Studies on seed germination of blackgram (*Vigna mungo L.Hepper*) under EMS induced mutagenesis

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Abstract- The present study an attempt was made to determine the effect of the mutagen (EMS) on seed germination in blackgram mutation breeding program. The blackgram accession IC436585 was collected from NBPGR regional centre, Hyderabad was used in the present study. The results showed that the percentage (%) of seed germination in black gram, subjected to treatment with different concentrations of EMS is less than that of their Control. It is clearly indicates that the mutagen (EMS) have clearly exerted an inhibitory effect on seed germination. Percent of seed germination has decreased with an increase in concentration or dose of the mutagens (EMS). The results also revealed that the black gram cultivar was more sensitive to the mutagens EMS. The results also showed that the shoot and root length were decreased with an increase in concentration or dose of the mutagens (EMS). It may concluded that the blackgram genotype **IC 436585** may be germinated up to 0.3% EMS concentration to create variability in blackgram. Further variable lines are useful for crop improvement programe.

I. INTRODUCTION

Pulses are most important crops which provides higher proteins for the populations. Among pulses Blackgram (*Vigna mungo* (L.) Hepper) popularly known as urdbean, belongs to family Fabaceae. It is highly nutritious crop rich in seed protein content (24-28 per cent) and contributes 76 per cent carbohydrate, 3 to 5 per cent fibre, 1.74 per cent fat, vitamins like thiamine (B1), riboflavin (B2) and niacin (B3) and also rich in minerals like phosphorus, calcium, magnesium and potassium etc. (Elangaimannan *et al.*, 2008). This crop has an important role in meeting the dietary protein requirement, in particular, in South India where its products are daily used in different forms like idli, dosa and vada etc. The perusal of the statistics of blackgram showed that India is the largest producer in the world with an area of 5.28 million hectares with a production potential of 3.49 million tonnes and a productivity of 662 kg ha-1 (Indiastat, 2017 - 18). Among the pulses, blackgram ranks fourth in area and production after chickpea, pigeonpea and mungbean and is one of the most highly prized pulses of India. However, the average yield of blackgram is very low in comparison to major grain legumes like chickpea and pigeonpea. Hence, in view of its growing importance and its suitability to various cropping systems and nitches, the production potential of blackgram crop should be enhanced by developing high yielding genotypes. However, as the genetic variability is very low in this crop due to cleistogamous nature and narrow genetic base among the released cultivars, the progress of breeding programmes is not in pace with the growing demands. As the genetic variability is essential for any crop improvement programme, induced mutagenesis could be one of the viable options to bridge this gap. In order to induce variable mutaions both physical and chemical mutagens are most commonly used in crop plants. In mutation breeding, the success is highly proportionate to the choice of the genotype and the dose of the mutagen which are directly related to the production of desired mutants. The dose that leads to 50% lethality (LD50) has often been chosen for induction of mutations as the lower dose cannot cause mutation in seeds and the higher dose leads to death of the mutated seeds and other deleterious effects. Hence, understanding the sensitivity of genotypes to the mutagens and also determining the LD50 values of mutagens is highly useful for establishment of mutation breeding programme in a cost effective way.

Therefore, the present investigation was undertaken to study the sensitivity of two different blackgram varieties (LBG 752 and TBG 104) to gamma rays, EMS (EthyMethane Sulphonate) and MH (Maleic Hydrazide) treatments in M1 generation by considering the effects of mutagens on traits like germination, shoot length and root length and to determine the LD50 value for different mutagens by probit analysis. Hence, in the present study an attempt was made to determine the LD50 and the GR50 in determining the effect of the mutagens in blackgram mutation breeding program.

