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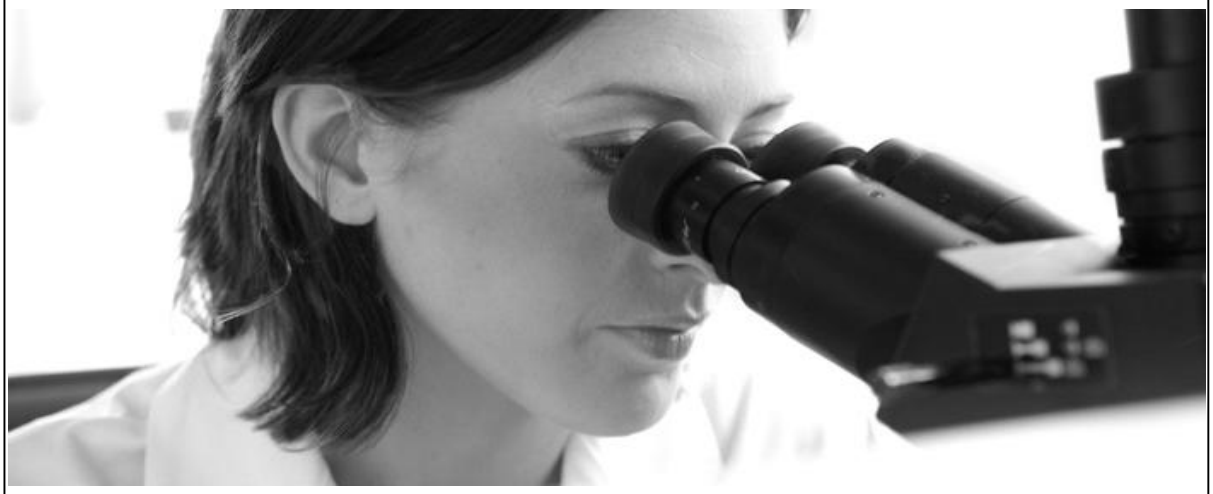

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RESEARCH ARTICLE

GENETIC VARIABILITY INDUCED BY ETHYL METHANE SULPHONATE AND SODIUM AZIDE ON SEED CHARACTERS IN CHICKPEA (*CICER ARIETINUM L.*)

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ABSTRACT

In the present investigation two cultivars of chickpea (BDN 9-3 & PG-5) were practiced for mutagenic treatment of EMS and SA to study the effect on 100 seed weight and seed coat colour characters. A mixed trend of positive and negative shift in mean values was observed in both the cultivars in all the mutagenic treatments for the number of pods per plant and 100 seed weight in M2 and M3 generations.
In this study *Anthoseed* mutants were observed which characterized by development of anthocyanin in the testa of seeds. They took slightly less number of days to attain maturity as compared with control in both BDN9-3 and PG-5..
The heritability estimates for number of pods bearing branches, number of pods, 100 seed weight and seed yield per plant were higher in M3 than in M2 generation in the two varieties of chickpea. The high estimates of heritability in yield and yield components has been found to be useful from plant breeder's view point as this would enable him to base his selection on the phenotypic performance.

INTRODUCTION

The genus *Cicer* belongs to the family Fabaceae. The genus *Cicer* consists of 44 species, including 35 perennial and eight annual wild species and one the domesticated chickpea, *Cicer arietinum* L. (Toker & Cagiranan 2007). The plant has a deep tap root having the presence of well defined root-nodules. Stem is mostly erect and green. Leaves are stipulate and imparipinnately compound, usually small leaflets in each leaf which are arranged on a rachis with a small petiole. All external surfaces of the plant, with the exception of corolla, are covered by glandular hairs. Flowers are pedicellate bisexual with papilionaceous corolla, borne singly in Axillary racemes. The staminal column is diadelphous (10 stamens with an arrangement of 9+1). Ovary is monocarpellary, unilocular, 1-2 ovules and superior with a terminal slightly bent style and blunt stigma. Pistil and anthers usually remain inside the keel. Pollination takes place before the opening of the bud, thus self pollination is the rule (Auckland and van der Maesen, 1980). The fruit of chickpea is inflated pod with 1-2 seeds. The surfaces of the seeds are wrinkled or smooth and the germination is hypogeal in chickpea.

