Winter rapeseed mutant with decreased tendency to shattering

Tadeusz Łuczkiewicz

Department of Genetics and Plant Breeding, Academy of Agriculture, Wojska Polskiego 71 c, 60-625 Poznań, Poland

Introduction

Progress in winter rapeseed breeding, as well as in breeding of other species of cultivated plants, is connected with obtaining new genetic variability. Breeding varieties of winter rapeseed are genetically differentiated in a low degree. Thus it is necessary to induce new variability either by de noro synthesis of this species or by mutation induction. Mutation induction is of intrest not only for breeders but also for basic studies in the genetics of this species. Literature dealing with genetic researchers and rapeseed mutagenesis is not very aboundant.
It results from the difficulty in obtaining mutation of morphological characters in that species that is caused by large seed resistance to mutagenic factors as well as by a complex manner of inheriting characters in that allopoliploid.

Materials and methods

Each year since 1978 the seeds of three winter rapeseed varieties, Janpol, Brink, Jet Neuf, are being irradiated with gamma rays /doses 0.0, 50.0 KR, 100.0 KR/. In this way mutagenic effects of annually applied doses are summed up.
- As a result of irradiation of seeds of Swedish rapeseed variety Brink with the dose of 50.0 KR a "short pistil" mutant with devided pistils /$gamma_{1-3}$ generation/ was obtained in 1980.

In the subsequent years the pr·genies of mutated plants were observed and reproducted. Biometric measurments of flowers and the whole plants were performed.

- Biometric measurments were performed on 100 chosen at random flowers of a mutated line and pattern in the first day after flowering. The following characters were measured: length and width of petals, length of 4 long and 2 short stamen filaments, length of 6 anthers, length of a pistil. During the flowering period the fertility of pollen grains was stated in the Belling liquid for 50 mutated and control plants, by analysing of 300 pollen grains from a plant in averege.

- After harvesting the following characters of 100 chosen at random plants were measured: plant height, plant height to the first embranchment, length of silique and length of silique rostrum. Number of siliques, average seed number in a siligue and the number of 1st rate embranchments were counted. Also, the tendency of mutated plants to shottering was preliminarily evaluated. In order to do this 200 plants /mutated and control/ have been left for 4 weeks after achieving full maturity.

Results

"Short pistil" mutant of winter rapeseed is statistically significantly different from control plants in respect of all examined flower characters, that is length and width of petals, length of stamen filaments, length of an anther and a pistil /Tab. 1/. The flowers of mutated line were characterized by almost the same length of long and short stamen filaments and by much shorter length of a pistil. The values of variability coefficients for the examined flower characters were for the mutated line three times lower than for control plants. Character analysis of control and mutated plants revealed also that these genotypes are statistically significantly different in respect of the examined characters /Tab. 2/. The mutated plants are lower, have more 1st rate embranchments /and a large number of 2nd rate embranchments/, set more siligues. However, the length of siliques, number of seeds in a silique, and also the length of silique rostrum in mutants were much lower than in control plants. The differences in fertility of pollen grains in both genotypes was very high /above 97%/. Probably a very short rostrum in mutants causes plant resistance to shattering. Preliminary evaluation of resistance to shattering revealed, that small percent /8.8%/ of mutant siliques dehisces /control 59%/, and only after 6-8 weeks after technical maturity the siliques fall down onto the ground. In the result of crossing and selection performed in the last two years strains with high fertility, short rostrum and a habit close to that of control plants were obtained. These strains do not differ from mutated lines in respect of resistance to shattering.

Tab. 1

Comparison of morpholigical characters of flowers of control /N/ and mutated /K/ plants

Character	Genotype	Average value	NIR for α		Variability coefficient %	Character value	
			0,05	0,01		min.	max.
Length of petals /mm/	N	12,9	0,550	0,726	19,26	6,5	17,0
	K	16,4			7,63	13,0	19,1
Width of petals /mm/	N	6,2	0,338	0,446	23,81	3,5	11,1
	K	9,2			9,40	7,4	11,3
Length of a long stamen filament /mm/	N	7,3	0,266	0,351	17,12	4,5	11,0
	K	8,9			5,57	7,8	10,0
Length of a short stamen filament /mm/	N	5,1	0,285	0,376	24,02	2,0	9,0
	K	8,1			9,62	4,5	9,5
Length of an anther /mm/	N	2,4	0,088	0,116	16,86	1,6	3,5
	K	3,0			6,24	2,4	3,5
Length of a pistil /mm/	N	9,8	0,417	0,550	20,40	5,0	15,0
	K	6,9			10,41	4,5	8,6

Tab. 2

Comparison of characters of control /N/ and mutated /K/ plants

Character	Genotype	Average value	NIR for α		Variability coefficient %	Character value	
			0,05	0,01		min.	max.
Height of plants /cm/	N K	100,4 107,4	1,937	2,601	4,75 2,65	90,3 100,4	109,9 111,7
Height to the 1st embranchment /cm/	N K	37,1 19,3	4,097	5,500	20,12 46,89	23,8 8,9	51,5 38,4
Number of 1st rate embranchments	N K	2,9 8,7	0,596	0,800	25,57 17,46	1,8 5,6	4,4 10,7
Pollen grain fertility /%/	N K	98,9 97,4	0,796	1,054	1,54 2,46	93,4 91,0	100,0 100,0
Number of siliques on a plant	N K	48,3 33,7	10,104	13,564	56,63 28,35	19,0 19,0	123,0 50,0
Number of seeds in a silique	N K	17,3 3,3	0,862	1,157	13,95 16,30	14,1 2,6	21,9 4,5
Length of a rostrum /cm/	N K	1,30 0,13	0,087	0,118	14,6 33,3	1,0 0,1	1,8 0,3
MTN /g/	N K	4,5 5,8	0,284	0,381	12,68 10,19	3,6 4,8	5,3 6,8