

INHERITANCE OF SOME MUTATED TRAITS IN *BRASSICA NAPUS* L.

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ABSTRACT

As a result of multiple irradiation of seed of 4 varieties of winter rapeseed with gamma rays many morphological mutants were received. The way of inheriting of 3 flower mutations of rapeseed was defined. It was observed that two mutated traits are conditioned by duplicated recessive genes (segregations in F_2 generation - 15 :1), segregation characteristic for a monohybrid was received in F_2 for one trait.

INTRODUCTION

The progress in breeding of each species depends on the possibility to obtain a new genetic variability or better utilization of already existing variability. Breeding varieties of winter rapeseed (especially 00 varieties) are differentiated genetically to a small degree. Therefore there is a necessity to induce new variability by means of synthesis *de novo* of rapeseed, induction of mutation or obtaining transgenic genotypes. Obtaining gene mutants and their identification is very difficult in this species because of a complex way of traits inheritance and large resistance of rape seeds to the influence of mutagenic factors.

The conducted experiments aimed out obtaining genetic mutants in this species, at the analysis of the pattern of inheriting of mutated traits, examination of linkages and evaluation of the usefulness of mutant lines for breeding.

EXPERIMENTAL

Plant material used in the studies consisted of 4 varieties of winter rapeseed: French variety Jet Neuf, Swedish variety Brink and two Polish varieties - Wipol and Janpol. The seeds of these varieties (humidity 13%) were irradiated for the first time in 1978 with gamma rays (^{60}Co). The following doses were applied: 0.0kR, 50.0kR, 100.0kR and 140.0kR. In gamma₁ generation one silique was collected from every plant of each of 16 combinations (4 varieties, 4 doses). Thus collected seeds are being irradiated with gamma rays up till now (Generation gamma₁₋₁₇ in 1994).

In field experiments carried out every year about 40,000 plants were analyzed. Plants with changed phenotype are selected.

This paper presents the way of inheritance of 3 mutations of the flower of winter rapeseed selected in various post-radiation generations.

Crease petals of corolla

This mutation was obtained as a result of irradiation of rape seeds of Wipol variety with the dose of 140.0kR. The mutated line is characterized by intensive creases of petals. Protrandia has been also observed in mutated plants as a pistil growing through a flower bud. Morphological measurement of flowers also revealed that the mutated plants are characterized by a smaller width of petals (5.9 mm) and longer pistil in comparison to control plants in which the values of the above traits are respectively 7.6 mm and 8.9 mm. F₁ hybrids which are the result of reciprocal crossing of mutated plants with the control ones do not differ from non-mutated plants in the respect of morphological traits of the flower.

Phenotypic segregation was settled in F₂ generation and in offspring of a test crossing. Only two phenotypic classes have been observed: plants with creased and non creased petals in corolla. The model of inheritance of the examined trait characteristic for a monohybrid with full dominance has been accepted. The rightness of the accepted

model has been varified by chi-square test. Thus it can be assumed that the trait of the creased petals in corolla in rapeseed is conditioned by recessive gene and full dominance of gene conditioning non creased petals. The described mutation can be applied in breeding works as a genetic marker. Also this genotype can facilitate (protrandia) controlled crossing of rapeseed plants.

Mutants with dispersed petals in corolla

The line with dispersed petals in corolla was selected from a Polish variety Wipol in γ_{1-3} generation, i.e. after irradiation of seeds with gamma rays (a dose of 140.0kR) repeated three times. Plants belonging to this line are characterized by long and narrow petals in corolla (the average width of petals in a mutant is 5.8 mm and in control plants 7.6 mm). The flower of a mutated plant looks like a "dispersed" one. The accrete threads of pistils were observed in plants of this line as well as the anthers significantly shorter (1.3 mm) than in control plants (3.0 mm).

Genetically defined mutated line was crossed with controlled plants (in both directions). The structure of a flower in the hybrid of F_1 generation was not different than that of control plants which points to full domination of a gene (genes) conditioning morphology of petals characteristic for control plants. In F_2 generation of this crossing segregation into normal plants and plants with dispersed petals was observed, without transitional phenotypes in respect of the examined flower trait.

The received phenotypic segregation allowed for accepting a model which assume that the trait of dispersed petals is conditioned by two not related alleles. The rightness of the assumed hypothesis was verified with chi-square test.

Mutant with a splitted pistil stigma

The seeds of Swedish rapeseed variety Brink were irradiated with a dose of 50.0kR which resulted in a mutant (in generation γ_{1-3}) with a splitted pistil stigma (Luczkiewicz 1987). The characteristic of this genotype (besides morphologically changed stigma) are as follows:

- a shorter style (its average length in a mutant is 1.3 mm and in controls 2.0 mm)
- significantly shortened rostrum (in controls 1.00 cm and in mutated lines 0.41 cm)
- lemon-yellow colour of petals in corolla
- the lack of nectaries
- colour of deeply incised leaves lighter than of controls
- lowered fertility.

Changed morphological structure of a silique caused the increase of resistance to shattering. The difference in the rate of shattering seeds in control and mutated plants was 29 - 47% in behalf of a mutated line. The fertility of mutated lines is lower than fertility of control plants. The observed variability of this trait within a mutated line is large enough which allows for certain achievements in obtaining plants which do not differ from the model in respect of seed mass per plant. Genetically settled line was crossed with control plants. F_1 hybrids had a stigma, a style and a rostrum similar to those of control plants. F_1 plants were selfpollinated and also crossed with a mutated line. In F_2 generation and in the offspring of a test crossing phenotypic segregation was determined. Two phenotypic classes were observed: mutated plants and plants with normal morphology of a flower and the whole plant. The accepted model of inheritance of a mutated trait characteristic for a dihybrid was verified with a chi-square test.

Thus it can be assumed that "splitted" pistil stigma and a shorter style in rapeseed are conditioned by two pairs of not related alleles and occurs in recessive homozygote.

REFERENCES

- Luczkiewicz, T. (1987). Winter rapeseed mutant with decreased tendency to shattering. *Proceedings of 7-th International Rapeseed Congress, Poznań*, pp. 463-467.