Seed shape, size and coat colour seem to be under the control of poly genes. Disruption of any one of the genes might manifest in the form of seed mutations. The observed mutations in seed coat colour, size of the seed in chickpea might be due the disruption of one or few genes controlling these characters. Among the entire mutants tall, early maturing mutant, high yielding mutant, dwarf mutant, bushy mutant, white seeded and bold seed mutant, seems to be the most efficient ones for further improvement of the chickpea cultivars and there is scope for utilizing these characters for developing improved varieties of chickpea. Mutation breeding in general is relatively earlier method for crop improvement. Mutagenic agents can generate a wide spectrum of genetic variation. Pulse crops generally lack genetic variation due to their highly autonomous nature. Mutation breeding can be exercised to create genetic variation.

MATERIAL AND METHODS

The experimental seed material of chickpea (*Cicer arietinum* L.) namely, BDN9-3 and PG-5 occurred from Agricultural Research Station Badnapur, Dist: Jalna (Maharashtra) and Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist: A. Nagar (Maharashtra) India. Two chemical mutagens namely Ethyl methane sulphonate (EMS) and Sodium Azide (SA) were employed in the present investigation.

The chemical mutagenic treatments carried out room temperature of 25± 2o C. the fresh aqueous solutions of

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mutagens were prepared prior to their treatments. The concentration of solutions was 0.05%, 0.10% and 0.15% for EMS and 0.01%, 0.02% and 0.03% for SA. Seeds of uniform size were selected and immersed in distilled water for 6 hours to initiate presoaking. Such presoaked seeds were later on immersed in the mutagenic solution for 6 hours for EMS and SA treatments, with an intermittent shaking. The volume of mutagenic solution used was three times as that of seeds so as to facilitate uniform conditions. Post soaking was performed for 2 hours. The seeds soaked in distilled water for 14 hours served as control.

The 150 seeds of each treatment were sown in field following randomized block design (RBD) with three replications of 15 cm between the plants and 45 cm between the rows. All the plants from each treatment in M1 generation were harvested and the seeds were collected separately. Seeds of each 25 normal looking plants of M1 selected were collected on individual plant basis from the all treatment and control. They were used for raising the M2 generation on the plant to row basis. The study of M2 & M3 generation comprised of an analysis of the different parameters.

Randomly selected plants from each treatment along with control were studied thoroughly for different quantitative characters. The different quantitative traits analyzed are given below. The weight of the seeds was recorded in gm from random samples of 100 seeds from each plant

RESULT

The range of shift in mean values was mostly positive for all the mutagenic treatments in both the cultivars in M2 and M3 generations. The data of 100 seed weight (in gms) indicated an increase in 100 seed weight with higher concentrations of EMS and SA in both cultivars if chickpea in M2 and M3 generations. In M2 generations, the BDN 9-3 cultivar showed a negative shift in mean values at 0.05% concentration of EMS and 0.01% and 0.02% concentrations of SA, while at rest of the concentrations of EMS and SA positive shift in mean values could be noticed. In case of PG-5, the M2 generations showed mostly positive shift in mean values for all the mutagenic treatments except for 0.01% treatments of SA. In M3 generations all the mutagenic treatments showed positive shift in mean values except for 0.05% EMS and 0.01% SA in BDN 9-3 and PG-5, respectively.

Table 1 Effect of mutagens on 100 seed weight (in gms) in M2 generation of chickpea. Variety: BDN 9-3.

Treatment	Concentration (%)	Mean	± SE	Shift in mean	Coefficient of variation
Control	-	18.80	0.49	-	4.52
EMS	0.05	17.96	0.66	-0.84	6.40
	0.10	18.90	0.72	0.10	6.61
	0.15	19.66	0.63	0.86	5.59
SA	0.01	18.10	0.57	-0.70	5.52
	0.02	18.40	0.54	-0.40	5.16
	0.03	18.90	0.60	0.10	5.55
± SE = 0.20	CD at 1% =0.65		CD at 5% = 0.45		

Antoseed mutants were characterized by development of anthocyanin in the testa of seeds. They took slightly less number of days to attain maturity as compared with control in both BDN9-3 and PG-5. The number of pods per plant in such mutants was found to be reduced as compared with control.

Table 2 Effect of mutagens on 100 seed weight (in gms) in M2 generation of chickpea. Variety: PG-5.

