

Self-incompatibility interlocus dominance in *Brassica napus* L.

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#### Abstract:

Three *B. rapa* s-alleles and five *B. oleracea* S-alleles were examined in combination in *B. napus*. The type of interactions for the S-alleles ranged from Type I (MacKay, 1977) when a weak allele was combined with a strongly expressed allele to Type IV when two strong or two weak alleles were in combination. Dominance of one allele over another was a function of the individual alleles involved and was independent of the donor species.

#### INTRODUCTION:

Self-incompatibility has been used as a pollination control method in *B. oleracea* for many years (Wallace, 1979). A limitation to the use of SI in *B. oleracea* has been the conflicting needs for strong SI expression for the production of hybrids, coupled with the need for maintainability of the inbreds (Van der Meer and Niewhof, 1968, Ockendon, 1974). A large number of S-alleles would be desirable in *B. napus* to ensure that alleles with the proper combination of SI expression and maintainability could be found. S-alleles in *B. rapa* and *B. oleracea* typically exhibit complex dominance relationships (Thompson and Taylor, 1966, Ockendon, 1977, MacKay, 1977). Four types of interactions of S-alleles have been identified in *B. rapa* and *B. oleracea* based on expression of the alleles in the stigma and pollen of S-allele heterozygotes.

Alleles from both progenitor species of *B. napus* have been introgressed; the usefulness of these alleles for pollination control in *B. napus* will be determined through the level of expression of the alleles and the interlocus interaction of the alleles. In the current paper we report on attempts to characterize intergenomic S-allele interactions of known S-alleles which have been introgressed from *B. oleracea* and *B. rapa* into *B. napus*.

#### EXPERIMENTAL:

S-alleles were introgressed from *B. rapa* (Banks, 1988) and from *B. oleracea* (Ripley, pers. comm.) through interspecific hybridization and backcrossing into *B. napus*. Once the *B. rapa* or *B. oleracea* alleles were introgressed into *B. napus*, doubled haploids were produced for each of the lines through isolated microspore culture.

The S-alleles were examined in the homozygous and heterozygous form for expression of SI. The range of expression of SI in the *B. napus* lines homozygous for the *B. rapa* alleles was from 1.22 seeds/pollination for W1 to 15.33 seeds per pollination in the case of T4. Three of the five *B. oleracea* alleles examined expressed strong SI phenotypes in *B. napus*. In all cases with the exception of W1/SC, the single heterozygotes appear to express SI at a

reduced level as compared to the S-allele homozygotes.

The double heterozygotes such as W1/SC,S2/SC exhibit a range of intermediate phenotypes as compared to the single heterozygotes i.e. W1/SC,S2/SC=4.67 seeds per pollination whereas W1/SC set 0.11seeds per pollination and S2/SC set on average 22.56 seeds per pollination. The interesting combinations appear to be those between the alleles S2 and S24 and the B. rapa alleles. S2 and S24 exhibit positive interaction with T4 and H5 and show a similar trend with W1.

Table 1. Reciprocal testcrosses of double heterozygotes containing W1 and 5 B. oleracea alleles

Cross	Mean seeds per pod	Conclusion	SI Type*
W1SC/S2SC x W1W1	0.6		
W1W1 x W1SC/S2SC	8.3		
W1SC/S2SC x S2S2	34.0		
S2S2 x W1SC/S2SC	17.1	W1>S2	Type I
W1SC/S5SC x W1W1	1.9		
W1W1 x W1SC/S5SC	2.5		
W1SC/S5SC x S5S5	31.5		
S5S5 x W1SC/S5SC	5.7	W1>S5	Type I
W1SC/S13SC x W1W1	8.6		
W1W1 x W1SC/S13SC	21.2		
W1SC/S13SC x S13S13	19.4		
S13S13 x W1SC/S13SC	8.2	W1>S13 pollen W1=S13 stigma	Type III
W1SC/S24SC x W1W1	4.3		
W1W1 x W1SC/S24SC	2.3		
W1SC/S24SC x S24S24	0.8		
S24S24 x W1SC/S24SC	13.2	W1=S24	Type IV
W1SC/S39SC x W1W1	0.6		
W1W1 x W1SC/S39SC	2.2		
W1SC/S39SC x S39S39	33.4		
S39S39 x W1SC/S39SC	22.6	W1>S39	Type I

\*Type I to IV - after MacKay, 1977.

The interlocus interactions of the S-alleles examined covered the full range of interactions seen between S-alleles within the donor species. Interactions which appeared to fit the classical, Type I to Type IV interactions (MacKay, 1977) were observed. The most common interaction observed was Type I where one allele is dominant to a second allele in both the stigma and pollen (Table 1). The second most common interaction was Type IV, which is the case when the alleles are co-dominant in both the pollen and the stigma. Many of the interactions did not fall into classical groupings. The interactions of the weak *B. rapa* allele T4 with the *B. oleracea* alleles does not appear to fit the classical types of S-allele interaction however, this may be due to a range of SI expression levels (Wallace, 1979) or plant to plant variability (Ockendon, 1973, Johnson and Blyton-Conway, 1976, MacKay, 1977).

The S-alleles used in this study represent alleles high in the dominance series and alleles low in the dominance series. The strongest *B. rapa* allele used in the study was W1. W1 was dominant to S2, S5 and S39 which represent the weaker *B. oleracea* S-alleles, while W1 was codominant in the stigma and pollen with S24. W1 was codominant with S13 in the stigma and dominant to S13 in the pollen (Table 1). Within *B. rapa* the interactions of S-alleles tend to be largely of Type III interaction, where A>B in pollen and A=B in the stigma (MacKay, 1977). Interactions of S-alleles within the *B. oleracea* species tend to be of type IV (Wallace, 1979).

S-alleles now exist in *B. napus* from *B. rapa* and *B. oleracea*. Information presented here indicates that while the interactions of the alleles are complex, they are predictable and therefore should be of significant value for hybrid production in *B. napus*.

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