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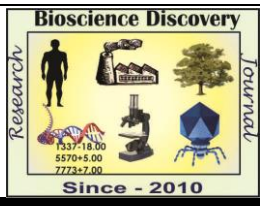

The induced mutagenic effects on yield contributing traits in French bean

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Abstract

French bean is a one of the important pulse crop. It is a rich source of proteins. In present investigations the effects of various doses of Gamma rays and various concentrations of Sodium azide and Ethyl methanesulphonate were studied in M_2 and M_3 generations on yield contributing characters of french bean. The different characters related to yield studied were number of pods per plant, pod length, number of seeds per pod and hundred seed weight. All the mutagens have shown negative and positive shifts in mean values for yield contributing traits. The present research work provides a base for selection and improvement of french bean for yield contributing traits.

INTRODUCTION

French bean is also popularly known by names such as kidney bean, common bean and navy bean (Singh, 1999; Pandey 2003). It is the third most important world-wide food legume. French bean is consumed largely as compared to other legumes. The green immature pods and matured seeds both are nutritionally rich. The yield is an important trait in any crop cultivation. Induced mutations are the best techniques to induce variability in yield contributing characters. The induction of micromutations in polygenic systems controlling the quantitative characters is important for crop improvement. Mutagenic treatments increase the genetic variability regarding yield traits, which can be utilized for selection and improvement of plants. This feature has been addressed by Palenzona (1966), Swaminathan (1963) and Scossiroli *et al.*, (1966) in different plants. Several researchers have studied various aspects of quantitative genetics. Some of the important ones in this field are Gustafsson (1963), Rawlings *et al.*, (1958), Blixt (1961) and Goud (1967). The induced mutations are also useful in inducing biochemical diversity in french bean (Mahamune *et al.*, 2017). Thus the present studies were undertaken to induce variability in yield contributing traits and improvement in productivity of french bean via selection.

MATERIALS AND METHODS

The seeds of french bean variety Varun (ACPR-94040) were procured from National Agricultural Research Project, Ganbeshkhind-7, Pune (M.S.) India for present research work. The healthy and dry seeds were subjected to mutagenic treatments. The physical mutagen gamma rays were employed to dry seeds of three doses 05kR, 10kR and 15kR. The chemical mutagenesis was carried out with the presoaked seeds by treating with Sodium azide (0.01%, 0.015% and 0.02%) and Ethyl methanesulphonate (0.05%, 0.10% and 0.15%). The mutagenized seeds were sown in the field following randomized block design (RBD) and M_1 generation was raised. Various morphological parameters were studied from M1 generation. The seeds were harvested separately on the plant basis. The separately collected seeds were sown to raise M_2 generation. The seeds of M_2 were collected and sown to raise M_3 generation.

The M_2 and M_3 populations were screened for quantitative traits contributing the yield characters. From each replication of every treatment including control, 30 plants were randomly selected for recording data on different yield contributing traits. The different traits studied were

Number of pods per plant: Total number of matured pods was counted for each plant separately and the average was recorded.

Pod length: Length of 10 pods from each plant was measured in cm and average was recorded.

Number of seeds per pod: Total number of seeds per plant was divided by total number of pods per plant to obtain a mean value of number of seeds per pod.

Hundred Seed weight: Twenty healthy seeds of each selected plant were weighed in grams and the weight of hundred seed was calculated. The mean for weight of hundred seeds of each population was recorded.

Biostatistical Analysis: All the quantitative characters were analyzed for the S.E. (Standard Error), mean and C.V. (Coefficient of Variation) by using the standard formulae based upon the total observation for each variable in M_2 and M_3 generations. Statistical analysis was performed by using standard formulae by Mungikar (1997). The shift in mean was also recorded for all the trait values. The detailed data regarding yield contributing traits is presented in tables 1 and 2.

Results and Discussion

Number of pods per plant (Tables 1 and 2): It is found from present study that all the mutagens succeeded in increasing the number of pods per plant significantly. All the highest concentrations/doses of the three mutagens showed significant increase in number of pods. Maximum mean number of pods per plant was observed at 0.15% EMS treatment. The character like number of pods per plant is important in deciding the yielding ability of plants. Increase in number of pods per plant directly contributes to better yield of plant. This was supported by Hakande (1992) in winged bean, Sagade (2008) in urdbean and Patil (2009) in cowpea. Maximum increase in number of pods per plant was observed at higher concentration of EMS in both M_1 and M_2 generations. Wani and Khan (2006) and Khan *et al.,* (1999) in mungbean also reported maximum increase in pod number at higher concentration of EMS.

