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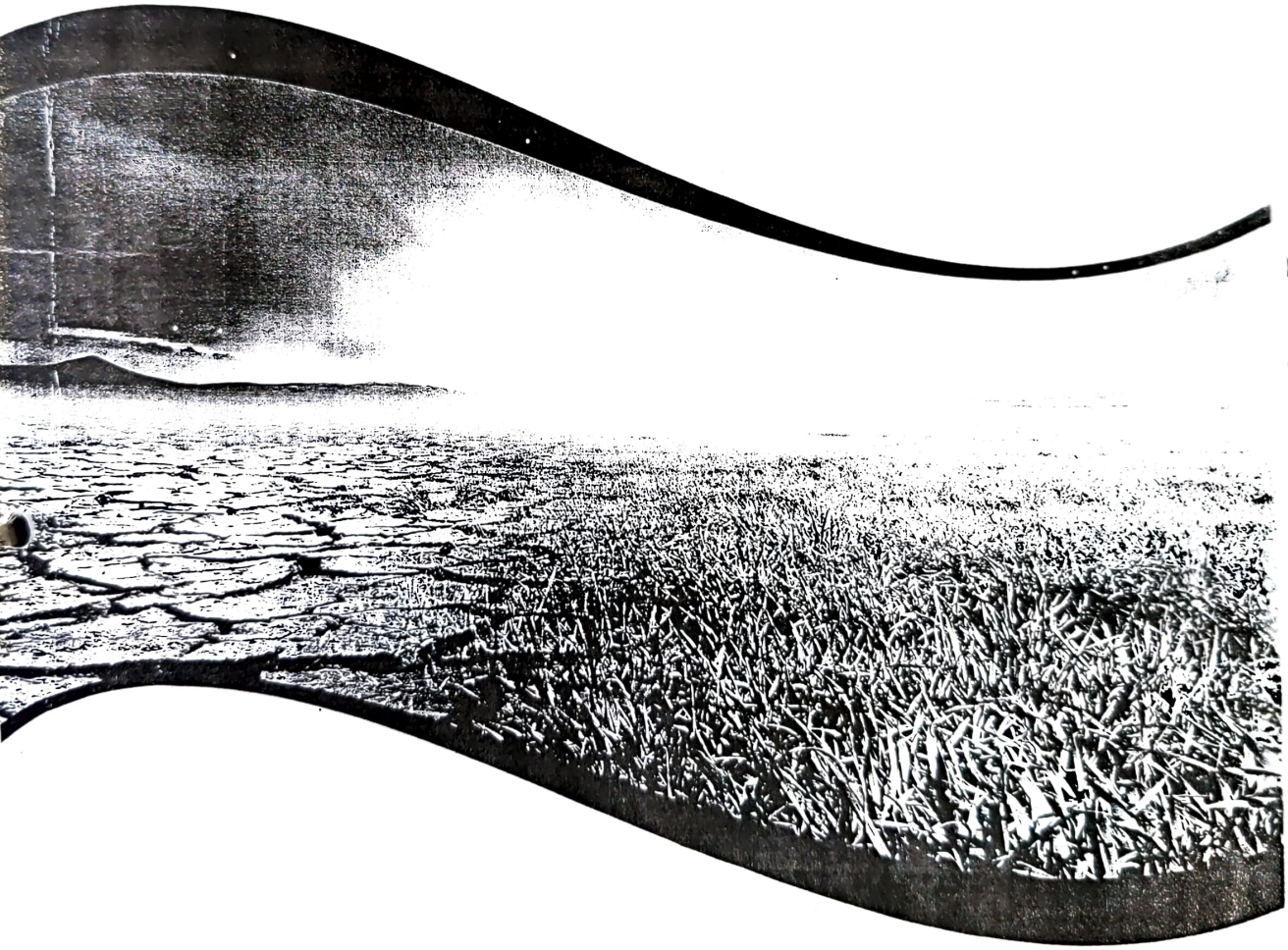

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Effect of Mutagens on Pollen Sterility of Cluster Bean *(Cyamopsis Tetragonoloba* (L.) Taub.)

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Abstract

In the present study two varieties of cluster bean, namely, Golden Early – 36 (GE-36) and Harit Rani (HR) were used to induce genetic variability. For present study physical mutagen like Gamma rays (5kR, 10kR and 15kR) and two chemical mutagens, namely, ethyl methanesulphonate (EMS) of different concentrations such as 0.05%, 0.10% and 0.15% and sodium azide (SA) of concentrations such as 0.01%, 0.02% and 0.03% were tried. Seeds from each treatment were sown in field following randomized block design (RBD) with three replications along with control as the M1 generation. Further two consequent generations were taken, M2 and M3 generations respectively. In M1generation pollen sterility was studied. The pollen sterility increased in varieties GE-36 and HR with increasing concentrations/doses of EMS, SA and Gamma rays. In GE-36 it was 04% and HR it was 05 %. The maximum pollen sterility in GE-36 was seen in EMS at 0.15% concentration of 20% and in HR it was seen in EMS (0.15% concentration) and Gamma ray for 15kR dose of 18%.

