

MUTAGENIC EFFECT OF 6-AMINOPURINE (BASE ANALOGUE) ON THE QUANTITATIVE AND QUALITATIVE TRAITS OF *LINUM USITATISSIMUM* L.

Botany

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ABSTRACT

The present account deals with the mutagenic impact of 6-aminopurine (6-AP) on the qualitative and quantitative traits of *Linum usitatissimum* L. The experiment was conducted in 2015-16 cropping season to study the mutagenic effect of the mutagen. The seeds were treated with different concentrations of 6-AP i.e 0.10%, 0.25%, 0.50%, 0.75% and 1.0%. Mutation was reported in terms of morphological traits as well as high phenotypic alterations were recorded in plant height, number of seeds/plant, number of capsules/plant, number of seed/capsule and number of branches/plant while comparing it with control. According to the observations, the lower doses of mutagen were found to be more effective as compared to the higher doses. Therefore, low concentrations would be beneficial for plant breeders to induce desirable mutations for improving other useful characters in crop plants.

KEYWORDS

Linum usitatissimum, 6-aminopurine, concentrations, mutations

INTRODUCTION

Linseed (*Linum usitatissimum* L.) belongs to the family Linaceae. It is an annual oil crop that accounts for approximately 1% of the world's oilseed supplies. The plant is known to have medicinal importance and according to the recent studies, flax may reduce the risk of certain cancers like breast cancer, prostate cancer and colon cancer as well as cardiovascular diseases. Therefore, it provides scope to improve the crop through mutation breeding and has been used to accelerate the process of developing different agronomical traits for selection. The aim of this experiment was to induce mutations using 6-aminopurine (6-AP) to produce different traits in linseed for selection. Earlier researches have proved the effect of different physical and chemical mutagens on linseed. Sodium azide and EMS were found to affect the quantitative traits of *Linum usitatissimum* L. as studied by (Akhtar *et al.*2012). It has been observed that the micronutrients (Fe, Cu and Zn) were found to effect the quantitative enhancement in different traits of linseed plants (Rastogi *et al.*2014). Gamma rays and SA have effectively induced the mutation in the morphological traits of *Linum usitatissimum* L. (Alka *et al.*2013) and also affect the seed germination of *L. usitatissimum* L. variety Neelum (Abidi *et al.*1978). Induction of mutation using different concentrations of EMS to produce M2 plants for phenotyping and DNA extraction was studied by (Chantreau *et al.*2013). Therefore, 6-AP has been used to induce mutations as it is known for base pair transitions, to produce desirable mutants in successive generations.

MATERIALS AND METHODS

The experiment was conducted in the year 2015-2016, in the net house of the department of Botany, Aligarh Muslim University, Aligarh. Certified and healthy seeds of *Linum usitatissimum*, 50 in each set, were presoaked in distilled water at room temperature (25±1°C) for 12 hours. One set of seeds was soaked in distilled water to act as control. Mutagenic solutions were prepared in phosphate buffer of pH 7. After presoaking, the seeds were subjected to treatments in each concentration of 6-AP (0.10%, 0.25%, 0.50%, 0.75% and 1.0%) for 24 hours. After the treatment, seeds were washed in running tap water to remove residual mutagens adhered to the seed coat and then the treated as well as untreated seeds were sown in three replicates in the pots. The seeds were then collected separately for sowing in M2 generation. In the present experiment, the mutagen used is 6-aminopurine, a base analogue of adenine which causes A-T G-C and G-C A-T transitions. The chemical formula of 6-AP is given below.

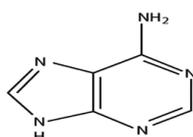


Figure 1 : Chemical structure of 6-Aminopurine (C₅H₅N₅)

RESULTS

By analyzing the effect of 6-AP on the observed parameters of *Linum usitatissimum*, it was concluded that the mutagen has immensely affect the qualitative as well as quantitative traits of the plant. According to the data given in Table 1, the seed germination was recorded 72% in control to 68% in mutant plant. The plant height of the mutant was increased to 75.20 cm as compared to the 70.60 cm in control. Number of branches per plant increased to 13.00 in mutant plant while it was decreased to 10.00 in control. Number of capsules per plant, number of seeds per capsule and total number of seeds per plant was reported 18.00, 11.00 and 88.00 as compared to the control where it was 14.00, 8.00 and 80.00 respectively. Table 2 shows the contrasting characters of the control plant to the mutant plant. Plant habit and growth pattern were same in both cases. However, mutant flower was found to be hexapetalous as compared to pentapetalous flower in control. Capsule size and seed size were normal in control while it was big in mutant. Seed color varies from brown in control to dark brown in mutant.

