Induction of a Novel, High Yielding Mutant of Pigeon Pea
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ABSTRACT
Pigeonpea [Cajanus cajan (L.) Millsp] is one of the major pulse crop of Maharashtra grown in Kharif season. It is cultivated in 35.54 lakh hectares in Maharashtra. In spite of its demand the yield of the pulse is low. In the present investigation an effort was made to improve the yield of the crop by mutation breeding. Germplasms of authentic sample of Pigeonpea (Var. ICPL-87) were procured from 'Pulses Improvement Division' of Mahatma Phule Agricultural University (M.P.K.V.), Rahuri, and District: Ahmednagar (Maharashtra). Seeds, presoaked in water for 12 hrs., were treated with different concentrations (10, 20, 30 and 40mM), of the chemical Mutagen, Ethyl Methyl Sulphonate (EMS) for 6 hrs., at 25 ± 2°C, followed by through washing under tap water. Presoaked seeds, untreated with EMS served as control. Both Control and EMS treated seeds were sown in the field to raise M, progeny. M, seeds, along with their controls were sown in next Kharif season to raise M, progeny. M, progeny plants were screened for Yield contributing traits like, Plant Height, Number of Branches per plant, Number of pods per plant, Pod length, Number of Seeds per Plant, 100 seed weight and Yield per Plant. M, Progeny were also screened for useful mutants. Results indicated that genetic variability in Yield contributing Traits, and viable mutants could be observed only at M, generation. The M, progeny raised from seeds treated with 40 mM concentration of EMS produced novel mutants showing two fold increases in number of branches per plant, number of Pods per plant and Yield per plant. This Mutant was named as High yielding (Robust) mutant. Differences observed between the High yielding (Robust) mutant and corresponding control plants and correlation between the parameters were discussed in the text. The High yielding (Robust) mutant seems to be very promising and can be release as variety after appropriate field tests.
KEYWORDS: Mutation Breeding, Pigeon Pea, Cajanus cajan

INTRODUCTION
Pigeonpea [Cajanuss cajan (L.) Millsp] is one of the major pulse crops of Maharashtra grown in Kharif season. It is cultivated in 35.54 lakh hectares with a production of 18.36 lakh tones in Maharashtra [1]. It is consumed as split Dhal, but is also consumed as green vegetable in many countries. Seed and fodder contains approx 20-22% protein. Seeds are rich in iron, iodine, and essential amino-acids like lycine, cystine and arginine. In spite of its nutritional importance, the yield of Pigeonpea is very low. Mutation breeding has become an alternative to conventional breeding since last three decades with the sole objective of developing better verities of economically important crops [2].Mutation breeding is one of the plant breeding techniques used for creating genetic variability in yield contributing traits and to improve the yield of crop plants [3]. In the present investigation, attempts were made to induce genetic variability in Yield contributing traits of Pigeonpea with an objective of isolating agronomically important, high yielding mutants, if any, at M, generation.

MATERIALS AND METHOD
The experimental material selected for the present study is Pigeonpea [Cajanuss cajan (L.) Millsp] var. ICPL-87. Germplasm of the variety was procured from 'Pulses Improvement Division' of Mahatma Phule Agricultural University (M.P.K.V.), Rahuri, (Maharashtra). The variety is a desi type; commercially and widely cultivated extensively in various parts of Maharashtra.

A chemical mutagen, Ethyl Methane Sulphonate (EMS), was used in the present investigation to induce genetic variability. Test solutions of different concentrations of EMS (10, 20, 30 and 40mM) were prepared in 0.1 M Phosphate buffer (pH 7.0). Two hundred fifty seeds were used for each treatment. The seeds were immersed in distilled water for 6 hours to initiate presoaking. The presoaked seeds were dried in blotting paper and later on
immersed in freshly prepared solutions of mutagens for 12 hours. The volume of mutagenic solution is about 5 times as that of seed for uniform absorption. The seeds treated with chemical mutagen were thoroughly washed under running water for 1 hr. The post soaking treatments were carried out to leach out the residual chemical. The treated and control seeds were dried in blotting paper. The 200 treated and control seeds were sown on the same day in well-prepared seed beds in the field. The seeds were sown in randomized block design (R B D) at a spacing of 20 cm. in rows of 5M long and 45 cm between rows.

