

Effect of Chemical and Physical Mutagens on Leaf Morphological Changes in Horse Gram (*Macrotyloma Uniflorum* (Lam.))

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ABSTRACT

Horse gram (*Macrotyloma Uniflorum* (Lam.) varieties viz., Phule Sakas and Man were mutated with EMS (ethyl methane sulphonate), SA (Sodium azide) and gamma rays (G), to determine the mutagenic potency in breeding programme. Considerable frequency of leaf changes carrying plants could be observed in both the varieties of Horse gram as a result of mutagenic treatments. The frequency of leaf change carrying plants revealed an enhancing feature with the gradual rise in concentration /dose of EMS, SA and Gamma rays in both the Horse gram varieties.

Keywords : *Uniflorum*, Induced Mutation, Leaf Morphology.

I. INTRODUCTION

Horse gram (*Macrotyloma uniflorum* (Lam) Verdc.) is a nutritious legume being cultivated in diverse agro climatic zones of various states of India. It has been quoted as potential food crop of tropics by US National Academy of Sciences owing to its enriched nutrient source coupled with drought tolerance potential (NAS, 1978). Horse gram, since time immemorial finds a part in Indian ayurvedic medicine which cures a variety of health issues starting from common cold to kidney stones (Prasad and Singh, 2015). The horse gram seeds fulfills cheap source of protein satisfying the nutritional requirements of developing nations (Aditya *et al.*, 2019). In compare to other legumes horse gram crop is used as fodder

source because of its enriched protein content (Fuller and Murphy, 2018).

The horse gram crop helps in improvement of soil fertility by fixation of atmospheric nitrogen (Cullis and Kunert, 2017). The current scenario of plant type possesses many undesirable traits such as indeterminate, twining growth habit, photosensitivity and asynchronous maturity (Chahota *et al.*, 2013). More or less scientific community of breeding and biotechnology are to be initiated and intensified for bringing improvement in horse gram in order to meet out future nutritional security (Mabhaudhi *et al.*, 2017).

The changes in morphology of leaflets induced by mutagens could be due to changes in physiological

and metabolic activities of the developing primordial cells and the consequent alterations in leaf morphology. In the present study the leaf morphological changes may have developed due to physiological disturbances and developmental alterations produced by the mutagens in both the varieties of Horse gram.

II. MATERIAL AND METHODS

The experimental seed material of two varieties of horse gram (*Macrotyloma uniflorum* L) for present investigation namely Phule Sakas and Man procured from the 'Mahatma Phule Agricultural University' Rahuri, Ahmadnagar India. (MS)

In the present investigation both the varieties of horse gram Phule Sakas and Man were treated by three mutagens. viz. 0.05%, 0.10% & 0.15 % concentrations of EMS (ethyl methane sulphonate), 0.02%, 0.04% & 0.06% concentrations of SA (Sodium azide) and 5kR, 10kR & 15kR doses of gamma rays (G), were raised in randomized block design which constitutes M₁ generation. The frequency of leaf morphological changes was calculated by counting the number of plants carrying leaf abnormalities from the plants of each treatment.

III. RESULT AND DISCUSSION

Leaf morphological changes. (Table. 01-02) (Graph. 1)

In the mutagenic treated plants leaf morphological changes were observed revealing different types, they exhibited variations in the shape and size as compared with the control plants. Some plants showed mostly enlarged leaves in comparison to control in some leaflets. the serrate margin got modified to slightly entire, dentate, undulating or crenate, Tip portion of some leaflets showed bolting, stalk of leaflets showed completely reduced to long features shape of leaflets changed to linear, oblong, narrow flattened, conical, lanceolate, guard shaped, fan palm like, cotton leaf

shape, adiantum fern like ovate, rotund, triangular and apical portion bilobed number of leaflets either reduced, remained same or increased Apex of leaflets became cuspidate toothed, pointed, obtuse, mucronate elliptical acuminate and notched, Arrangement of leaflets on rachis noted as whorled or cyclic, opposite and alternate, leaflet lamina showed enlarged same or extremely reduced size.