Key words: Mutagens, Pollen sterility, Cluster bean.

Introduction

Cluster bean is also called as guar. The word "GUAR" represents a derivation from the Sanskrit word "GAUAAHAR" which means cow fodder or fodder of live stock. Basically cluster bean is a drought hardy, deep rooted annual legume. The crop is mainly grown in the dry habitats of Rajasthan, Haryana, Gujarat and Punjab. In addition to its major cultivation in India, the crop is also grown as a cash crop, although to limited extent in other parts of the world like Australia, Brazil and South Africa. The crop is known for its exceptionally high adaptation towards poor and erratic rains, multiuse in cropping system, in industrial use in many ways besides other social and dietary uses. These qualities have made it most the favored crop of marginal farmers in arid areas.

Mutation breeding in crop plants is an effective tool in hands of plant breeders especially in crops having narrow genetic base. Many mutants have been identified as donors of desirable traits in breeding program. Mutation breeding work in soybean crop has yielded in identification of many mutant lines with desirable traits. Variations in M1 generation, though less important in view of obtaining stable gene 2 mutations,

are often considered as indicators in measuring efficiency of mutagen treatments (Plesnik, 1993). Also, pollen sterility is used for calculating the mutation index which is a good indicator to forecast the spectrum of genetic variability that can arise from the mutated sectors. The present investigation was, therefore, initiated to study the effect of physical (gamma rays) and chemical (EMS and Sodium azide) mutagenic treatments on some quantitative traits at different doses of two varieties of Cluster bean Golden Early -36 and Harit Rani.

Material and Method

The seed material of two varieties of cluster bean (*Cyamopsis tetragonoloba* (L.) Taub.) namely, Golden Early 36 and Harit Rani obtained from Golden Seeds Pvt. Ltd, Bangalore, Karnataka and Navalakha Seeds Pvt. Ltd, Pune have been used in the present study. The chemical mutagens namely ethyl methanesulphonate (EMS) and sodium azide (SA) and physical mutagen Gamma rays were used in the present study. The different concentrations used for the chemical mutagenic treatments were 0.05%, 0.10% and 0.15% for EMS and 0.01%, 0.02% and 0.03% for SA. While for the physical mutagen the doses given were 5kR, 10kR and 15kR, respectively. The seeds which were given physical mutagenic treatment were sown in field immediately. . Immediately after the completion of treatment, the seeds were washed thoroughly under tap water. Later on seeds with chemical mutagenic treatment were kept for post soaking in distilled water. For each treatment a batch of 300 presoaked seeds was used. 50 seeds from each treatment were dried between the folds of filter paper and germinated in petridishes to record germination percentage. The remaining 250 seeds from each treatment were sown in field following randomized block design (RBD) with three replications along with control as the M1 generation.

For study of pollen sterility, flower buds were collected from 10 randomly selected plants belonging to each treatment. The pollen grains from freshly dehisced anthers were fixed in Carnoy's fluid (absolute alcohol: chloroform: acetic acid, 6:3:1 v/v) for 24 hours after which they were stored at 4! and later stained with 1% acetocarmine. Slides were prepared by the squash technique and stained with 1% acetic carmine. Ten slides per treatment were evaluated and sterile pollens were counted and averaged. Pollen grains that stained fully were counted as fertile, while the empty, partially stained and shriveled ones were counted as sterile.

Results and Discussion

A trend towards increased pollen sterility with increasing concentrations/ doses of mutagens could be observed in GE -36 and HR. In case of control 04% pollen sterility in GE-36 and 05% pollen sterility in HR could be recorded. The maximum pollen sterility (20%) could be seen at 0.15 % EMS in variety GE-36, while in variety HR the maximum pollen sterility (18%) could be seen at 0.15% EMS and 15kR gamma ray treatments.

The pollen sterility ranged from 6% to 20% and 8% to 18 % after EMS, from 14% to 18% and 10% to 16% after SA and from 12% to 18% and 10 to 18% after the Gamma ray treatments in GE-36 and HR varieties of cluster bean(Table 1 and 2).

Table 1: Effect of mutagens on pollen sterility in M_1 generation of *Cyamopsis tetragonoloba* (L.) Taub. variety GE- 36.

Treatment	Concentration (%)/ Dose	Pollen sterility %	± SE
Control	--	04	0.182
EMS	0.05	06	0.389
	0.10	10	1.047
	0.15	20	1.362
SA	0.01	14	1.962
	0.02	16	2.342
	0.03	18	2.524
Gamma rays	5kR	12	2.645
	10kR	14	2.669
	15kR	18	2.716

Table 2: Effect of mutagens on pollen sterility in M_1 generation of *Cyamopsis tetragonoloba* (L.) Taub. variety HR.

