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Research article

A study of effect of induced mutation on flowering of plant in M2 & M3 generations in chickpea (*Cicer arietinum* L.)

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Abstract: In the present investigation of induced mutation in chickpea (*Cicer arietinum* L.) both the chemical mutagens (EMS and SA) succeeded in inducing variability in days to flowering of plants in both the cultivars. In case of SA treatments, an increasing trend with increasing concentrations was observable in both the cultivars of chickpea in M2 and M3 generations as regards days to flowering. The frequency of viable mutant showed the highest value at the 0.10% EMS and 0.02% SA concentration in both the cultivars of chickpea. Most of the viable mutants have been observed as true breeding in the subsequent M3 generation. They can be very well utilized on a commercial scale in view of the varied positive attributes carried by them.

Keywords: Induced mutation - Flowering - Chickpea.

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INTRODUCTION

Chickpea belongs to family Leguminosae a view accepted by the majority of biologist (Verdcourt 1970). However some taxonomist follow Hutchinson's classification and according to this classification, chickpea belong to the family Fabaceae (Papilionaceae) of the order leguminales and class dicotyledonous. The binomial nomenclature of chickpea is *Cicer arietinum* L., where *cicer* is the genus and *arietinum* is the species.

The chickpea flower is typically papilionaceous and zygomorphic. The calyx forms a tube which is persistent and green. The corolla is papilionaceous and consists of standard; the wings and keel. The colour of flower varies from pinkish, purplish, redish-blue to white. The stamens are ten diadelphous, arranged 9+1; the anthers are bicelled, basifixed and orange in colour. The ovary is superior, sessile and oval with terminal bent style and a blunt knob like stigma.

Mutation breeding can constitute a valuable tool to the conventional breeding methods in widening the genetic base of cultivated germplasm in crops through creation of some useful mutants, henceforth, mutation breeding finds a prominent place in the augmentation and recreation of genetic variability and has played a significant role in the development of many crop varieties (Micke 1988, Maluszynski *et al.* 2001).

It is now the known fact that the availability of the large genetic variability within the species is prerequisite for the improvement of the cultivated plants and the mutagenesis has proved to be a handy tool to enhance the mutation rate and thereby enlarging the genetic variability and increasing the scope for obtaining the desired selections.

In recent years a lot of work has been undertaken on induced mutagenesis through physical and chemical mutagens with keen interest to know its impact on food security and malnutrition conditions. It has been clearly shown in a number of plant species that the effect induced, varies with the varying mutagens and with the variation in mutagen doses. Thus selecting a mutagen and its optimum dose for a genotype in any plant species is an important step in mutation breeding programme.

MATERIALS AND METHODS

The experimental seeds of chickpea (*Cicer arietinum* L.), cultivar BDN 9-3 were procured from Agricultural Research Station Badnapur, Dist: Jalna (Maharashtra) and PG-5 from Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist: A. Nagar (Maharashtra) India, ethyl methane sulphonate (EMS) and sodium azide (SA) were

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employed in present study for the treatments of seeds. Ethyl methane suphonate (CH3SO2O2C2H5) a monofunctional alkylating agent, with molecular weight of 124.16 manufactured by sisco research laboratory, Mumbai and Sodium Azide (NaN3), with molecular weight of 65.01, manufactured by Spectrochem *pvt*. Ltd. Mumbai was used in the present work.

Healthy and dry uniform seeds of chickpea cultivars with moisture content of 10-12 % were treated with 0.05, 0.10 & 0.15 % Ethyl methane sulphonate, while 0.01, 0.02 % 0.03 % concentration of sodium azide. The treated seeds (675) from each treatment were used for raising M1 generation in field. All the experiments were carried out in triplicate following RBD design. The seeds of individually harvested M1 plants were sown in the experimental field to raise M2 generation. M2 plant population was screened for scoring viable mutations in the field. The spectrum and frequency of viable mutations was calculated.

A thorough statistical analysis was carried out by computing the mean, slandered error and coefficient of variation using slandered formulae (Mungikar 1997). Differences in means between controls and treated populations were estimated to study the amount of variability induced by two mutagenic treatments. Days to flowering was recorded as the number of days from the date of sowing to the opening of first flower on the plant.