II. EXPERIMENTAL METHODOLOGY

The research work entitled with' **Studies on seed germination in blackgram (*Vigna mungo* L. Hepper) under EMS induced mutagenesis'** was carried out at Department of genetics, Osmania University, Hyderabad during in the month of Febrauary, 2021. The blackgram accession IC436585 was collected from NBPGR regional centre, Hyderabad was used in the present study. Healthy and uniform size of blackgram (IC 436585) seeds (75) were surface sterilized with 0.1% mercuric

chloride solution for about one minute, washed thoroughly and soaked for 5 hrs in distilled water and treated with EMS in five different concentrations *viz.*, 0.1, 0.2, 0.3, 0.4 and 0.5% and keep above five sets in incubator shaker (25 ± 1 °C) for 2 hrs. After two hrs, the seeds were thoroughly washed in running tap water to remove the residual mutagen from seed surface. Fifteen treated seeds of each concentration were placed in Petri plate in three replication along with untreated seeds for germination test. The germination was observed on the 6th day after treatment while shoot and root length of seedling was recorded on the 12 day.

III. Results and Discussion

Effect of different concentration of EMS on biological parameters such as seed germination, shoot and root length (cm) were studied. The results obtained are as follows. The percent seed germination in black gram, subjected to treatment with different concentrations of EMS is less than that of their Control. It is clearly indicates that the mutagen (EMS) have clearly exerted an inhibitory effect on seed germination. Percent of seed germination has decreased with an increase in concentration or dose of the mutagens (EMS). The percent of seed germination was 93.33% in Control of black gram. Maximum decrease in percent seed germination was observed with EMS (0.4 and 0.5%) (Fig.1).Thus 0.4 and 0.5% dose of EMS seemed very effective in reducing percent seed germination in black gram. The results also revealed that the black gram cultivar was more sensitive to the mutagens EMS.