DISCUSSION

Mutagenesis is an abrupt and heritable genetic change, induced by chemical or physical agents (mutagens). They induce the morphological changes and enhance the yield parameters. In the present account, the mutations are caused due to the application of 6-AP, which causes slight reduction in germination rate but enhances other yield parameters like increased height, increased number of branches, increase in number of seeds, increased seed size and increase in total number of seeds per plant. The mutant was recorded at 0.25% dose of 6-AP. Lower doses of mutagen were found to be effective as it induces mutation which can be beneficial in producing desirable mutant. Induction of mutation leads to genetic variability in some economically important crops where crossing is difficult e.g wheat (Srivastava *et al.*2011). The selection of different traits viz. seed yield/plant, seed weight, seeds/capsule, capsules/plant, branches/plant, plant height etc. are likely to improve the performance of genotypes. These observations were conformed from the previous findings of (Tadesse *et al.* 2010), (Vardhan and Rao, 2012), (Bibi *et al.*2013), (Pali and Mehta, 2013). Similar mutagenic effect was observed by (More and Malode, 2016) on *Brassica napus* L.CV. Excel in M1 generation. Hydroxylamine and acridine (chemical mutagens) were found to be having highest inhibitory effect on germination and survival of plants whereas X-rays (physical mutagen) shows the same effect (Bhat *et al.*2016). Early maturing mutant in M2 generation of *Nigella* showed the potential effect of Caffeine for inducing mutation as studied by (Asif *et al.*2016). The linseed diversity in Ethiopia shows the substantial morphological variations in the germplasm showcasing the regional and altitudinal differences (Negash *et al.*2015) and the Ethiopian linseed accessions were found to be highly variable for producing the superior traits of high yielding cultivars (Ali *et al.*2014).

Flax has been considered as one of the potent dietary fiber which is gaining demands day by day. Consumption of 50g/day of flaxseed proved to be beneficial for human health. Therefore, production of linseed with enhanced characters will be possible by mutation breeding of crop plant at large scale.

CONCLUSION

It can be concluded that, the use of 6-AP was found to induce mutations to obtain desirable traits in linseed with improved commercial properties suitable for Indian agricultural landscape. Since the mutations were observed at the lower concentrations of 6-AP, it will prove to be beneficial for plant breeders to produce the crop with desirable yield traits using small amount of mutagen to enhance the productivity of crop plants.

Table 1: Effect of 6-AP on the quantitative traits of *Linum usitatissimum* L.

S.NO	TRAITS	CONTROL	MUTANT
1	Percentage Germination	72.00	68.00
2	Plant Height (cm)	70.60	75.20
3	Number of Branches/Plant	10.00	13.00
4	Number of Capsules/Plant	14.00	18.00
5	Number of Seeds/Capsule	8.00	11.00
6	Total Number of Seeds/Plant	80.00	88.00

Table 2: Effect of 6-AP on the qualitative traits of *Linum usitatissimum* L.

S.NO	TRAITS	CONTROL	MUTANT
1	Plant Habit	Erect	Erect
2	Growth	Normal	Normal
3	Flower	Pentapetalous	Hexapetalous
4	Capsule Size	Normal	Big
5	Seed Color	Brown	Dark Brown
6	Seed Size	Normal	Big

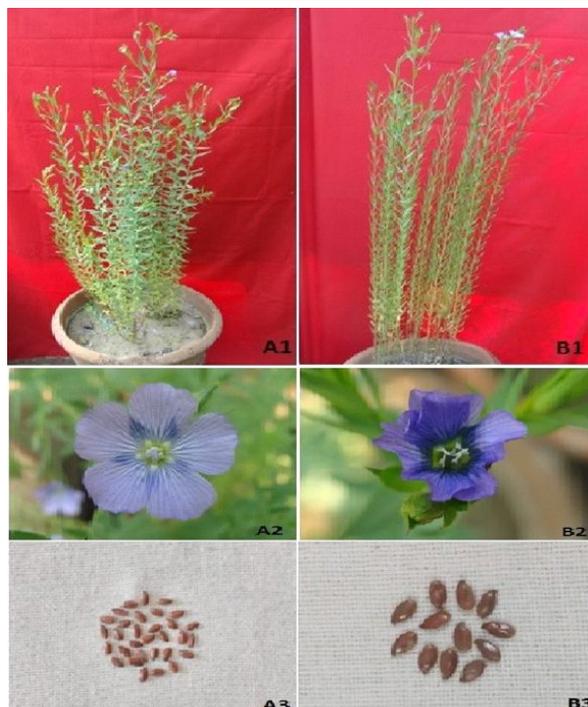


Figure 2: Mutagenic effect of 6-AP on the morphological characters of *Linum usitatissimum* L.

A1: Control Plant B1: Mutant Plant
 A2: Control Flower B2: Mutant Flower
 A3: Control Seeds B3: Mutant Seeds

ACKNOWLEDGEMENT

The authors are grateful to the chairman, Department of Botany, Aligarh Muslim University, Aligarh, U.P, India, for their contribution in carrying out this study.

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