Analysis on the self-compatibility of *winter rapeseed* (*Brassica rapa*) in China

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Abstract

Analysis on the self-compatibility of Winter Rapeseed (*B. rapa*) by use of 202 cultivars between 2004 to 2006. The results suggested that the self-compatible gene was existed and the self-compatibility varied greatly among the cultivars. The self-compatibility indexs of 31 cultivars in the 202 cultivars were >1.0 and that of 171 cultivars was ⩽1. The self-compatibility of *B. rapa* in Changjiang basin was better than that of north cultivars and the self-compatibility of individual plants in better compatibility group was much different. The self-compatibility had a certain relationship to the seed colour.

Key words: *Brassica Rapa*, compatibility, winter rapeseed

Introduction

The *Brassica Rapa* belongs to the typical incompatible crops and its nature cross-pollination rate is 85%~90%.It is one of the main cultivars in Shanxi, Gansu, Shanxi, Henan and so on. As a result of the long-term cross-pollination, the community of *B. rapa* has become a heterozygous community, which caused the intrinsic recessive disadvantageous genes covered by the relative dominant advantageous genes, simultaneously tremendously influenced the idioplasm pure and output potential. Therefore, to research the self-compatibility of incompatible crops and breed self-compatible lines have the extremely vital significance. The article mainly reported the analysis result on self-compatibility of *Brassica rapa*.

Materials and Method

The 202 materials were used in the experiment, among them there were 38 local cultivars, including 11 Gansu cultivars,10 Shaanxi's,2 Henan's,3 Anhui's,3 Shanxi's, 2 Sichuan's,3Yunnan's and 4 Hubei's; and 164 breeding lines.

The experiment was located in the Tianshui agricultural center Zhongliang test station, its elevation was 1650 meters. Each material planted 2 rows (2 meters long each row) in 2004. Five plants each material were chose to cover the host inflorescence or upside inflorescence in flowering to keep self-pollinate. the self-pollination pod number and seed number of 20 flowers in each plant were investigated in mature period. Compute self-compatibility index according to the equation : Self-Compatibility Index = self-pollination seed number / processed bud flowers; Sow the self-pollination seeds the in next year. Each materials was planted 1 or 2 rows according to the seed number. The cultivation and treatment method was the same as the year before.

Results and Analysis

In the 2004, the investigation results showed that there were 31 compatible materials (self- compatibility index⩾1.00) and 171 incompatible materials (self-compatibility index<1.00) (Table 1). In the compatible materials, self-compatibility index of 29 materials was 1.00 to 4.00, and the self-compatibility index of 2 materials was more than 4.00; In incompatible materials, the self-compatibility index of 165 lines was below 1.00, and that of 6 lines was 0..

Based on the test result, the materials can be divided into 4 types: 2 high compatible materials(self-compatibility index>4.00),29 compatible materials (self- compatibility index was 1.00 to 4.00), 165 incompatible materials (self-compatibility Index<1.00) and 6 high incompatible materials (self-compatibility Index=0).

Table 1 The discrepancy among cultivars self-compatibility index

Self-compatibility types	Compatibility index	number of lines	Percentage of all materials(%)
High self-compatibility	〉4.00	2	0.99
Self-compatibility	1.00-4.00	29	14.36
Self-incompatibility	⩽1.00	165	81.68
High self-incompatibility	0	6	2.97

The self-compatibility index of plant in a same material had much difference, regardless of the compatible cultivars or the incompatible cultivars, e.g. the average compatibility index of the line 193 was 3.79, but the self-compatibility index of single plant was between 0 to 21.10; The average self-compatibility index of line 195 was 7.15, and in the 11 processing plants, the

self-compatibility index of 4 plants was 0, that of 3 plants was above 10, and that of the highest single plants was 21.55 (table 2,figs1,figs2).

In the 38 local cultivars, only 5 cultivars's self-compatibility index was more than 1.00, one of them come from the south Gansu, and the other 4 were the Yangtze valley cultivars. Average self-compatibility index of 164 breeding lines were 0.66, in which the self-compatible materials were 26 and self-incompatible materials were 141. The self-compatibility of breeding lines were more than the local cultivars.

Table 2 Distribution of the self-compatibility index of the individual plant in two lines

No. of lines	Plant number	Average compatibility index	Compatibility index and plant number					
			0	≤1.00	1.00-5.00	5.00-10.00	10.00-20.00	>20.00
193	8	3.79	4	0	1	1	1	1
195	11	7.15	4	0	2	2	2	1

The self-compatibility index of the yellow-seeded materials was listed in table 4, the average self-compatibility index of all materials was 0.62 in 2004; but that of 34 yellow-seeded lines was 0.89 and 64 brown seed lines was 0.60. The average self-compatibility index of all materials was 1.75 in 2005, among them 62 yellow-seeded line's self-compatibility index was 2.03 and self-compatibility index of 64 brown-seeded lines was 1.51. The self-compatibility index of yellow-seeded lines was more high than that of brown-seeded lines.

Table 3 The discrepancy between different area and ecology cultivars self-compatibility

Source		Number of lines	Total plants	All pod number	Compatibility materials	Incompatibility materials	Average compatibility index
Local cultivars	Gansu	11	166	26	1	10	0.43
	Shaanxi	10	132	23	0	10	0.29
	Henan	2	10	3	0	2	0.32
	Shanxi	3	36	8	0	3	0.36
	Anhui	3	24	3	1	2	0.37
	Sichuan	2	20	4	1	1	0.94
	Yunnan	3	26	4	1	2	0.74
	Hubei	4	35	8	1	3	0.81
Breeding lines		164	1615	154	26	141	0.66
Total		202	2064	233	31	171	0.62

Table 4 Self-compatibility index of yellow seeds and brown seeds in the two years

	Year 2004		Year 2005	
	Brown	Yellow	Brown	Yellow
Line number	64	34	64	62
Percentage of the all materials(%)	46	54	50	50%
Self-compatibility index	0.39	0.89	1.51	2.03
Average self-compatibility index	0.62		1.75	

Discussion

This experiment indicated that the self-compatibility of winter rapeseed (*Brassica Rapa)* had much difference. In 202 materials, the lowest self-compatibility was 0.00, and the highest was 7.15. Based on the test result, the materials can be divided into 4 types by the self-compatibility index.

Self-compatibility of different area and different ecology materials had the much difference too. The self-compatibility of breeding lines is strong than the local cultivars. The experiment also discovered that the self-compatibility had certain relations to the seed color, in the experimental materials, the average self-compatibility index of yellow-seeded rapeseed was higher than that of brown-seeded rapeseed. Therefore, it was advantageous in enhancing the self-compatibility by breeding the yellow seed character.

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