RESULTS AND DISCUSSION

In the present study, the days to flowering were observed to be delayed in many treatments of all the mutagens in case of both the cultivars (Table 1–2). An early flowering feature could be well correlated with early maturing characters possessed by the concerned plant types. Early flowering mutants were observed by several researchers in many plant systems after different mutagenic treatments. Delay in flowering has been attributed to delay in germination (Bianchi *et al*. 1963) or slowness in growth of the plant (Iqbal 1972).

Table 1. Effect of mutagens on days to flowering in M2 generation of chickpea.

Treatment		Concentration (%)	Mean	Standard error	Shift in mean	Coefficient of variation
Variety: BDN 9-3	Control	-	47.80	0.34	-	1.25
	EMS	0.05	49.10	0.63	1.30	2.24
		0.10	45.40	0.60	-2.40	2.31
		0.15	46.20	0.72	-1.60	2.70
	SA	0.01	46.10	0.54	-1.70	2.06
		0.02	47.40	0.69	-0.40	2.53
		0.03	48.60	0.60	0.80	2.16
Variety: PG-5	Control	-	47.80	0.34	-	1.25
	EMS	0.05	49.10	0.63	1.30	2.24
		0.10	45.40	0.60	-2.40	2.31
		0.15	46.20	0.72	-1.60	2.70
	SA	0.01	46.10	0.54	-1.70	2.06
		0.02	47.40	0.69	-0.40	2.53
		0.03	48.60	0.60	0.80	2.16

Table 2. Effect of mutagens on days to flowering in M3 generation of chickpea.

Treatment		Concentration (%)	Mean	Standard error	Shift in mean	Coefficient of variation
Variety: BDN 9-3	Control	-	47.10	0.46	-	1.69
	EMS	0.05	48.80	0.66	1.70	2.35
		0.10	45.80	0.72	-1.30	2.72
		0.15	46.60	0.75	-0.50	2.78
	SA	0.01	47.00	0.60	-0.10	2.23
		0.02	48.10	0.57	1.00	2.07
		0.03	48.80	0.63	1.70	2.25
Variety: PG-5	Control	-	48.60	0.49	-	1.74
	EMS	0.05	50.10	0.60	1.50	2.09
		0.10	47.20	0.66	-1.40	2.43
		0.15	46.10	0.63	-2.50	2.38
	SA	0.01	49.00	0.72	0.40	2.55
		0.02	50.10	0.77	1.50	2.69
		0.03	51.40	0.69	2.80	2.33

It is an important character which plays a significant role in altering the life cycle of any plant. Both the mutagens succeeded in inducing variability in days to flowering of plants in both the cultivars of chickpea. Some of the mutants showed an early flowering in control were 47.80 and 49.80 in BDN 9-3 and PG-5, respectively. In case of EMS treatments, the values for days to flowering varied with the varied concentrations in BDN 9-3, where as in PG-5 the values were in inducing order with increasing concentrations, in both M2 and M3 populations of chickpea. In case of SA treatments, an increasing trend with increasing concentrations was observable in both the cultivars of chickpea in M2 and M3 generations as regards days to flowering.

The early flower mutants were characterized by development of flowers as early as control. They attained flowering in 30.20 and 31.60 days as against 47.80 and 49.80 days in control of BDN 9-3 and PG-5, respectively. They mature as early as control in both the cultivars in chickpea.

Kaul (1980b) suggested that the mutation of two dominant genes to their recessive forms makes for an early flowering in peas. Higher doses of both the mutagens induced late flowering while lower doses induced early flowering. Similar results were also observed by Chopde (1976), Khan & Veeraswamy (1974), Brij & Pandya (1986), Micke *et al*. (1990) and Bhatia *et al*. (1991). EMS treatment was found to be most effective in inducing early flowering followed by gamma rays. Result obtained was in confirmation with results of Rao *et al*. (1984), Biradar (2004), Shinde (2007) in pigeon pea, Manjaya & Nandanvar (2007) and Tambe (2009) in soybean.

The reports of delayed flowering with increasing concentrations of mutagenic treatments have been stated by Gregory (1956), Doly (1961), Das & Chowdhary (1962), Chowta & Dnyansagar (1974), Chary (1983), Kothekar (1987), Vandana & Dubey (1990), Padmavathi (1993), Satpute (1994), Rayyan (1995), Panchbhaye (1997).

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