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REGULAR ARTICLE

EFFECTS OF SODIUM AZIDE ON YIELD PARAMETERS OF CHICKPEA (*CICER ARIETINUM* L.)

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SUMMARY

The mutagenic effects of different concentrations of sodium azide (0.01%, 0.02% and 0.03%) on chickpea (*Cicer arietinum* L.) varieties Akash and Vishal were investigated. The characters studied include; days of flowering, days to maturity, plant height, number of pods per plant, number of seeds per plant and hundred seed weight in M_2 and M_3 generations. Both negative and positive shifts in mean values were recorded as a result of the chemical treatment. The results indicate the possibilities of evolving higher yield variants through proper selection. Thus, economic traits like days to maturity, number of pods per plant, number of seeds per plant and hundred seed weight in M_3 generation offer scope for selection and improvement.

Key words: Chickpea, Mutagenic effects, Sodium azide

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1. Introduction

Chickpea (*Cicer arietinum* L.) is the second largest grown food legume of the world (Gaur *et al*., 2008). It ranks third among pulses after beans (*Phaseolus vulgaris* L.) and peas (*Pisum sativum* L.), fifth among grain legumes and 19th among grain crops of the world. It is self pollinating and possesses limited variability. Consequently, the extent to which chickpea cultivars may be improved through conventional breeding method is limited. Mutation breeding supplement conventional plant breeding as a source of increasing variability and could confer specific improvement without significantly altering its acceptable phenotype (Ojomo *et al*, 1979). The successful utilization of sodium azide to generate genetic variability in plant breeding has been reported in groundnut (Mensah and Obadoni, 2007), barley (Kleinhofs and Sander, 1975) and other crops (Avila and Murty, 1983; Routaray *et al*, 1195). It has been demonstrated by many workers that genetic variability for several desired characters can be induced successfully through mutations and its practical value in plant improvement programme has been well established. The main advantage of mutation breeding is the possibility of improving one or two characters without changing the rest of the genotype. The present study was undertaken to investigate the mutagenic effects of sodium azide as a means of increasing the variability within the cultivars and hence improve its productivity.

2. Materials and Methods

The experimental plant material selected for the present investigation comprised two cultivars of chickpea (*Cicer arietinum* L.) namely, Akash (BDNG-797) and Vishal (Phule G-87207). Germplasm of these two cultivars was procured from the Agricultural Research Station, Badnapur, Dist. Jalna (M. S.) India.

Healthy and uniform seeds of two chickpea varieties Akash (BDNG-797) and Vishal (Phule G-87207) were surface sterilized with 0.1 % mercuric chloride solution for about one minute and washed thoroughly with distilled water. They were presoaked in distilled water for 6 hours. Such presoaked seeds were treated with freshly prepared mutagenic solution for 6 hours. All

chemical treatments were carried out at room temperature 25 ± 2 °C with intermittent shaking. The volume of the mutagenic solution used was three times as that of the seeds so as to facilitate uniform conditions. Post soaking was performed for 2 hours. The seeds treated with various concentrations of chemical mutagens were thoroughly washed under running tap water before sowing for about an hour to terminate the reaction of the chemical mutagen and to leach out residual chemical. The seeds soaked in distilled water for 14 hours served as control.

200 seeds of each treatment were sown in the field following randomized block design (RBD) with three replications along with control for raising the M_1 generation. The seeds were sown at a distance of 10 cm between the plants and 30 cm between the rows. At maturity, M_1 plants were individually harvested and sown as M_2 family. M_2 plants were harvested and sown as M_3 family.

A thorough statistical analysis was carried out by using standard formulae of Mungikar (1997). The shifts of mean was also studied to asses the amount of induced variability due to mutagenic treatments. The data pertaining to M_2 and M_3 generations recorded for the different polygenic traits in both the cultivars of chickpea are presented in table1.