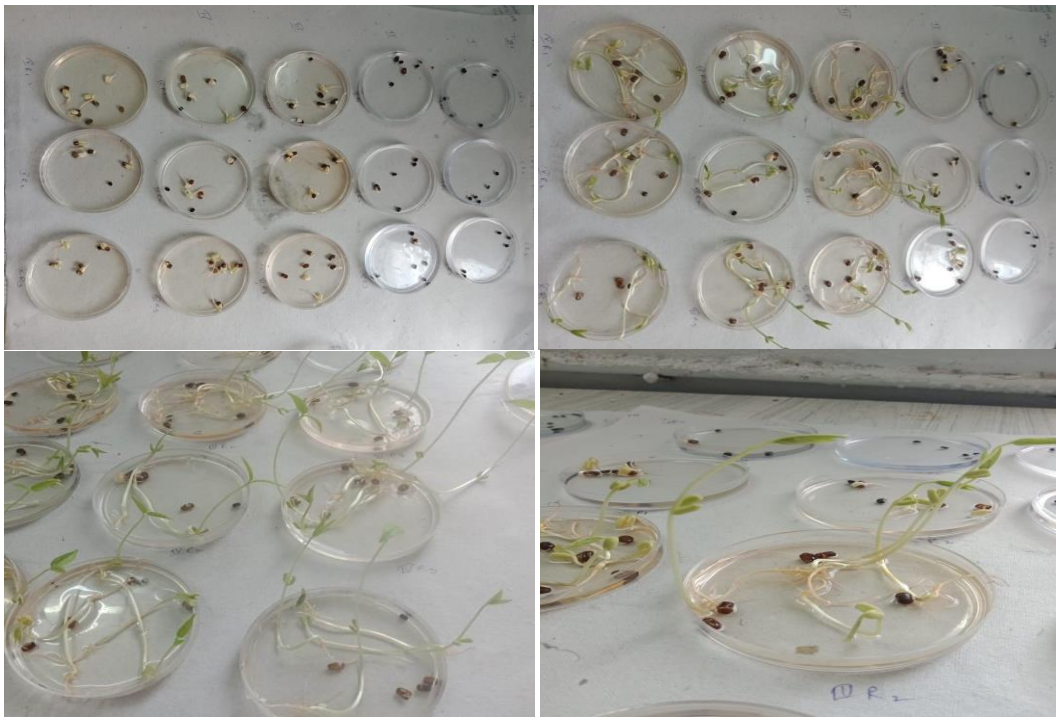

Fig.1. Germination of blackgram seeds induced by EMS mutagen

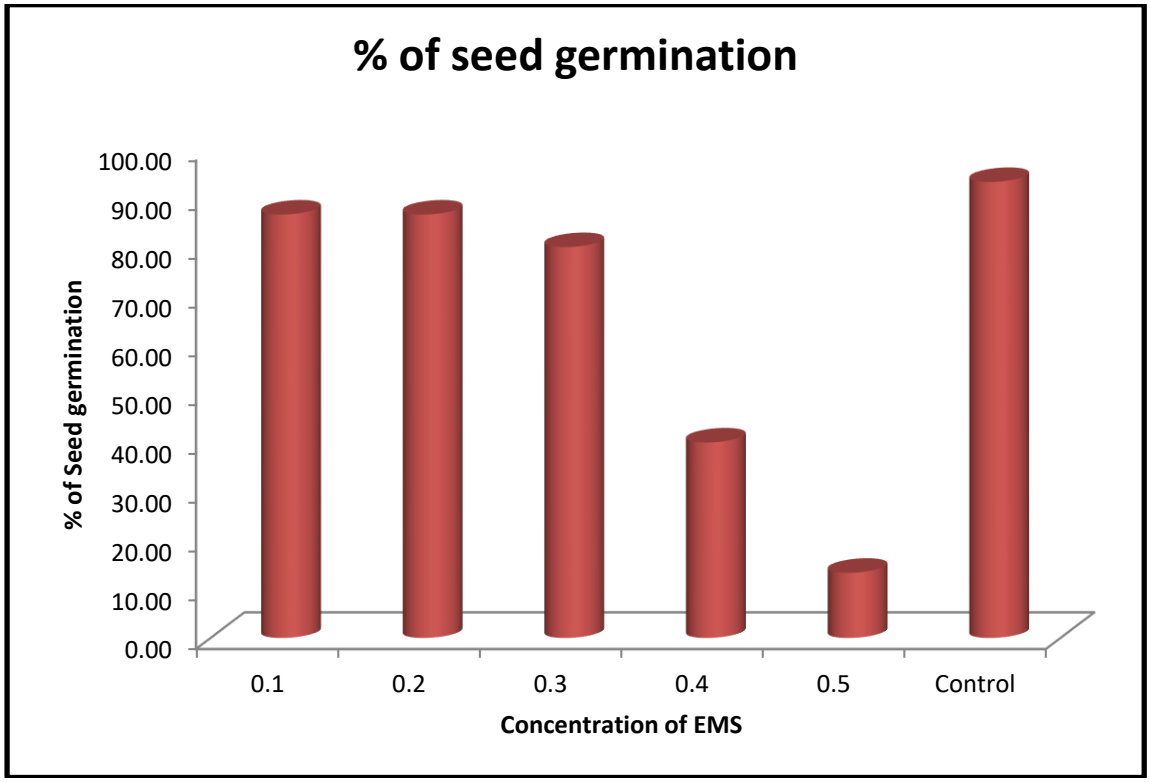

Fig.2. Graphical presentation germination percentage of blackgram seeds induced by EMS mutagen

