tions ($\chi^2 = 0.0032$; $P = 0.98$–0.95). And test crosses with the full-green parent segregated into red (323) and full-green (306) phenotypes in 1 : 1 ratio ($\chi^2 = 0.4594$; $P = 0.50$–0.30).

When the least-pigmented type was crossed with red type (JRO 878), F_1's were all red and in F_2 segregation both parental types (red = 2124; least-pigmented = 686) reappeared in 3 red : 1 least-pigmented ratio ($\chi^2 = 0.5167$; $P = 0.50$–0.30). Back crosses with the red parent gave rise to only red type progenies, whereas test crosses with the least-pigmented parent gave rise to both red (214) and least-pigmented (205) types in 1 : 1 ratio ($\chi^2 = 0.1933$; $P = 0.70$–0.50).

The above results show that the crosses between the full-green (JRO 632) and least-pigmented types involve the operation of two factor pairs. The modified dihybrid ratio showing the appearance of a new pigmented phenotype (red) with higher intensity of pigmentation as compared to the least-pigmented parent in the F_1, F_2 and back cross progenies shows that in addition to the multiple alleles, another dominant pigment intensifier gene is concerned in the crosses. Thus, besides possessing the gene ao, the lowest member of the multiple allelomorphic series, the full-green type also contains the dominant intensifier gene, *viz.*, R which is responsible for the intensification of colour of the least-pigmented plants in crosses. However, the intensification of colour in the red type is not pronounced with any detectable classification amongst red plants. Hence crosses with red type show F_2 segregation in monofactorial pattern. The genetic constitution of the different pigment patterns are suggested as : Full-green : $a^o a^o RR$; least-pigmented : $A^o A^o rr$; Red : $A^{oR} A^{oR} rr$; and Deep-red : $A^{oD} A^{oD} rr$.

Author is thankful to the Director, Jute Agricultural Research Institute, for providing facilities.

Jute Agric. Res. Institute, Barrackpore, West Bengal, October 5, 1972.   K. CHAKRAVARTY.

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EARLY-DWARF MUTANT IN LINSEED INDUCED BY GAMMA-RAYS

EARLY flowering associated with early maturity would be desirable in the oil yielding crops like linseed. In the course of an investigation on induced variants in linseed (*Linum usitatissimum* L.) an early-dwarf mutant was isolated. This communication reports the agronomic characters of the mutant.

Seeds of *L. usitatissimum* L. var. *Neelum*, a high yielding, recommended variety (obtained from Dr. G. N. Pathak, Economic Botanist, Kanpur) were exposed to 25, 50, 75 and 100 kR gamma-rays at a dose rate of 15·5 kR/min. Plants were raised in lines from treated and untreated (control) seeds, the spacing followed was 45 cm between rows and 22·5 cm between plants.

In the M_1 generation, there was reduction in average plant size with increase in radiation level. Ten plants were selected at random from each treatment and control and the seeds of the remaining plants were bulked treatmentwise. During subsequent generations, plants were grown in random lines, the spacing followed being the same as in M_1 generation.

In the M_2 generation, four plants from amongst 50 kR bulked population flowered about 25 days earlier than the control. These four plants were relatively short as against the control and had sparsely arranged, long narrow leaves. The seeds of these variants were harvested individually and were raised in the M_3 generation. The variants bred true for the mutant characters and have been designated as '*Early-Dwarf*' (Fig. 1).

Mean time of flowering was calculated by taking the date of flowering of every plant in the parent and the mutant lines; the results are given in Table I. Since the selections from the '*Early-Dwarf* did not show significant differences among themselves in flowering or in other morphological characters, they were bulked during the M_3 generation.

The mean time of flowering of the mutant during M_3, M_4 and M_6 generations was earlier by about 30 days as compared to the parent; the differences being highly significant.

Ten plants were selected at random from *Neelum* and the *Early-Dwarf* mutant in the M_6 generation for comparing the agronomic characters and the data are given in Table II.

The results show that the mutant was about 50% shorter than *Neelum* which is highly significant. In mean weight of 1,000 seeds, the mutant was superior to the parent. However, in mean yield, the *Early-Dwarf* was inferior to *Neelum*.

