HETEROSIS BREEDING OF SELF-INCOMPATIBILITY IN *BRASSICA NAPUS*

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ABSTRACT

The breeding of self-incompatible (SI) lines of *Brassica napus* began in 1971. It is demonstrated that (1) transfering SI alleles from *Brassica campestris* to *Brassica napus* is an effective way of SI breeding in *Brassica napus*. (2) The hybrid ratio of F_1 seeds from SI system can be more than 96.5%. (3) It is possible to use SI lines, SI maintainers and restorers in SI hybrid seed production in *Brassica napus*.

INTRODUCTION

The studies of SI in *Brassica napus* began in 1971 in our institute, and a few *Brassica napus* SI lines, such as 211, 271, 219, were developed in 1975 (Fu et al., 1975, 1977, Liu et al., 1981). The problem remained in SI hybrid breeding is the reproduction of SI parents in large scale. In order to reslove this problem, we set up a breeding program of SI maintainers and restorers in *Brassica napus*. This paper presents our breeding work.

EXPERIMENTAL

Breeding of SI lines of *Brassica napus*

Three methods were employed in the breeding of *Brassica napus* SI lines: (1) isolating SI plants in varieties of *Brassica napus* by continously selfing. (2)Selecting SI plants in a population of *Brassica napus* exposed to γ radiation advanced. (3) Introducing SI genes from *Brassica campestris* to *Brassica napus*. The results were listed in table 1.

TABLE 1 The origin of 15 self-incompatibility lines of *Brassica napus*

Origin	Selfing	γ radiation	interspecific hybridization (*B. campestris* × *B. napus*)
The number of SI lines	1	3	11
%	6.6	20.0	73.3

The results in table 1 suggested that interspecific hybridization between *Brassica napus* and *Brassica campestris* is an effective way of SI breeding in *Brassica napus*.

Breeding of SI maintainers and restorers in *Brassica napus*

From 1980—1993, we used 494 varieties (or lines) of *Brassica napus* as pollinators to testcross the SI lines 211 and 271, and found 92 maintainers and 120 restorers, counting for 18.62% and 24.29%, respectively.

TABLE 2 The index of compatibility (CI)of different testcrossing combinations

The total No. of combinations	The No.of incompatible (CI<1.0)	The No.of less compatible (CI=1.1—CK)	The No.of high compatible (CI>CK)
494	92	282	120
%	18.62%	57.08%	24.29%

* CK—Huayou No.6, a self-compatible cultivar of *Brassica napus*

The data of table 2 showed that the SI of the SI lines 211 and 271 is intermediate in dominance and geneticly different from dominant SI and recessive SI. Therefore, it is easy to select SI maintainers and restorers of 211 and 271 among varieties of *Brassica napus*. These maintainers can be SI lines or SC lines.

Although both SI and some SC lines of *Brassica napus* could be used as maintainers, but they had different effect on the degree of self-incompatibility of three way hybrids from SI lines, SI maintainers and restorers (table 3). When one SI line was used as maintainer of another SI line, their hybrids coming from the crosses of [(SI line ×SI line)× restorers] had lower compatibility than the hybrids from the crosses of [(SI line×SC lines)×restorers] in which SC were used as maintainers.

TABLE 3 The effect of SI maintainer types on the compatibility of three way hybrids

Maintainer types	Crosses	Seedset(the number of seeds/per flower)
SC line	(271×Wan 11)×Xiaota	19.15
	(271×Wan 11)×Huayou 8	18.70
	(271×Wan 11)×75-53	18.10
	mean	18.65
SI line	(211×271)× Xiaota	16.51
	(211×271)× Huayou 8	15.00
	(211×271)× 75-53	15.90
	mean	15.80

F_1 seed production of SI system

In order to investigate hybrid ratio of F_1 seeds produced by SI lines and their restorers, two low erucic acid SI lines 271 and 184 having round edge leaves were planted row by row with a high erucic acid restorer "Huaye" having deeply carved edge leaves, respectively. The result was listed in table 4.

TABLE 4 Hybrid ratio from different combinations of SI lines × restorer at different parent row ratio

SI lines	Restorer	Row ratio	Hybrid ratio (%)
271	Huaye (a)	1:1	98.0
		2:1	97.0
184	Huaye (a)	1:1	97.5
		2:1	96.8
	Huaye (b)	1:1	97.8
		2:1	96.7

* Huaye (a): The caculation based on leaf-shape.
Huaye (b): The caculation based on erucic acid content.

The results in table 4 showed that the hybrid ratio produced from SI system could be higher than 96%.

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