Study on Genetic Character of Sunflower Silver Pollen Grain

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Abstract:
A mutant of silver pollen grain was discovered in the native edible variety of sunflower (*Helianthus annuus* L.) and a special variety of silver pollen grain was gained through breeding. This variety was determined by a pair of recessive genes with independent inheritance and was completely linked with the light yellow of ligulate flower. At the same time, it had maintaining ability to the male—sterile materials.
Key Words: Silver pollen grain, recessiveness, complete linkage

Introduction

The pollen grains of sunflower (*Helianthus annuus* L.) (a plant of composite family) are orange. In 1983 we discovered a mutant of silver pollen grain from the selfed progeny of an edible variety, "Fuxindace", through studying the native materials. After S_1 progenies and sibling hybridization of three generations, a special variety of sunflower with silver pollen grains which for the time being named F8350 was gained.

Further study was conducted during 1987—1990 to find out its hereditary traits and practical value of breeding practice.

1. Materials and Methods

1. 1 Reciprocal crossing was made using F8350 as a source of silver pollen grains and "Heilaoguazui" as an orange pollen grains, the former one had silver pollen grains, white stigma, orange ligulate flower, grey—dark seed coat, while the latter one had orange pollen grains and ligulate flower, violet

stigma. Then we use biometrical analysis to analyse the plants with different color of pollen grains in F_1 and F_2.

1. 2 Cross breeding was made using F8350 as male parent, male sterile 74102 — 4A (introduced from Sunflower Institute of Jilin Province) as female parent while analysing statistically for F_1 fertilities.

2. Results and Discussions

2. 1 Reciprocal crossing combination was formulated in 1987. The next year 43 F_1—plants of F8350×"Heilaoguazui" and "Heilaoguazui"×F8350 were gained respectively in the field. Growing characters and growing vigours were uniform accomponied with clear luxuriance. The stigmas were all violet, pollen grains and ligulate flowers were all orange and the seed coats violet. In 1989, 44 F_2 plants (F8350×"Heilaoguazui") were gained through F_1 controlled pollination within the line. After blossoming, the two combining characters seperated. Besides the parent form, there were also recombinants of violet stigma, silver pollen grain and white stigma orange pollen grain. There were 139 plants with orange pollen grains and 45 plants with silver pollen grains out of the 184 plants of F_2. The ratio was 3. 09 : 1 $\chi^2=0.029(<\chi^2_{0.05,1}=3.84)$. This result accorded with the law of segregation in a pair of allele, and the trend of reciprocal crossing showed no differences (Table 1). To check the results, backcross and test cross were made in the meantime of field investigation. 33 plants of first backcross generation ((F8350×"Heilaoguazui")×F8350) were gained in the field in 1990, among which sixteen were silver pollen grain, seventeen orange (the ratio was 1 : 1. 06≈1 : 1). 31 F_3 plants were gained through F_2 (Silver pollen grain) controlled pollination within the line. The pollen grains of these plants were all silver. This results accorded with the expected theoretical value (Table 2).

From the above test, the plants of F_1 showed no difference. They were all the same with violet stigma, orange pollen grain and ligulate flower. The segregation appeared in F_2, with the ratio of 3 : 1 (orange pollen grain : silver pollen grain). This results accorded with the law of segregation. Besides this, there were recombinants also. So to say, the character of silver pollen

grain was determined by a pair of recessive genes with independent inheritance.

2. 2 Through the investigation of 446 plants of parent and progeny of a cross, we can draw the conclusion that silver pollen grain always happens together with lihgt yellow ligulate flower, while orange pollen grain with orange ligulate flower. No exception can find (Table 3).

This means: (1) Like other characters, the color of ligulate flower is determined by relevant genes. (2) Like the silver color character of pollen grain, the light yellow color character of ligulate flower is also determined by a pair of recessive genes with independent inheritance. (3) The genes of ligulate flower color and those of pollen grain color located in the same chromosome, complete linkage.

2. 3 Pollinating to male—sterile plants of 74102—4A with F8350, we can get 43 male—sterile plants in F_1, the male—sterile ratio is 100%. So F8350 had maintaining ability to the male sterile materials of 74102—4A.

Table 1 Segregations of pollen grain color in F_2.

Cross combination	total number	plants with orange pollen grain	plants with silver pollen grain	ratio of orange v. s. silver
F8350× H*	44	33	11	3 : 1
H× F8350	140	106	34	3.12 : 1
total	184	139	45	3.09 : 1

*, H="Heilaoguazui".

Table 2 Investigation of backcross and test cross progeny.

Cross combination	total number	plants with silver pollen grain	plants with orange pollen grain	ratio of silver v. s. orange
(F8350×H) ×F8350	33	16	17	1 : 1.06
F_3 plants segregated from silver pollen grain	31	31	0	1 : 0

Table 3 Statistical analysis of correlation among traits

traits of correlated traits	plants of various traits				
	male parent	female parent	F_1	F_2	tatle
total number of plants	100	100	62	184	446
silver pollen grain, orange ligulate flower	0	0	0	0	0
orange pollen grain, light yellow ligulate flower	0	0	0	0	0
silver pollen grain, light yellow ligulate flower	0	100	0	45	145
orange pollen grain, orange ligulate flower	100	0	62	139	301