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Effect of EMS and SA on the frequency and spectrum of viable mutants in winged bean (*Psophocarpus tetragonolobus* (L.) DC.

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Abstract

Winged bean (*Psophocarpus tetragonolobus* (L.) DC.) appears to be a promising future legume crop for the tropics due to its nutritional value. For larger scale cultivation, development of promising mutants would be necessary. By keeping this view in mind, the seeds of winged bean variety II-EC-178313 and 2I-EC-38825 were treated with chemical mutagens like Ethyl methane sulfonate (EMS) and Sodium azide (SA) separately. Mutagenic treatments resulted in induction of nine types of viable mutants in M_2 generation of both the varieties of winged bean. These viable mutants are early flowering, late flowering, early maturing, *Chlorina*, linear leaflet, flat pod, long pod, anthostem and high yielding.

Keywords: Winged bean, EMS, SA, Mutants, Linear leaflet.

Introduction

It has become necessary to study in depth the neglected or little known legume species which are underexploited but which possess great potential for contributing to not only protein rich food for humans but also excellent quality feed and forage for animals. Among such group of plants the "Winged bean" (*Psophocarpus tetragonolobus* (L.) DC.) stands outstanding. Due to the extraordinary potentials of winged bean as a highly productive and nutritive food, feed, and forage crop, many developing nations like the Philippines, Papua New Guinea and Srilanka have already designated it as the priority crop NAS (1981). Winged bean is often known as wonder legume because all parts of the plant are edible ie. Seeds, root tubers, leaves and flowers. The seeds which are very similar nutritionally to soybeans, have the advantage that they have pleasant sweet flavour in contrast to the rather bitter flavour of the soybean. The seeds are similar in composition to soybean averaging 20% edible oil with a good proportion of polyunsaturated fatty acids Claydon (1979) and Haq (1982). Another interesting feature of the crop is the high protein of the seeds and root tubers which could help alleviate protein deficiency in local diets.

Though winged bean shows immense potential for food, feed and forage however it possess few shortcomings that are obstructing the wide scale popularization and ready usage. The shortcomings like labour intensive nature of the crop, relatively long duration of its life cycle and the presence of antinutritional factors in its seeds tubers. Thus in present investigation, strategy has been formulated for inducing mutations in winged bean with reference to early maturity, yield potential and quality aspects of leaf/seed proteins and seed oil in different mutants of

that plant. The effect of different mutagens will be assessed through M_1, M_2, and M_3 generations and the promising mutants will be evaluated for their combining abilities so as to involve them in cross breeding programme of winged bean.

Materials and Methods

For the present studies, the seeds of winged bean (*Psophocarpus tetragonolobus* (L.) DC. variety II-EC-178313 and 2I-EC-38825 were obtained from the National Bureau of plant Genetic Resources, Regional station, PKV, Akola, Maharashtra.

Details of mutagenic treatments

Prior to mutagenic treatment seeds were immersed in distilled water for 6 hours. The presoaking enhances the rate of uptake of the mutagen through increase in cell permeability and also initiates metabolism in the seeds for treatment. Such presoaked seeds were later on immersed in the mutagenic solution for 6 hours with intermittent shaking. Seeds soaked in distilled water for 12 hours served as control.

The different concentrations used for the chemical mutagenic treatments were 0.05%, 0.10% and 0.15% for EMS and 0.01%, 0.02% and0.03% for SA, respectively. Immediately after the completion of treatment, the seeds were washed thoroughly under running tap water. Later on they were kept for post soaking in distilled water for 2 hours. After the completion of treatment process, the seeds were sown in field following randomized block design (RBD) with three replications along with control as the M_1 generation. Seeds were harvested separately from each plant of M_1 progenies, stored in polythene bags and used for M_2 generation.

Selection of viable mutants

Collected seeds were sown to raise M_2 generation and the population was screened keenly for selection of different types of viable mutants. The frequency and the spectrum of mutations were calculated.

Results and Discussion

A wide range of viable mutants could be seen in the M_2 generation of both the varieties of winged bean. These viable mutants are early flowering, early maturing, *chlorina*, linear leaflet, flat pod, long pod, anthostem and high yielding.