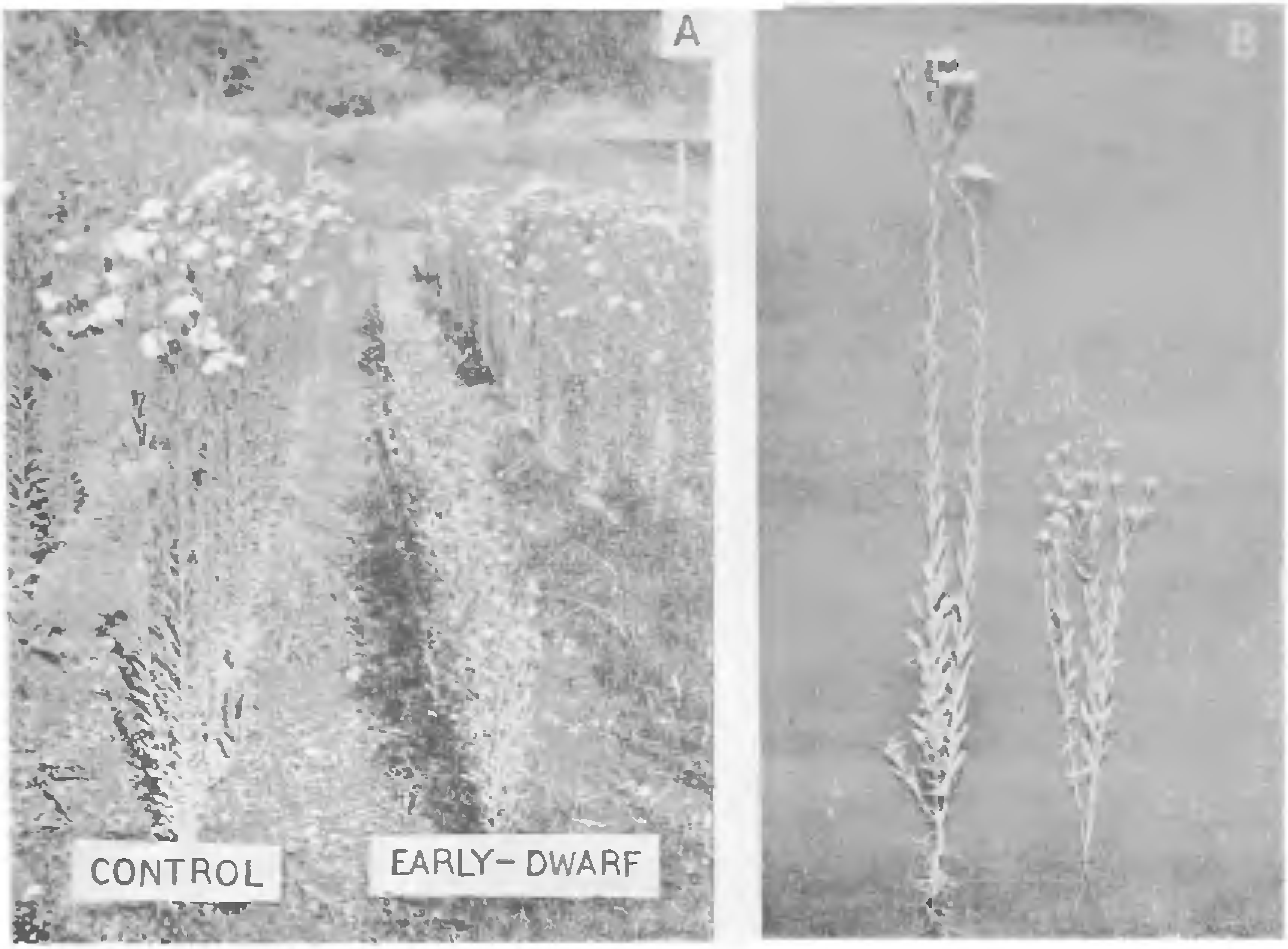

FIG. 1. Flowering in *Neelum*, Control and *Early-Dwarf*: A. Field view; B. Single plants. It may be noted that while the mutant has partially mature fruits, the control plants are in their first blooms.

TABLE I
Mean time of flowering in Neelum *and the* Early-Dwarf

Selection No.		Mean time of flowering ± SE (in days)		
		M_3−1968	M_4−1969	M_6−1971
R 28	*Neelum* (Control)	63·83 ± 0·39	65·11 ± 0·43	62·47 ± 0·62
S_1	*Early-Dwarf*	35·98* ± 0·42		
S_2	*Early-Dwarf*	37·43* ± 0·42	35·81* ± 0·50	33·71* ± 0·78
S_3	*Early-Dwarf*	36·08* ± 0·44		
S_4	*Early-Dwarf*	37·35* ± 0·28		

* Significant at 1% level.

The maturity period for the *Early-Dwarf* was 70–80 days as compared to 110–120 days in the parent under our field conditions. The sparse leaf arrangement is a good genetic marker and helps in identifying the mutant at seedling stage.

The earliness in flowering by about four weeks and harvesting by about six weeks attained in *Neelum* is of great agronomic importance. Although yield per plant is comparatively low, the *Early-Dwarf* will serve as a good material especially in crop rotation and for further breeding purposes. As the mutant plants are short and early, more population can be raised in an unit area as compared to *Neelum*.

TABLE II
Agronomic characters in Neelum *and* Early-Dwarf *(M_6-1971 generation)*

Variety	Mean ± SE				
	Height at harvest (cm)	Number of primary branches	Number of fruits per plant	Weight of seeds per plant (gm)	Weight of 1,000 seeds (gm)
Neelum (Control)	77·6 ± 1·44	4·5 ±0·53	51·8 ± 4·10	3·61 ±0·32	8·4[illegible] ±0·24
Early-Dwarf	40·3* ± 1·54	3·9 ±0·33	32·3* ± 2·01	2·59† ±0·18	9·39† ±0·25

* Significant at 1% level. † Significant at 5% level

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