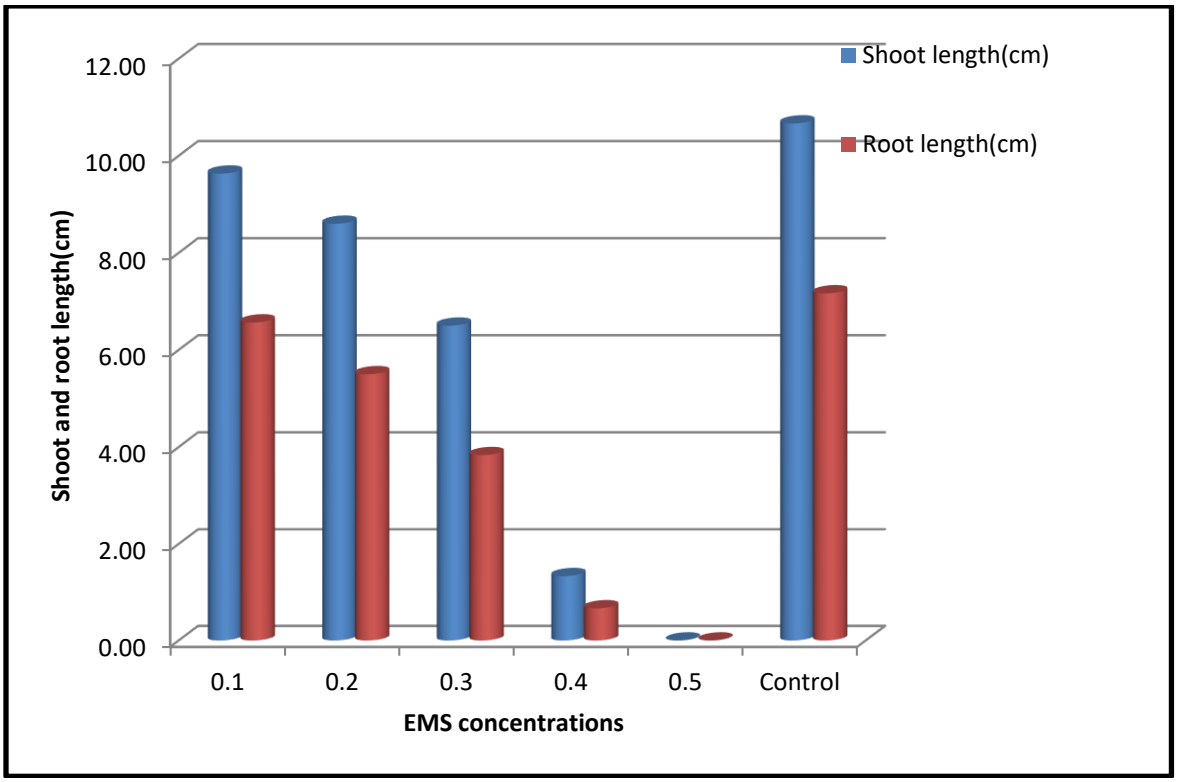

Fig.3. Graphical presentation of shoot and root length (cm) of blackgram induced by EMS mutagen

The results also showed that the shoot and root length were decreased with an increase in concentration or dose of the mutagens (EMS). The maximum shoot (9.63cm) and root length(6.57cm) were observed at 0.1% of EMS (Fig.2). Maximum decrease shoot and root length was observed with EMS (0.4 and 0.5%). The perusal of the results suggested that as the dose of mutagen was increased, the germination percent was reduced with impact more conspicuous at higher doses as compared to lower doses of gamma rays and EMS. The impact of germination could be attributed to damage in the seeds at the time of cell division in

the meristemic activity during the process of germination. The similar results have reported by Singh and Chaturvedi, 1980; Khan and Goyal, 2009 and Thanga, 2015 in *Vigna radiata*; Solanki and Sharma, 1994 in lentil; Sagade and Apparao, 2011, Dhasarathan *et al.*, 2014 and Ramya *et al.*, 2014 in *Vigna mungo*; Ariraman *et al.*, 2014 in *Cajanus cajan*; Umavathi and Mullainathan, 2014 in *Cicer arietinum*; Dhulgande *et al*., 2015 in *Pisum sativum*; and Aparna *et al.*, 2013 in *Arachis hypogaea*. The reduction in radical length recorded in laboratory study has been attributed to change in levels of auxin and absorbic acid and to physiological and biochemical disturbance or chromosomal aberrations, changes in enzymatic activity, and impaired mitosis in the meristemic zone of growing seedlings. It might be due to decrease in respiratory quotient in the seedlings obtained from treated seeds. The similar results for radical length are also reported earlier by Sujay and Singh, 2001 and Thanga, 2015 in *Vigna radiata*; Rajiv Kumar *et al.*, 2008 in *Cyamopsis tetragonoloba*; Patel, 2008 in *Macrotyloma uniflorum*. Speed of germination decreased with increased dose of the mutagenic concentration this type of result obtained because of decrease in germination per cent with increased dose of mutagenic concentration. The impact of germination could be attributed to damage in the seeds at the time of cell division in the meristemic activity during the process of germination. The results are in accordance with the results of Aparna *et al.*,2013 in *Arachis hypogaea.*

IV. Conclusion

The results indicated that the blackgram genotype IC 436585 may be germinated up to 0.3% EMS concentration to create variability in blackgram. Further variable lines are useful for crop improvement programs.

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