Table 1: Effect of sodium azide on some yield parameters of chickpea in M_2 and M_3 generations

Variety / SA concentration (%)	Plant height		Days to flowering		Days to maturity		Pods per plant		Seeds per plot		100 seeds weight	
	M_2	M_3	M_2	M_3	M_2	M_3	M_2	M_3	M_2	M_3	M_2	M_3
Akash												
0.00 0.01 0.02 0.03	32.32±0.88 33.19±0.52 34.29±0.54 **40.03±0.91	33.07±0.29 33.15±0.64 34.81±0.52 **40.80±0.89	37.29±0.21 35.78±0.74 **33.35±0.69 *39.79±0.89	36.79±0.36 34.89±0.78 *34.35±0.52 **40.26±1.22	108.55±1.89 106.65±1.46 **101.73±0.96 **113.77±1.04	106.63±1.75 105..85±1.41 103.39±0.83 **113.39±0.62	41.37±0.98 42.25±0.89 *52.96±0.62 42.00±0.61	41.91±0.98 40.99±1.13 **53.25±0.87 41.11±0.82	41.24±0.90 **49.10±0.64 43.35±0.54 41.92±0.62	40.95±0.82 **48.51±0.59 *43.92±0.58 40.74±0.37	21.40±0.86 *19.71±0.26 20.87±0.85 22.40±0.59	22.00±0.69 20.17±0.81 20.38±0.61 *20.02±0.73
Vishal												
0.00 0.01 0.02 0.03	44.42±0.59 45.43±0.66 **52.17±110 45.31±0.75	45.26±0.82 46.47±0.55 **52.64±108 44.79±0.60	38.98±0.52 **33.12±0.43 **42.07±0.84 **37.20±0.61	38.34±0.47 **34.09±0.81 40.26±0.74 36.60±0.48	102.03±1.64 *96.96±0.77 *107.63±1.52 102.24±1.86	102.94±1.54 **95.88±0.67 *108.12±1.31 101.83±1.95	37.88±0.46 38.41±0.54 39.86±0.33 **51.02±102	38.77±0.52 39.02±0.65 40.29±0.91 **51.4±1.03	37.35±0.53 37.91±0.53 *39.65±0.38 **47.76±0.59	37.97±0.48 37.15±0.68 *40.04±0.33 **46.76±0.62	29.37±0.65 28.35±0.21 29.14±0.31 30.13±0.58	30.12±0.52 28.53±0.21 29.34±0.46 30.70±0.41

* Significant at 5% C.D.
** Significant at 1% C.D

3. Results and discussion

In the present investigation, different quantitative characters were studied to estimate the induced variability in M_2 and M_3 generations. Induced variability was thoroughly studied in chickpea cultivars Akash and Vishal for both the M_2 and M_3 generations in regard to days of flowering, days to maturity, plant height, number of pods per plant, number of seeds per plant and hundred seed weight.

Days to flowering: The character of days to flowering plays a significant role in altering the life cycle duration of any plant. The mutagen succeeded in inducing variability in days to flowering of plants in both the cultivars of chickpea. Most of the treatments have shown an early flowering character and have shown statistically significant shift in mean in M_2 and M_3 generations in Akash. In Vishal, all values have shown statistically significant negative shift in mean except

0.02% concentration in M_2 generation. In M_3 generation, 0.01% concentration showed statistically significant negative shift in mean. Several researchers like Madhavrao (1982) in green gram, and Panchabhaye (1997) in sunflower reported early flowering after mutagenic treatment.

Days to maturity: Days to maturity in control were 108.55 (Akash) and 102.03 (Vishal) in M_2 generation. Whereas in M_3 generation, the values were 106.63 and 102.94 in Akash and Vishal, respectively. In M_2 generation of Akash, 0.02% concentration showed statistically negative shift in mean while the 0.03% concentration showed significant positive shift in mean values. In M_3 0.03% concentration has shown significant positive shift in mean. In Vishal, 0.01% concentration showed statistically negative shift in mean in both the generation.

Plant height: It was observed that all the mutagenic treatments employed in the present study succeeded in affecting the plant height in both Akash and Vishal cultivars of chickpea in M_2 and M_3 generations. In case of Akash cultivar of chickpea, all treatments have shown changes in plant height in both M_2 and M_3 generations. All treatments have shown positive shift in mean values. In M_2 generation of Vishal, it showed a positive shift in mean values. 0.02% concentration has shown statistically significant positive shift in mean. All values except 0.03% concentration revealed statistically positive shift in mean values in M_3 generation of Vishal. 0.02% concentration showed statistically positive shift in mean values. The magnitude of variability in Akash was observed to increase along with the increasing concentrations. These results support the observations of various other workers (Micke, 1961; Chary, 1983; and Padmavathi 1993).

Number of pods per plant: The effect of all the mutagenic treatments on pods per plant revealed statistically significant negative as well as positive shifts in mean values in Akash in M_2 and M_3 generations. In Vishal there was positive shift in mean values in both the generations. 0.03% concentration showed statistically positive shift in mean values. There was an increase in the number of pods per plant with some exceptions. This was supported by Hakande (1992) in winged bean, Rayyan (1995) in black gram and Sagade (2008) in urdbean.