The frequency of plants carrying leaf morphological changes ranged from 8.33 to 18.33 and 10.00 to 18.26 after EMS treatments in Phule Sakas and Man both the varieties of Horse gram, while the frequency value ranged from 11.66 to 23.33 and 15.00 to 23.00 in Phule Sakas and Man after SA mutagenic treatments. In case of Gamma rays treatment the frequency of plants with leaf morphological changes ranged from 10.00 to 21.66 and 11.66 to 21.33 in both varieties (Phule Sakas and Man) of Horse gram.

The frequency of plant carrying different leaf morphological changes enhanced with increasing frequency values with increasing concentration/dose of mutagens were recorded in both the varieties of three mutagens. In SA (0.06 %) concentration recorded highest leaf morphological changes in both varieties of Horse gram (23.33 & 23.00).

The minimum frequency recorded at 0.05% EMS concentration (8.33) in variety Phule Sakas and (5.00) at 0.02 % SA in variety MAN. These phenotypic changes are presumably brought about by genotypic and mutational events among different loci of chromosomes providing the fundamental variability required for plant improvement through mutation breeding.

Leaf morphological changes induced by mutagens have also been reported by several workers like Sudharani (1990) in black gram, Panchbhaye (1997) in Sunflower; Hakande (1992) in winged bean, Kashid & Salve (2014) in Okra. The maximum frequency of

plants carrying chlorophyll chimeras was reported in SA treatments in both the varieties of French bean (Mahamune and Kothekar, 2012).

Table: 01. Effect of mutagens on frequency of plants carrying leaf morphological changes in M₁ generation of Horse gram (*Macrotyloma uniflorum* (Lam.) Verde)

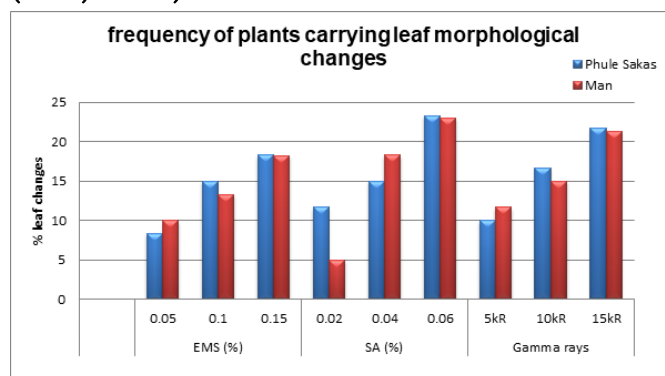
Variety: Phule Sakas			
Treatment	Concentration / Dose	frequency of plants carrying leaf morphological changes	+SE
Control	Control	-	-
EMS (%)	0.05	8.33	0.70
	0.10	15.00	0.91
	0.15	18.33	1.00
SA (%)	0.02	11.66	0.81
	0.04	15.00	0.91
	0.06	23.33	1.11
Gamma rays	5kR	10.00	0.76
	10kR	16.66	0.95
	15kR	21.66	1.11

Table: 02. Effect of mutagens on frequency of plants carrying leaf morphological changes in M₁ generation of Horse gram (*Macrotyloma uniflorum* (Lam.) Verde) Variety: Man.

Treatment	Concentration / Dose	frequency of plants carrying leaf morphological changes	+SE
Control	Control	-	-
EMS (%)	0.05	10.00	0.76
	0.10	13.33	0.86
	0.15	18.26	1.00
SA (%)	0.02	5.00	0.91
	0.04	18.33	1.00

	0.06	23.00	1.11
Gamma rays	5kR	11.66	0.81
	10kR	15.00	0.91
	15kR	21.33	1.11

Graph: 1. Effect of mutagens on frequency of plants carrying leaf morphological changes in M₁ generation of Horse gram (*Macrotyloma uniflorum* (Lam.) Verde)



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