Seeds from M₁ progeny were harvested separately and carefully from each treatments as well as control and sown for M₂ progeny. In M₂ progeny plants are carefully screened for Morphological mutations such as early mutant, high yielding (Robust) mutant, tall mutant, late maturing mutant etc.

**RESULTS**

Results indicated that all concentrations of EMS are effective in inducing genetic variability in yield contributing traits at M₁ generation in Pigeonpea. However, the 40 mM concentration of EMS was found to be very effective in inducing novel agronomically important, high yielding (Robust) mutant (Fig. 2).

![Fig. 2 Variation between the mutant and control. A- High yielding Robust Bushy Mutant, BControl](image)

![Fig. 3 Number of pods and branches per plant of control and high yielding mutant of Pigeon pea.](image)

The M₂ progeny raised from seeds treated with 40 mM concentration of EMS produced novel mutants showing two-fold increase in number of branches per plant (Table), number of Pods per plant (Fig. 3) and Yield per plant (Fig. 4). This Mutant was named as High yielding (Robust) mutant. Differences in yield contributing traits, observed between the High yielding (Robust) mutant and corresponding control plants are shown in the table. No significant difference in plant height, pod length, number of seeds per pod and hundred seed weight could be observed between the control and the mutant (Table).
Isolation of mutants of agronomic and economic significance was a major goal of mutation breeding [4]. In the present investigation we were able to isolate a mutant which is high yielding and agronomically significant. Similar agronomically important mutants in Pigeonpea were also reported earlier by [5, 6]. Our results clearly indicate that mutation breeding can be applied for inducing genetic variability in yield contributing traits and to change specific characters in otherwise good varieties by incorporating some useful changes such as, number of branches, pods per plant and yield per plant, in a comparatively shorter time than conventional breeding methods.

**DISCUSSION**

Isolation of mutants of agronomic and economic significance was a major goal of mutation breeding [4]. In the present investigation we were able to isolate a mutant which is high yielding and agronomically significant. Similar agronomically important mutants in Pigeonpea were also reported earlier by [5, 6]. Our results clearly indicate that mutation breeding can be applied for inducing genetic variability in yield contributing traits and to change specific characters in otherwise good varieties by incorporating some useful changes such as, number of branches, pods per plant and yield per plant, in a comparatively shorter time than conventional breeding methods.

**CONCLUSION**

In the present investigation an effort was made to improve the yield of Pigeonpea by mutation breeding. Seeds, presoaked in water for 12 hrs. were treated with different concentrations (10, 20, 30 and 40mM), of the chemical Mutagen, Ethyl Methyl Sulphonate (EMS) for 6 hrs., at 25 ± 2°C. Presoaked seeds, untreated with EMS served as control. Both Control and EMS treated seeds were sown in the field to raise M1 progeny. M1 seeds, along with their controls were sown in next Kharif season to raise M2 progeny. M2 progeny plants were screened for Yield contributing traits like, Plant Height, Number of Branches per plant, Number of pods per plant, Pod length, Number of Seeds per Plant, 100 seed weight and Yield per Plant. M2 Progeny were also screened for useful mutants.

The M2 progeny raised from seeds treated with 40 mM concentration of EMS produced novel mutants showing two fold increases in number of branches per plant, number of Pods per plant and Yield per plant. This Mutant was named as High yielding (Robust) mutant. Differences observed between the High yielding (Robust) mutant and corresponding control plants and correlation between the parameters were discussed in the text. The High yielding (Robust) mutant seems to be very promising and can be release as variety after appropriate field tests.

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