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SCREENING OF CHICKPEA MUTANT LINES AGAINST *FUSARIUM OXYSPORUM* F.SP. *CICERI* CAUSING CHICKPEA WILT

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Chickpea is an important grain legume crop having multifarious uses. Pre-soaked seeds of chickpea varieties, Akash and Vishal were treated with different concentrations of chemical mutagens like, EMS and SA. Studies comprised of collection of data on the various effects of different mutagens on morphological variabilities induced by chemical mutagens in chickpea. The mutagenic treatments proved to be effective in producing morphological mutations along with improved tolerance to *Fusarium* wilt. These mutants with resistant to tolerant reaction for *Fusarium* wilt could be used in hybridization program for transferring of resistance genes into high yielding elite cultivars/ producing better recombinants.

Keywords : Chickpea; Ethyl methane sulphonate; *Fusarium oxysporum* f.sp. *ciceri;* Mutagens; Sodium azide.

Introduction

Chickpea is an important grain legume crop sown under rainfed conditions in India. It is a rich and cheap source of vegetable protein for human nutrition[1]. Although, a number of factors contribute for low chickpea production, but wilt disease caused by *Fusarium oxysporum* f. sp. *ciceri* is the major cause. It is reported to cause annual yield losses of 10-15 percent as a regular feature[2]. It causes complete loss in grain yield if the disease occurs in the vegetative and reproductive stages of the crop[3,4].Currently, the use of resistant cultivars appears to be the most practical and economically efficient control[5]. The continuous use of a variety made it susceptible to wilt pathogen in certain area[6].Since the host plant resistance is not stable due to emergence of new pathotypes of *F. oxysporum* f. sp. *ciceri,* therefore, identification of resistant sources against the prevalent pathotypes/isolates should be considered[7]. The disease is a vascular pathogen that travels in seed, soil and consequently is difficult to handle by the use of chemicals and through crop rotation[8,9]. The pathogen can stay alive in the soil in the absence of the host for at least 6 years[10,11]. The wilt can be observed in susceptible genotype within 25 days after sowing in the field. The pathogens attack the roots of plants and cause wilting as a result the whole plant shows drooping of leaves and paler color than healthy plants. The plant finally collapses and dies. Such plants do not show external rotting and look healthy, when cut vertically downward from the collar region, show brown streak of the internal tissues. Since most of the commercial cultivars in the country have been found to be susceptible, there is therefore urgent need for an extensive screening of germplasm for the identification of resistant sources. But screening program of chickpea germplasm has been abortive to identify stable and high level resistance against a number of diseases[12,13]. Limited germplasm of chickpea resistant to *Ascochyta* blight and *Fusarium* wilt is found in existing chickpea species so it is, necessary to search out new sources of resistance to this disease[14]. The use of induced mutation appears to be the best management option for the disease. Mutation breeding does not disturb co-adapted linkages of agronomically important commercial varieties and can create new and complex loci for resistance that can confer durable resistance. In view of above facts, it was planned to conduct the screening of advance promising morphological mutants in M_3 and M_4 generation for the identification of mutant (s) having increased level of resistance to *Fusarium* wilt.

Material and Methods

Genetic variability was induced in two BDNG-797 (Akash) and Phule G-87207 (Vishal), varieties obtained from Marathwada Agricultural University Research

Table 1. Screening of chickpea mutants var. Vishal against *F. oxysporum* f.sp. *ciceri.*

Mutagens	Concentration (%)	Wilt (%)				
		Control	Highly virulent	Virulent	Moderately virulent	Avirulent
EMS	0.05	33	77	37	37	28
	0.10	40	48	46	55	38
	0.15	35	18	34	36	33
SA	0.01	57	78	66	68	59
	0.02	50	31	31	30	29
	0.03	40	28	23	19	19
Control	--	--	81	71	68	28

Table 2. Screening of chickpea mutants var. Akash against *F. oxysporum* f.sp. *ciceri.*

Mutagens	Concentration (%)	Wilt (%)				
		Control	Highly virulent	Virulent	Moderately virulent	Avirulent
EMS	0.05	55	78	44	66	36
	0.10	38	76	42	62	34
	0.15	24	21	39	49	26
SA	0.01	38	66	37	18	28
	0.02	10	33	27	16	20
	0.03	10	20	28	20	16
Control	--	--	82	65	76	52

Station, Badnapur, Dist. Jalna, (MS) through ethyl methane sulphonate (EMS) and sodium azide (SA). Mutations were induced in chickpea by using different concentrations of two chemical mutagens like 0.05, 0.10 and 0.15% of EMS and 0.01, 0.02 and 0.03% of SA[15]. Total 900 seeds of both the chickpea cultivars were presoaked in distilled water for 6 hrs and then treated with different concentrations of EMS and SA for 6 hrs, and post soaked in distilled water for 2 hrs. After these were washed thoroughly with running tap water. Corresponding controls were also maintained in distilled water for EMS and SA. The mutants were sown in this field in third week of October in a randomized block design with three replications. The spacing between row was maintained at 30x30 cm and 10x10 cm in between plants. Altogether 25 isolates were purified from different districts of Maharashtra. The highly virulent, moderately virulent, virulent and avirulent isolates were selected for this study from earlier work[16]. Among them only four isolates were used as inoculum of pathogen. The F. *oxysporum* f. sp. *ciceri* inoculums maintained as a sick plot. Weeding was performed manually. The wilt incidence was noted at 10-day intervals starting from 30 days after sowing till seed maturity and harvest[5]. The data on the number of wilted seedlings in each row for each mutant was calculated for each mutant line by using the following formula:

$$\text{Wilt incidence (\%)} = \frac{\text{Number of plants wilted}}{\text{Total number of Plants}} \times 100$$

Results and Discussion

The chickpea wilt observed in all the cases of virulence against mutagens EMS and SA applied @ concentration

0.05, 0.10, 0.15% and 0.01, 0.02, 0.03%, respectively. It is depicted in Table 1 that under the influence of EMS 0.05 percent, it was constantly decreasing as concentration of mutagen is increasing. It was found that 18 percent wilt was found at 0.15 percent concentration of EMS. Similar results were noted in SA. The increase in concentration is directly proportional to the decrease in the percent wilt. The wilt percent was 28 at 0.03 percent concentration when compared with control. The resistant cultivars from 0.15 percent of EMS and 0.03 percent of SA were found to be resistant to *F. oxysporum* f. sp. *ciceri.* The results in Table 2 indicate the wilt percent is decreased in both the mutagens used. In both the mutagens the percent wilt was 21 and 20 in EMS and SA, respectively, tested under highly virulent category of pathogen. The cultivars when tested under virulent and moderately virulent, the similar results were observed and it was concluded that the mutagen concentration affects on enhancement of resistance against pathogen. These results are in agreement with the other workers[17-21]. The mutagenic treatments proved to be effective in producing morphological mutations along with improved tolerance to *Fusarium* wilt. These mutants with resistant to tolerant reaction for *Fusarium* wilt could be used in hybridization program for transferring of resistance genes into high yielding elite cultivars/ producing better recombinants.

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