There was no significant difference among treatments for flowering cycle, panicle number per m^2, length of peeled and polished grains and intact grain percentage after milling. All ten tested lines were different from the parent variety in at least one of the evaluated characters, and only the mutant lines 4, 5, 7, 8, 9 and 10 showed a reduction in plant height compared to parent. An increase was observed in the tiller number per plant in mutant lines 7 and 8, reduction in panicle length in mutants 8, 9, 10, reduction in number of fertile spikelets per panicle in mutants 1, 4, 5, 7, 8, 9 and 10, reduction in productivity and increase in the percentage of sterile spikelets in the mutant lines 1, 3 and 13, increase in grain width in the mutant line 2 and reduction in grain thickness in 4, 5, 7, 9 and 10. In relation to the length/width ratio, which determines the grain type, the reduction was observed in mutant lines 5 and 10 and an increase in mutants 1 and 8. The mutant line 7 was the most promising because it showed reduction in culm length and increase in tiller number, without changing its panicle length and productivity in comparison to parent variety Douado Precoce.

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INDUCTION OF BACTERIAL BLIGHT RESISTANCE IN ELITE INDIAN RICE CULTIVARS USING GAMMA-RAYS AND ETHYL METHANESULFONATE

Rice is the most important cereal crop in the world feeding more than 50 percent of the human population. During the last 30 years, induced mutation breeding has played a significant role in rice breeding programmes. Rice mutants with higher yield, greater tolerance to diseases and pests and other agronomic qualities have been released for commercial cultivation in many countries. Bacterial blight (BB) caused by *Xanthomonas oryzae* pv. *oryzae* is the second most important disease in Southeast Asia. In the Basmati field sometime the yield loss is up to 100%. Moreover, there is no resistance source available in Basmati rice, which is known for its quality and aroma. Induction of bacterial blight resistance in Basmati will help in developing high yielding Basmati type cultivars without compromising the quality. Therefore, seeds of two Indian rice varieties viz. 'PR 106' and 'Pusa Basmati 1' were treated with ethyl methanesulfonate (EMS - 0.25% and 0.5%) at pH 7.0 at 25 ± 1^0C for 12 h and gamma rays (1 and 2 Gy) (Table 1). A 3500 curie Co^{60} gamma cell with a dose rate of 3200 radians per minute was used for gamma irradiation of the paddy seeds containing 13 ± 1% moisture. The mutagen treated seeds were germinated along with corresponding parent variety in petri dishes lined with wet filter paper. The seeds from the M_1 generation were grown in plant-to-progeny method for the M_2 generation at Kapurthala, Punjab Agricultural University. Each progeny had

22-25 plants. The plant to plant distance was 20 cm and row to row distance was 30 cm. For every 20 lines, one line of corresponding parent variety was grown.

Screening against BB was made in the M_2 generation by inoculating the plants at maximum tillering stage, following Kauffman *et al.* [1]. Observations for disease severity were recorded after 14 days of inoculation following standard techniques. Plants with a lesion length up to 2.5 cm were scored as resistant. In M_2, out of 89,045 plants, a total of 40 lines comprising 145 plants (2.47%) were resistant to bacterial blight. The gene action for resistance was observed in M_2. It was found that in 34 lines, the resistant plants segregated as controlled by recessive gene. In four cases the ratio of resistant and susceptible plants did not give a clear picture (Table 2). The M_3 generation was raised by the plant-progeny method for all plants of lines screened in M_2. Observations were made to see whether the resistant lines in M_2 were true breeding in M_3.

Table 1. Treatments, viability of M_1 and number of lines and plants screened in M_2 for PR 106 and Pusa Basmati 1

Variety	Treatments	No. of seeds treated	Final stand in M_1	M_1 viability up to maturity (%)	No. of lines in M_2	Total plants in M_2
PR 106						
	EMS 0.25 %	1100	608	55.27	598	13,635
	EMS 0.50 %	1100	481	43.73	481	10,510
	Gamma rays 1Gy	1100	323	29.36	322	6,730
	Gamma rays 2Gy	1100	479	43.55	475	10,380
Pusa Basmati 1						
	EMS 0.25 %	1100	362	32.91	349	8,290
	EMS 0.50 %	1100	354	32.18	337	8,005
	Gamma rays 1Gy	1100	642	58.36	636	15,910
	Gamma rays 2Gy	1100	661	60.09	631	15,585
Total					3,829	89,045

In PR 106, 24 lines out of 1,876 segregated for BB resistance (1.279%) whereas it was 16 out of 1,953 (0.819%) in the case of Pusa Basmati 1. In a study by Padmanabhan *et al.* [3], 0.36% resistant and 0.65% moderately resistant plants were obtained in the M_2 population derived from EMS treated variety. The rate of successful induction of resistance during the present investigation is comparatively low since the moderately resistant and moderately susceptible plants in the M_2 were considered as susceptible. The resistance developed in the present study needs to undergo allelic testing and testing against different pathotypes. When observed in terms of mutagens, 17 out of 24 mutants were induced by EMS in case of PR 106 whereas for Pusa Basmati 1, in 12 out of 16 cases the resistance was induced by gamma rays.

Table 2. Number of BB resistance lines and their segregation in M_2 generation

Varieties	Treatments	Gene action			Total
		Segregating 3:1	Non-segregating	Not clear segregation	
PR 106	EMS 0.25 %	5	0	0	5
	EMS 0.50 %	11	0	0	11
	Gamma rays 1Gy	2	0	0	2
	Gamma rays 2Gy	3	0	3	6
Pusa Basmati 1	EMS 0.25 %	2	0	0	2
	EMS 0.50 %	0	1	1	2
	Gamma rays 1Gy	1	0	0	1
	Gamma rays 2Gy	10	1	0	11
Total		34	2	4	40

Induced mutants have been used to develop new BB resistant gene(s) viz. *xa-nm(t)* by Nakai *et al.* [2] and *xa-19* by Taura *et al.* [4]. The productive BB resistant lines developed here were grown in plant-progeny methods by screening in every generation. Advanced lines are under field trial and would be used to study the genetics of the BB resistance or released as commercial cultivars for the farming community of this region.

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AN EXTRA EARLY MUTANT OF PIGEONPEA

The redgram (*Cajanus cajan* (L.) Huth) variety 'Prabhat DT' was gamma irradiated with 100, 200, 300 and 400 Gy doses. Several mutants have been identified viz., extra early mutants, monostem mutants, obcordifoliate mutants and bi-stigmatic mutants. The extra early mutant was obtained when treated with 100 Gy dose. The mutant was selfed and forwarded from M_2 to M_4 generation. In the M_4 generation the mutant line was raised along with the parental variety. Normal cultural practices were followed and the biometrical observations were recorded (Table 1). It was observed that for the characters viz., total number of branches per plant, number of pods per plants, seeds per pod, 100 seed weight and seed yield per plant there was no difference between the mutant and parent variety. Whereas, regarding the days to