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RESEARCH ARTICLE

EFFECT OF EMS AND SA ON SURVIVAL OF PLANTS AT MATURITY IN M_1 GENERATION OF *PSOPHOCARPUS TETRAGONOLOBUS* (L.) DC.

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Abstract

Winged bean (*Psophocarpus tetragonolobus* (L.) DC. has been described as a wonder legume in the sense that virtually every part of the plant is edible and comprises a rich source of good quality of protein. However it possesses few drawbacks which obstruct the wide scale popularization among the farmers. In the present investigation, the seeds of winged bean of variety II-EC-178313 and 2I-EC-38825 were treated with two chemical mutagens namely Ethyl methane sulfonate (EMS) and Sodium azide (SA) to induce mutations. These treated seeds were sown in field to raise M_1 generation and the effects of EMS and SA on plant survival were observed. The survival of plants at maturity expressed as percent of control showed a gradual decrease with an increase in concentration of the two mutagens. The main objective of this study is to develop the improved varieties of winged bean by using the novel approach of mutation breeding.

Introduction:-

The winged bean (*Psophocarpus tetragonolobus* (L.) DC.) is the member of legume family i.e. fabaceae. It is also popularly known as Goa bean, four angled bean, four-cornered bean, Manila bean, Mauritius bean and Dragon bean and mainly cultivated in Papua New Guinea and Southeast Asia. It is considered to be a potentially important crop because of its high protein and oil contents. With the realization that this crop could be as important as a soya bean, particularly in the humid and tropical regions NAS (1981). Winged bean is a twining, perennial herbaceous plant that is characterized by its tuberous roots and its winged pod. Although the winged bean is perennial, it is most usually cultivated as an annual, because for pod and seed production. The chemical composition and the protein quality of the winged bean seeds which have increasing importance through out the world as a protein and energy-rich food crop. It contains all amino acids in sufficient quantity, with the exception of the sulphur containing amino acid. It is widely recognized by farmers and consumers particularly in Southern Asia for its variety of uses and disease resistance. It is nutrient rich and all parts of the plant are edible. Leaves can be eaten like spinach, flowers can be used in salads, and tubers can be eaten raw or cooked. It possesses excellent potential to become a major multiuse food crop in each and every part of the world. The other nutrients like vitamin A, vitamin C, calcium and iron were recorded from all parts of the winged bean, Hettiarachchy and Sri Kantha (1982).

The winged bean seeds are rich not only in protein, but in tocopherols which acts a antioxidants that facilitate vitamin A utilization in the body. In Malaya, winged beans are used as an effective remedy for Smallpox and as a cure for Vertigo. It is a potential food source for ruminants, poultry, fish and other livestock, Khan (1982). Though it

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possesses several positive attributes, unfortunately it is neglected all over the world due to presence of antinutritional factors, long duration of crop, twining nature of crop and absence of market demands. Thus in the present work, the attempts have made to develop improved varieties of winged bean through the approach of mutation breeding.

Material and Methods:-

The seed material of winged bean (*Psophocarpus tetragonolobus* (L.) DC.) variety namely II-EC-178313 and 2I-EC-38825 procured from National Bureau of Plant Genetic Resources (NBPGR), Regional Station, PKV, Akola (M.S.) was used in the present study.

Mutagens Used:-

In the present work, the two chemical mutagens such as Ethyl metane sulfonate (EMS) and Sodium azide (SA) were used.

Details of Mutagenic Treatments:-

The pilot experiments were conducted for determining the suitable concentration for further studies. 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 an 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% and 0.03% 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. Further these treated seeds were sown in the field to raise M_1 generation, and this M_1 population was observed carefully to check the effect of EMS and SA on plant survival in both the varieties of winged bean. The number of plants reaching maturity in the field was noted and expressed as percentage of control.

Results and Discussion:-

The survival of plants at maturity expressed as percent of control showed a gradual decrease with an increase in concentration of the two mutagens. In variety II-EC-178313 the survival ranged from 96.46% to 84.00% in EMS and 93.96% to 82.35% in SA treatments. As compared with this in variety 2I-EC-38825 the survival ranged from 95.00% to 90.51% in EMS and 92.24% to 81.90% after the SA treatments. **(Table-1 and 2)** .

The highest survival values (96.46% and 95.00%) could be seen at 0.05% of EMS in variety II-EC-178313 and variety 2I-EC-38825 of winged bean respectively. The lowest survival values (82.35% and 81.90%) were noticeable at 0.03% SA treatments in case of both the varieties of winged bean.

The extent of survival of plants is considered as one of the most reliable indices in evaluating the effect of any mutagen. In the present investigation, an inverse correlation was observed between concentration of EMS and SA survival in both II-EC-178313 and 2I-EC-38825 varieties of winged bean.

The researchers such as Sree Ramulu (1971) in Sorghum, Kaul and Bhan (1971) in rice, More (1992) in *Medicago sativa* and Giriraj and Deshpande (1996) in sunflower have reported reduced survival after mutagenic treatments, resulting in higher rates of lethality. Gaul (1964) proposed that the positive correlation between increasing mutagen dose and M_1 plant survival may be due to alterations at the physiological and cytological levels which leads to chromosomal and extra chromosomal injury.

According to Ashri and Levy (1974), the DA variety of peanut was more sensitive to chemical mutagens than TBR and Congo. They suggested that there were some factors within the embryo of Congo which enabled it to withstand the physiological injuries caused by DES. Hakande (1992) in winged bean reported intervarietal difference pertaining to survival of plants after mutagenic treatments. He further stated that it may be due to differential genotypic make up of the varieties.

In the present studies, an inverse correlation was observed between the survival of plants at maturity and the mutagenic treatments indicating the alterations caused at the physiological and cytological level by the latter.

Table 1:- Effect of EMS on survival of plants at maturity in M_1 generation of *Psophocarpus tetragonolobus* (l.) DC.

Variety	Concentration	Survival of plants at maturity (% of control)	± S.E.
II-EC-178313	Control	-	-
	0.05%	96.46	1.20
	0.10%	93.51	0.88
	0.15%	84.00	1.15
2I-EC-38825	Control	-	-
	0.05%	95.00	2.64
	0.10%	93.27	0.57
	0.15%	90.51	1.15

± S.E. = Standard Error

Table 2:- Effect of SA on survival of plants at maturity in M_1 generation of *Psophocarpus tetragonolobus* (L.) DC.

Variety	Concentration	Survival of plants at maturity (% of control)	± S.E.
II-EC-178313	Control	-	-
	0.01%	93.96	0.88
	0.02%	89.09	1.45
	0.03%	82.35	2.30
2I-EC-38825	C0ntrol	-	-
	0.01%	92.24	1.45
	0.02%	87.61	1.52
	0.03%	81.90	1.76

± S.E.= Standard Error

Conclusion:-

The survival of plants at maturity revealed reduced values with the enhancing concentration of both EMS and SA in II-EC-178313 and 2I-EC-38825 varieties of winged bean.

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