Indian J. Genet., 52 (1): 26–28 (1992)

GAMMA-RAY INDUCED FEMALE MUTATION IN CASTOR

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(Received: July 31, 1989; accepted: June 25, 1991)

ABSTRACT

Three female mutants in castor (*Ricinus communis* L.) were obtained from 100 to 125 kR gamma-rays treated M_2 population. The racemes of these mutants bore only pistillate flowers. This character is monogenic, recessive and these mutants can be used for large scale hybrid seed production.

Key words: Induced mutation, castor.

The reproductive organs of the spermatophytes, the flowers, exhibit almost infinite morphological and physiological expressions. Floral adaptations are concerned mainly with efficient pollination and regulation of level of outbreeding. There is a wealth of information on modification of sex expression in spermatophytes [1]. Sex expression in castor is influenced by environmental factors as well as by modifying genes [2]. The present paper is a part of the study on the modifications of sex expression in castor (*Ricinus communis* L.).

The dry seeds of *Ricinus communis* L. var. Aruna were irradiated with 75, 100, 125 and 150 kR gamma rays. Seeds from M_1 plants were collected at random. Progenies of individual plants were raised to obtain the M_2 generation. Three perfect female mutants were obtained from 100 and 125 kR gamma-ray treated M_2 population. These were crossed with the controls, and F_1 plants selfed to obtain F_2 population.

Table 1. Mutation frequency in M_2 generation of castor

Gamma-ray treatment (kR)	M_2 plants	Female mutants	Mutant frequency (%)
75	236	0	0.00
100	242	2	0.82
125	251	1	0.39
150	230	0	0.00
Total	723	3	0.41
Control	325	0	0.00

The frequencies of plants with only female flowers among gamma-rays irradiated populations are given in Table 1. It is evident that three plants (0.41%) are perfectly female out of the total M_2 population of 723 plants. The mutants GRFM1 and GRFM2 were isolated from 100 kR (0.82%) and mutant GRFM3 from 125 kR (0.39%) population. These mutants consisted of only female flowers. The data on plant height, number of lateral branches, number of racemes, days to the first pistillate flowers, number of pistillate flowers, fruits and seeds/plant, and 100-seed weight are given in Table 2.

Table 2. Main features of three female mutants in castor

Mutant	Plant height	No. of lateral branches	No. of racemes	Days to first pistillate flower	No. of pistillate flowers	Fruits per plant	Seeds per plant	100-seed weight (g)
GRFM1	135	5	7	112	239	157	366	17.8
GRFM2	131	4	6	120	391	130	295	18.8
GRFM3	137	7	5	110	279	140	335	19.2
Control	134	5	6	108	232	125	290	17.2

The results show that the female mutant GRFM1, GRFM2 and GRFM3 were almost similar to the control plants in plant height, number of lateral branches and racemes. The mutants, however, were late flowering, but the number of flowers was significantly higher than in control resulting in higher fruit and seed yield in the mutants over control. It was interesting to note that 100-seed weight in mutants was also higher than in the control.

The frequency of female mutants and normal monoecious plants in three F_2 populations [Table 3] was tested for goodness of fit to an assumed ratio of 3 normal : 1 mutant. The χ^2 values obtained indicate that a single recessive gene controlled the perfect femaleness in castor, as suggested earlier [3–7]. According to these reports, a recessive gene causes femaleness in castor and this gene is rather stable ontogenetically but slightly modified by

Table 3. Segregation of female mutants in F_2 populations of mutants x control (fit to 3:1 ratio)

Cross	F_1	Total F_2 plants	Normal	Mutant	χ^2	P
GRFM1 x Control	Normal	286	207	79	1.05	0.10–0.50
GRFM2 x Control	Normal	361	264	97	0.67	0.10–0.50
GRFM3 x Control	Normal	331	243	88	0.44	0.50–0.95
Total		978	714	264		
		d.f.	χ^2	P		
Total χ^2		3	2.16	0.50–0.95		
Pooled χ^2		1	2.07	0.50–0.95		
Heterogeneity χ^2		2	0.09	0.50–0.95		

environment as male flowers may also occur under certain conditions. The female mutants obtained in this study can be used in large scale hybrid seed production.

ACKNOWLEDGEMENT

Financial assistance from the Hindustan Lever Research Foundation, Bombay, is gratefully acknowledged.

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