In case of EMS treatment, the frequency of viable mutants demonstrated the highest values at the middle (0.10%) concentration in variety II-EC-178313 and variety 2I-EC-38825 of winged bean. In SA treatment, the maximum frequency values could be noted at 0.02% concentration in both the varieties of winged bean.

The highest frequency (22.89%) was found to be induced by 0.02% concentration of SA in variety II-EC-178313, while the lowest value (12.69%) was observed at the 0.15% concentration of EMS in variety 2I-EC-38825. However the frequency values showed a variable features in both the varieties of winged bean. The relative percentage of individual mutant type was found to be random in the two mutagenic treatments in case of both II-EC-178313 and 2I-EC-38825 varieties of winged bean (**Table-1and 2**).

Table 1: Effect of EMS on the frequency and spectrum of viable mutants in M_2 generation of *Psophocarpus tetragonolobus* (L.) DC.

Variety	Conc. %	Freq. of viable mutants %	Spectrum and relative percentage of viable mutants								
			Early flowering	Late flowering	Early maturity	*Chlorina*	Linear leaflet	Flat Pod	Long pod	Antho stem	High yielding
II-EC-178313	0.05	18.26	17.41	15.37	6.62	7.97	18.42	14.19	8.09	7.47	4.46
	0.10	21.34	18.39	24.07	12.54	9.52	6.11	15.86	5.00	5.63	3.42
	0.15	14.20	16.82	12.92	19.13	10.23	11.32	13.00	3.44	8.06	5.08
2I-EC-38825	0.05	17.54	18.24	16.33	13.36	13.21	7.63	13.34	8.09	6.62	3.18
	0.10	19.67	16.59	20.14	16.20	7.92	11.25	12.37	5.13	5.12	5.28
	0.15	12.69	15.82	17.32	17.24	6.39	16.66	15.53	4.11	3.14	4.79

Table 2: Effect of SA on the frequency and spectrum of viable mutants in M_2 generation of *Psophocarpus tetragonolobus* (L.) DC.

Variety	Conc. %	Freq. of viable mutants %	Spectrum and relative percentage of viable mutants								
			Early flowering	Late flowering	Early maturity	*Chlorina*	Linear leaflet	Flat Pod	Long pod	Antho stem	High yielding
II-EC-178313	0.01	17.56	21.29	18.59	15.21	14.18	16.27	3.87	5.46	2.02	3.11
	0.02	22.89	22.14	19.16	14.22	9.08	14.10	9.07	2.14	6.56	3.57
	0.03	16.11	15.67	15.73	13.50	19.54	12.11	5.44	3.21	7.38	7.42
2I-EC-38825	0.01	19.23	21.21	17.41	14.27	15.05	16.37	4.48	5.12	2.04	4.06
	0.02	22.31	23.17	18.74	12.45	9.09	15.45	8.49	4.18	2.08	6.32
	0.03	15.00	16.19	19.85	9.82	17.38	14.53	10.15	3.09	2.11	6.88

The frequency of viable mutants revealed an increasing trend with an increase in concentration of EMS/SA except at the higher concentration of mutagens. Several researchers have reported induction of viable mutants in leguminous and other plants, namely, Gregory (1968) in peanut, Blixt (1972) in pea, Thakare and Pawar (1990) in Urdbean and Datta and Laxmi (1992) in fenugreek.

In the present investigation quite a good number early flowering mutants have been observed in M_2 generation of winged bean. The features like early flowering and ripening have always been given paramount importance while planning the breeding strategies in almost all crop plants. However, late flowering and late maturing mutants have also been recorded. The early flowering mutants have been reported in several plants by different workers, such as Zacharias (1956) in soybean, Down and Anderson (1956) in bean, Carpenter (1958) in clover and Kothekar and Kothekar (1992) in moth bean. Researchers like Khuspe and Ugale (1977), Deshpande (1980) and Satpute (1994) have recorded late flowering mutants in different crop plants.