Number of seeds per plant: It is evident from the pertinent observations that statistically significant increase in mean values for number of seeds per plant could be observed in the Akash in M_2 generation. In M_3 except 0.03% concentration all values have shown positive shift in mean. In case of variety Vishal, 0.02% and 0.03% treatments have indicated statistically significant positive shift in mean at M_2 and M_3.

100 seed weight: The data on 100 seed weight indicated an increase mostly at higher concentrations in both the cultivars of chickpea in M_2 and M_3 generations. In M_2 generation, the Akash cultivar showed a negative shift in mean values at 0.01% and 0.02% concentrations, In case of Vishal, the M_2 generation showed mostly negative shift in mean values for all the mutagenic treatments except 0.03% treatment. In M_3 generation, all the mutagenic treatments have shown negative shift in mean values except 0.03% concentration. In variety Akash 0.03% concentration has shown statistically significant negative shift in mean.

4. Conclusion

The results indicated the possibilities of evolving higher yield variants through proper selection. Thus, economic traits like days to maturity, number of pods per plant, number of seeds per plant and hundred seed weight in M3 generation offer scope for selection and improvement.

Mutagenic treatments increase the genetic variability, which can be utilized for selection and improvement of plants. This aspect has been addressed by Swaminathan (1963) and Scossiroli et al (1966) in different plants. The mutagen SA used in the present investigation has definitely proved successful in broadening the genetic base to

an appreciable extent. It is hoped that the mutagenic treatments induced polygenic variability may have further scope in chickpea improvement through its incorporation in conventional breeding.

References

Avila and Murty, (1983): Cowpea and mungbean improvement by mutation induction. Mutation Breeding Newsletter, 21:9

Chary S. N. (1983): Mutagenic studies in pigeon pea (*Cajanas cajan* L. Millsp.) Ph. D. Thesis, Osmania University, Hyderabad.

Gaur P. M., Gaur V. K. and Srinivasan S. (2008): An induced brachytic mutant of chickpea and its possible use in ideotype breeding. *Euphytica* 159:35–41.

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

Kleinhofs and Sander (1975): Azide mutagenesis in barley. Third barley genetics symp. Garching. Proceedings of symp. 113-122.

Madhava Rao (1982): Experimental mutagenesis in green gram (*Vigna radiata* (L.) Wilczek). Ph. D. Thesis, Osmania University, Hyderabad, India.

Mensah J. K. and Obadoni B. (2007): Effects of sodium azide on yield parameters of groundnut (*Arachis hypogaea* L.). *African Journal of Biotechnology*. 6 (6): 668 – 671.

Micke A. (1961): Comparison of effect of gamma rays and thermal neutrons on viability and growth of sweet clover *Melilotus alba* after irradiation of dry seeds In: *Effect of ionizing radiation on seeds* Proc. Symp. IAEA, Vienna: 403-410.

Mungikar A. M. (1997): An introduction to Biometry, book published by Saraswati Printing Press. Motikaranja, Aurangabad. M. S., India.

Ojomo A.O., Omueti O., Raji J. A. And Omueti O. (1979): Studies in induced mutation in cowpea, 5. The variation in protein contents following ionizing radiation, Nig. J. Appl. Sci. 21, 61-64.

Padmavathi T. (1993): Mutagenic studies for the improvement of sunflower (*Helianthus annuus* L.) Ph. D. Thesis, Osmania University, Hyderabad.

Panchabhaye P. M. (1997): Mutation breeding of sunflower (*Helianthus annuus* L.). Ph. D. Thesis, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, India.

Routaray B. N., Mishra R. G. and Das S. N. (1995): Genetic variability and effectiveness of some chemical mutagens on black gram in relation to resistance source against *Meloidogyene incognita*. Curr. Agric. Res. 8: 3-4.

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

Sagade (2008): Genetic improvement of urdbean (V*igna mungo* L. Hepper) through mutation breeding. Ph. D. thesis, University of Pune, India.

Scossirolli R. E., Palenzona D. L. and Scossirolli Pellegrini (1966): Studies on induction of new genetic variability for quantitative traits by seed irradiation and its use for wheat improvement. Mutations in Plant Breeding. IAEA Vienna: 197-229.

Swaminathan M. S. (1963): Evaluation of the use of induced micro and macro mutations in the breeding of polyploid plants. Proc. Symp. *Appl. Nuclear Energy Agric. Rome* 1961: 243-277.