Treatment	Concentration (%)	Mean	± SE	Shift in mean	Coefficient of variation
Control	-	27.94	0.23	-	1.43
EMS	0.05	28.12	0.46	0.18	2.84
	0.10	29.36	0.63	1.42	3.74
	0.15	29.74	0.51	1.80	3.02
SA	0.01	27.23	0.34	-0.71	2.20
	0.02	28.10	0.46	0.16	2.84
	0.03	28.86	0.40	0.92	2.45
± SE = 0.30	CD at 1% =0.97		CD at 5% = 0.67		

Table 3 Effect of mutagens on 100 seed weight (in gms) in M3 generation of chickpea. Variety: BDN 9-3.

Treatment	Concentration (%)	Mean	± SE	Shift in mean	Coefficient of variation
Control	-	18.20	0.54	-	5.21
EMS	0.05	18.10	0.63	-0.10	6.07
	0.10	19.40	0.60	1.20	5.41
	0.15	20.18	0.66	1.98	5.69
SA	0.01	18.24	0.72	0.44	6.85
	0.02	18.70	0.63	0.50	5.88
	0.03	19.10	0.69	0.90	6.28
± SE = 0.26	CD at 1% =0.84		CD at 5% = 0.58		

Table 4 Effect of mutagens on 100 seed weight (in gms) in M3 generation of chickpea. Variety: PG-5.

Treatment	Concentration (%)	Mean	± SE	Shift in mean	Coefficient of variation
Control	-	28.10	0.34	-	2.13
EMS	0.05	28.92	0.51	0.82	3.11
	0.10	29.50	0.46	1.40	2.71
	0.15	29.80	0.57	1.70	3.35
SA	0.01	27.78	0.69	-0.32	4.31
	0.02	28.35	0.51	0.25	3.17
	0.03	28.98	0.75	0.88	4.48
± SE = 0.25	CD at 1% =0.81		CD at 5% = 0.56		

DISCUSSION

The character of 100 seed weight is a reliable source of measuring yielding ability in pulses. In the present study, 100 seed weight has shown a very significant increase from the control with most of the treatments of gamma rays and EMS used either singly or in combination in both the varieties of chickpea. This character has been reported to be governed by a relatively smaller number of genes, unlike other polygenic traits. On the contrary, Jana and Roy (1971), Waghmare and Mehra (2001)) reported the reduction in the mean 100 seed weight.

Variations in the colour of seed testa (*Anthoseed*) and seed size were also being observed in the present investigation. The seed coat colour is affected by genetic factors like pigmentation factor (P), pigment complementary factor and modifying factors (Moh 1971). Variation in seed coat was reported by Sharma (1969), Moh (1971) Thakare *et.al*, (1973), Malik and Ghosh (1980), Chary (1983), Chary and Bhalla (1986), Reddy (1991), Padmavathi (1993), Vanninrajan *et.al*, (1993), Rayyan (1995) and Gaikwad (2002) Moh (1971) Chary (1983), in different plant systems.

Variation in seed size has been reported by Nerkar (1970) in Lathyrus, Reddy and Reddy (1972) and Sarala and Reddy (1974) in rice, Malik and Mary (1973) in rye grass species, Pawar *et.al*, (1979) and Chary (1983) in pigeon pea, Bhamburkar (1981), Sudharani (1990), Singh and Raghuvanshi (1991) and Rayyan (1995) in black gram, and Gaikwad (2002) in lentil.

Increase in mean seed yield per plant may be due to the selection of normal looking plants in M2 which led to elimination of aberrant plants and also due to changes induced at genetic level. The selection process should be delayed until M3 or later generations following mutagenic treatment. However, the selection of progenies on the basis of desirable mean and greater variance in M2 was found to be highly useful. Many other workers have also proposed that effective selection for quantitative traits can be done in early generations even in M2 itself (Kharkwal, 1983; Sarker and Sharma, 1988; Singh *et al*., 2001; Solanki and Sharma, 2002; Sheeba *et al*., 2003; Arulbalachandran and Mullainathan, 2009).

Seed coat colours were induced due to various mutagenic investigation Coffee colour seed (CCSM), Light brown seed (LBSM) and white seed (WSM) coat colour mutants were reported by Chopde (1976), Nadarajan *et al*., (1982b), Marekar (1987, 1988b), Chary (1983), Biradar (2004) Shinde (2007) in pigeonpea.

Singh and Yadav (1991) reported different seed variants viz., bold seed, light black seeds, dull green, shining green, light brown and yellow coloured mutants in green gram induced with gamma radiation.

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