The early maturing feature in the present investigation may be correlated with reduction in days to attain pod maturity by these mutants. Early maturing mutants have also been recorded by Prasad (1967) in *Vigna radiata* and Kaul (1977) in *Pisum sativum.*

In M_2 generation, the viable chlorophyll mutant such as *Chlorina* have been observed. It grows well and developed pods with well filled seeds, but its yield is quite less. Similar type of *Chlorina* mutant have been recorded earlier by Hankande (1992) in winged bean. Another mutant such as linear leaflet were recorded from M_2 generation. The high yielding mutant was also noted from M_2 population of winged bean. Earlier similar type of mutant were obtained by Dahiya (1973) with gamma rays and Bhatnagar et al. (1979) reported an early, high yielding mutant in *Cicer arietinum.*

The mutants such as long pod and flat pod could be recorded in M_2 generation. Earlier Hakande (1992) was successful in inducing long pod and flat pod mutants with NEU and EMS respectively. In the present investigation both the varieties showed a marginal difference in their response towards the mutagens pertaining to the frequency of viable mutants.

Conclusion

Among the mutants discussed above, the early flowering, early maturing and high yielding mutants seem to be the most promising one. Such mutants can be exploited from the commercial point of view.

References

Blixt S. (1972): Mutation genetics in *Pisum*. Agric Hort. Genet. 21: 178-216.

Bhatnagar C.P., Luthra J.P., Anand Kumar and Avanti A.K. (1979): An early high yielding mutant in gram (*Cicer arietinum* L.). In: "The Role of Induced Mutations in Crop Improvement". Proc. DAE Symp., PP 184-187.

Claydon A.(1979): The use of legumes as sources of edible oil (with special reference to winged bean) In : Legumes in the Tropics, Kwala-Lumpur (Proc. Symp.), PP 473-477.

Carpenter J.A. (1958): The induction of mutation in subterranean clover by X- irradiation. J. Australian Inst. Agric. Sci. 24: 39-44.

Deshpande N.M. (1980): The effect of gamma rays and chemical mutagens in *Momordica charantia* L. Ph.D. Thesis, University of Nagpur.

Dahiya B.S. (1973): Improvement of mung bean through induced mutations. Ind. J. Genet., 33: 460-468.

Datta S.K. and Laxmi V. (1992): Induced morphological mutations in Fenugreek. J. Indian Bot. Soc. 71: 65-68.

Down E.E. and Anderson A.L. (1956): Agronomic use of X-ray induced mutants. Science, 124: 223-224.

Gregory W.C. (1968): A radiation breeding experiment with peanuts. Rad. Bot. 8: 81-147.

Haq N. (1982): Germplasm resources, breeding and genetics of the winged bean. Z. Pflanzenzucht, 88: 1-12.

Hakande T.P. (1992): Cytological studies in *Psophocarpus tetragonolobus* (L.) DC. Ph.D. Thesis, Marathwada University. Aurangabad, MS. India.

Kothekar A.V. and Kothekar V.S. (1992): Promising mutants in moth bean. Marathwada University J. Sci., 19: 1-2.

Khuspe S.S. and Ugale S.D. (1977): Effect of CO60 and ethyl methanesulfonate on growth and fruit development of *Capsicum annum*. J. Maharashtra Agric. Univ. 2 (1): 3-5.

Kaul M.L.H. (1977): Curr. Sci. 46: 198-200. Quoted by Satpute R.A. 1994: Mutational studies in safflower *Carthamus tinctorius* (L.) Ph.D. Thesis, Dr. B.A.M. University, Aurangabad.

National Academy of Sciences (1981): "The Winged Bean- A High Protein Crop of the Tropics". Natl.Acad. Sci. Washington. D.C. *Nayar G.G. 1978: Mutation breeding Newsletter, 11:9.

Prasad A.B. (1967): Comparison of the effect of X-rays (soft X-rays) on the production of mutation in diploid and tetraploid species of *Phalaris* Cytologia, 32: 444-449.

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

Thakare R.G. and Pawar S.E. (1990): Radiation induced mutants for the improvement of Urdbean. INS. Newsletter, 2: 18-19.

Zacharias M. (1956): Mutations versche an Kultirflanzen. VI. Rontgenbest ranlungen der sosabohne (*Glycine soja* L.) Zilcchter 26: 321-328.

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