Preliminary study of white-flowering germplasm resources in rapeseed (*Brassical napus* L.)

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Abstract

A white-flowering mutant was discovered in rapeseed. In this paper, the heredity and traits of the white-flowering mutant was described. The reciprocal cross parents were white-flowering and yellow-flowering materials. Statistic analysis indicated that the flower colors of F_1 all appeared as yellowy-white while F_2 separated into white, yellowy-white and yellow, which accorded with the 1:2:1 theoretic proportion. When backcross between parent white-flowering and F_1, BC_1 separated into white and yellow offspring, which accorded with the 1:1 theoretic proportion. When backcross between parent yellow-flowering and F_1, BC_1 separated into yellowy-white and yellow offspring, which accorded with the 1:1 theoretic proportion. It indicated that white-flowering character relative to yellow-flowering character was controlled by a pair of incomplete dominance genes. Hybridization between white-flowering material and male sterile line 9A was carried out. The results indicated that the petals were all white colors, and the pollen were all sterility. At the same time, the actuality and foreground of using germplasm resources of white-flowering in rapeseed was discussed.

Key words: Rapeseed (*Brassical napus* L.), white-flowering, germplasm resources.

Introduction

In recent years, rapeseed (*B. napus* L.), whose petal color is currently yellow, has been reported that it had other colors such as white, saffron, ivory-white, nacarat etc. Amongist, the white-flowering character was mostly studied. And the demitint type could hybridize with other varieties. The formation of flower color was associated with genome type. Tisakal etc obtained an amalgamation (2n=47) by fusing the cytoplasm between rapeseed (*B. napus* L.) and radish. However, along with the increasing of backcross, the flower color turned into yellow when the genome type returned to 2n=38. This article mainly reported the characters and traits of white flower in rapeseed by our institute and advanced its foreground.

Materials and Methods

WR-1, a mutant of white-flowering in rapeseed among testing materials was discovered by our institute. The material was discovered and then had selfing in 2000. The reciprocal cross between yellow-flowering Suyou No.1 and white-flowering WR-1 was finished in Spring 2003. The flower color was investigated at F_1 in Spring 2004 while F_2 and BC_1 by selfing and backcross were produced. Investigated the characters of flower color in Spring 2005. The flower colors of F_2 all appeared as white, yellowy-white and yellow. Chi square test was based on theoretic proportion by the Stat.

Results

1. Characters of white-flowering material

The white-flowering mutant was half stand-up at seeding stage with dark green leaf, wave blade, zigzag leaf margin, 4 pairs of decomposite leaf. It was 170 cm tall with compact type, pure white flowers and bigger petals. The material had been sent to Shanghai Academy of Agricultural Sciences for quality detection. The results showed that its oil content was 36.49%, erucic acid content was 0.16%, thioglycoside content was 10.28μmol/g, oleic acid content was 67.07%, linoleic acid content was 17.48%, linolenic acid content was 9.12% and protein content was 33.95%. The material had not only double-low character but also some better characters such as higher oleic acid content. It would be an excellent rapeseed resource or variety by further selection.

2. Results of reciprocal cross and backcross between white and yellow flower parents

The reciprocal cross parents were white-flowering material WR-1 and yellow-flowering material Suyou 1. Statistic analysis indicated that the flower colors of F_1 all appeared as yellowy-white while F_2 separated into white, yellowy-white and yellow (Table 1). Chi square test indicated that it accorded with the 1:2:1 theoretic proportion. When backcross between parent WR-1 and F_1, BC_1 separated into white and yellow offspring. It accorded with the 1:1 theoretic proportion by chi square test. When backcross between parent Suyou 1 and F_1, BC_1 separated into yellowy-white and yellow offspring. It also accorded with the 1:1 theoretic proportion by chi square test. Thus it could be seen, white-flowering character relative to yellow-flowering character was controlled by a pair of incomplete dominance genes.

3. Results of hybridization between white-flowering material and male sterile line

Hybridization between white-flowering material WR-1 and male sterile line 9A and investigation of the florescence of F_1 in the field were carried out. The results indicated that the number of white-flowering plants was 126. The sterility

investigation indicated that the F_1 were all sterility and had appreciably powder. It accorded with the character of male sterile line 9A. Thus, it could be seen, the white-flowering mutant had potential for heterosis application in rapeseed and awaits further study.

Table 1 Flower color segregation of cross between white and yellow flower parents

Combination	Generation	White flower	Yellowly-white flower	Yellow flower	E	X^2	P
Yellow/white	F_1		28		0:1:0		
White/yellow	F_1		33		0:1:0		
	F_2	32	76	36	1:2:1	0.667	0.50~0.75
White/yellow//yellow	BC1		29	27	0:1:1	0.018	0.75~0.90
Yellow/white//white	BC1	39	35		1:1:0	0.061	0.75~0.90

Actuality and foreground of white flower character in rapeseed

1. Actuality of white flower character in rapeseed

There already had some reports about inheritance mechanism of white-flowering character in rapeseed. Cun-kou Qi etc thought the white-flowering character in rapeseed was incomplete dominant inherited relative to yellow-flowering character. Petal color was controlled by a pair of genes. Jie-fu Zhang etc thought the white and yellow flower character was controlled by a pair of incomplete dominant genes. The heterozygotic type appeared as ivory-white flower. Our results were basically consistent with above results.

Up to now, domestication of double-low white-flowering rapeseed varieties reported are Yinhua 1, Yinhua 2 and Yinhua 3 developed with microspore culture technique by Yunnan Academy of Agricultural Sciences. And they have been experimentally planted for production. Besides, white-flowering character has ever been applied on breeding of hybrid rapeseed. Then restorer has been bred and the purity has been improved effectively.

2. Foreground of white flower character in rapeseed

The innovative germplasm resource in rapeseed is one of breeding targets. Experts inside and outside attach quite importance to rapeseed quality and a lot of new germplasm resources have been invented. The white-flowering material discovered would be a high quality rapeseed resource after being improved because it has better quality and specific appearance.

Marking with special character is mostly used in heterosis utilization both domestically and overseas, especially leaf shape mutant. The aim of using restorer with dominant character marks is to distinguish the configuration of F_1 and improve the purity by trash extraction at seeding stage. In the same way, domestic marking with flower color is a good standard in male sterile and its value by breeding restorer with white flower mark, sterile, maintainer line and crossbreed.

Rapeseed is an important oilseed crop. It plays a huge part of speeding the economic development and improving our living standard. And the effect will keep on in the further. However, in developed areas, the direct contributions on agricultural production will be weakened while sightseeing rapeseed will be incarnated. Rapeseed has been used as sightseeing crop in some places such as Nantong and Suzhou. As a result, if white-flowering rapeseed is applied in production and reasonably arranged with yellow-flowering rapeseed or other plants in touring places, especially in esthetic area of agriculture, it will not only increase the agricultural income, but also add another function of rapeseed.

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