection and from J. G. van Hal (URL). Recently, WALLACE (1979) published results on dominance relationships in white cabbage, including the results of HOSER-KRAUSE (1971).

Full knowledge of the interactions of the S-alleles in Brussels sprouts should facilitate the development of hybrid varieties in Brussels sprouts and other Brassicas. However, the scheme is still far from complete. Therefore, it was considered worthwhile to summarize the comprehensive data collected in the course of the research carried out at URL and IVT.

MATERIAL AND METHODS

The data for this publication were derived from investigations and practical breeding work carried out at URL and IVT. The 21 S-alleles involved were selected by URL from inbred lines of commercial varieties and from inbred lines released by IVT. In order to prevent future confusion, URL originally coded the S-alleles by means of colour names instead of numbers. In the meantime, the THOMPSON collection of S-alleles that had been built up by THOMPSON and TAYLOR at the Plant Breeding Institute at Cambridge has been tested against the URL collection and some unidentified alleles have been included in the international coding system (OCKENDON, 1975b). The numbering of this system is used in this paper.

Activities of S-alleles in heterozygotes were determined in several ways. The data presented partly consist of a collection of empirical data found in the course of the breeding work by crossing within selfed offsprings of S-heterozygotes made for identification of S-genotypes. Another part consists of data that became more or less automatically available from investigations of the strength of self-incompatibility. Finally, a number of S-heterozygotes were deliberately made to fill the gaps caused by missing combinations. The F1 S-heterozygotes were selfed and crossed reciprocally with their parents (and sometimes with other plants homozygous for the S-alleles concerned). Parents were crossed and selfed too. Normally, 3 to 10 plants of each heterozygote F1 were taken and each plant was tested at least twice on different days by one cross- and one selfpollination. In most cases, much more extensive pollinations were made. Most data were collected from 1969 to 1972 at URL and during 1974 and 1975 at IVT.

For standardization purposes, the following rules were applied:
1. the pollen used was from fresh flowers showing full anthesis;
2. pollinations were made on stigmas of flowers that had opened one or two days before so as to avoid inhibition of germination on very young stigmas (VAN HAL, 1967) and old-flower compatibility (KAKIZAKI, 1930);