Pod length (Table 1 and 2): In present investigations variability in pod length was observed. All the mutagens at lower concentrations/doses revealed significant increase in pod length in both M_2 and M_3 generations. Maximum reduction in pod length was found at 0.020% SA. Increase in pod length can contribute to higher seed yield by increasing number of seeds per pod. The mean pod length differed significantly from its mean in both directions, due to different mutagenic treatment. Most of the higher concentrations/doses of mutagens have decreased the mean pod length as compared to control. Similar findings were also reported earlier by Singh *et al.*, (2000) in urdbean and Sheeba *et al.,* (2003) in sesame.

Number of seeds per pod (Tables 1 and 2): Number of seeds per pod is a main character which affects the yield of plant. Plants containing pods with increased number of seeds may contribute to better yield. It is evident from pertinent observations that statistically significant increase in mean values for number of seeds per pod could be noticed in treatments of EMS (0.05%) and SA (0.010%) in M_2 and M_3 generations. Significant negative shift in mean could be observed at 0.020% SA treatment in M_3 generation. Data on number of seeds per pod obtained in present investigation revealed positive as well as negative shift in mean for all mutagenic treatments. Similar observations were recorded by Singh and Chaturvedi (1982) in mungbean. Increase in number of seeds per pod was mostly recorded at lower concentrations/doses of mutagens. Similar results were obtained by Waghmare and Mehra (2000) in grass pea and Odeigah *et al.,* (1998) in cowpea.

Hundred seed weight (Tables 1 and 2): The treatments of all the mutagens employed in present work succeeded in inducing variability regarding weight of hundred seeds. The range of shift in mean values was mostly positive for all the mutagenic treatments in M_2 and M_3 generations. EMS (0.10% and 0.15%), SA (0.010%) and gamma rays (10kR) showed significant positive shift in mean values in M_2 generation while significant positive shift in mean values could be observed only at 0.10% EMS and 10kR gamma ray treatments in M_3 generation. Significant negative shift in mean was noted in M_2 generation of only at 0.020% SA treatment. Increase in 100 seed weight as a result of treatment with mutagen was also reported by Kulthe and Kothekar (2011**)** in chickpea and Patil (2009) in cowpea.

The results regarding yield contributing characters reveals that the improvement in yield characters of french bean is possible through induced mutation breeding programme.

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Table 1: Effect of different mutagens on yield contributing traits in M_2 generation of French bean

Mutagen	Concentration (%) / Dose (kR)	No. of Pods/ Plant	Pod length cm	No. of seeds/ Pod	Hundred seed weight gm
Control	--	16.76	12.14	5.43	37.47
EMS	0.05	17.05	15.37**	7.17**	37.54
	0.10	12.97**	12.02	5.31	40.02**
	0.15	22.66**	11.73*	4.88	38.36**
SA	0.010	11.37**	16.14**	6.19**	38.41**
	0.015	16.98	11.66*	5.40	37.27
	0.020	22.55**	9.27**	4.94	36.68*
Gamma rays	05kR	17.10	13.30**	5.53	37.52
	10kR	13.82**	12.09	5.39	39.58**
	15kR	21.46**	12.15	5.47	37.29

*Significant at p=0.05 **Significant at p=0.01

Table 2: Effect of different mutagens on yield contributing traits in M_3 generation of French bean

Mutagen	Concentration (%) / Dose (kR)	No. of Pods/ Plant	Pod length cm	No. of Seeds/ Pod	Hundred seed weight gm
Control	--	17.60	12.76	5.58	38.28
EMS	0.05	18.06	16.12**	7.63**	38.83
	0.10	13.15**	12.31**	5.53	41.10**
	0.15	23.54**	11.96**	5.01	39.05
SA	0.010	11.30**	17.14**	6.75**	38.60
	0.015	17.78	11.40**	5.53	38.06
	0.020	23.25**	9.16**	5.00*	38.17
Gamma rays	05kR	18.15	13.93**	5.68	38.43
	10kR	14.52**	12.30**	5.63	41.02**
	15kR	22.70**	12.89	5.67	38.12

*Significant at p=0.05 **Significant at p=0.01

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