Treatment	Concentration (%) / Dose	Pollen sterility %	± SE
Control	--	05	**0.365**
EMS	0.05	08	**0.779**
	0.10	10	**0.981**
	0.15	18	**1.338**
SA	0.01	10	**1.465**
	0.02	14	**1.544**
	0.03	**16**	**1.721**

Gamma rays	5kR	10	1.800
	10kR	16	1.742
	15kR	18	1.704

SE = Standard Error

The pollen sterility increased in varieties GE-36 and HR with increasing concentrations/doses of EMS, SA and Gamma rays. According to Sparrow (1961) the mutagenic treatment reduces the reproductive capacity causing severe stunting or inhibition of growth, sterile flowers, abortive pollen or embryo. These may be the consequences of chromosomal/ gene mutations, cytoplasmic mutation and physiological effects which might together contribute to pollen sterility.

Pollen sterility which is an index of disruption in reproductive mechanism, increased with an increase in dose of gamma rays in chilli (Ramana Rao et al., 1991). Nandpuri et al., (1971) reported increased pollen sterility with an increase in dose of mutagen in okra. The gamma rays produced more effect than EMS in terms of pollen sterility in okra (Jehangir and Chandrashekharan, 1978).

Sato and Gaul (1967) have divided the pollen sterility induced by EMS in three categories namely, 1) chromosomal, 2) genic and 3) purely physiological.

Singh and Chaudhary (1972) observed increased pollen sterility in cluster bean and stated that poor growth, chlorophyll deficiencies and chromosomal abnormalities could be the probable reasons for the pertinent development.

Induction of pollen sterility through chemical mutagens has been reported by Gohal et al., (1970), Kothekar (1978), More (1992), Satpute (1994), Rayyan (1995), Bale (1999) and Gaikwad (2002) in different plant systems.

According to Nilan, (1964), gross injury due to gene controlled biochemical processes or acute chromosomal aberrations or both may be the reasons for pollen sterility. Wanjari and Kutarekar (1977) stated that the major cryptic changes in meiosis due to mutagenic treatments can be implicated for pollen sterility.

Sudhakaran (1971) has concluded that the pollen sterility might represent the cumulative result of aberrant meiotic stages as well as physiological and genetic effects.

Conclusion

A general trend towards increased pollen sterility with increasing concentration/dose of the three mutagens could be observed in variety GE-36 and HR of cluster bean.

References

1) **Plesnik, S. (1993):** The evaluation of some quantitative traits in M1 generation in soybean after laser emission and ethylenemine treatment. Acta Facultatis rerum naturalism universitiatis comenianae. Genetica et biologia molecularis. 25-25: 105-113.

2) **Sparrow A.H. (1961):** Radiation sensitivity of cells during mitotic and meiotic cycle with emphasis on possible changes. *Ann. N. Y. Acad. Sci.* 51:1508-1540.

3) **Ramanna Rao, Rao Y.V., Ravindra Babu. M.V.B., Kumar Rama. V. and Subramanyam D. (1991):** Efficiency and effectiveness of physical and chemical mutation in M2 generation of chilli. *Nuclear Agric. Biol.* 20(4): 255-259.

4) **Nandpuri K. S., Sandhu K. S. and Randhava K. S. (1971):** Effect of irradiation on variability of okra (*Abelmoschus esculentus* (L) Moench). *J. Res. P. A. U.* 8 183-188.

5) **Jehangir K. S. and Chandrashekharan P. (1978):** Competitive mutagenic effects of gamma rays and diethyl sulphate in bhindi. Madras, *Agri. J.* 65 (4). 211-217.

6) **Sato L. and Gaul H. (1967):** Effect of ethyl methanesulphonate on fertility in barley. *Rad. Bot.* 7:7-14.

7) **Singh B.P. and Choudhary J.B. (1972):** Studies an irradiated Gaur. *The Nucleus.* 15(1): pp. 16-22.

8) **Gohal M. S., Kalia H.R., Dhillon H. S. and Negi K. S. (1970):** Effect of ethyl methanesulphonate on the mutation spectrum in Guar. *J. Heredity.* 2: pp 51-54.

9) **Kothekar V.S. (1978):** Mutational studies in *Solanum nigrum* L. Ph.D. Thesis, University of Nagpur.

10) **More A. D. (1992):** Cytogenetical Studies in *Medicago sativa* L., Ph.D. Thesis, Marathwada. University, Aurangabad, India.

11) **Satpute R.A. (1994):** Mutational studies in Safflower (*Carthamus tinctorius* L.) Ph.D. Thesis, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, MS, India.

12) **Rayyan Asra (1995):** Mutagenesis and tissue culture studies in *Vigna mungo* (L.) Hepper. Ph. D. Thesis, Osmania University, Hyderabad.

13) **Gaikwad N. B. (2002):** Genetic improvement of lentil through mutagenesis Ph.D. Thesis, Dr, Babasaheb Ambedkar Marathwada University, Aurangabad.

14) **Nilan R.A. (1964):** Factors governing plants radio-sensitivity. Proc. *Atomic Energy Comm.* Report II, pp -7512: 151-162.

15) **Wanjari K. B. and Kutarekar D. R. (1977):** Study of M1 parameter in different treatment of gamma rays and chemical mutagens in *Sorghum. J. Cytol. Genet.* 12: 55-61.

16) **Sudhakaran I. V. (1971):** Meiotic Abnormalities Induced by gamma rays in *Vinca rosea* Linn. *Cytologia.* 36: 67-79.