GENETIC VARIABILITY IN DIFFERENT ENVIRONMENT IN CHICKPEA (*CICER ARIETINUM* L.).

Geeta Chaudhary[1], B.S. Dahiya[1], Dhirendra Singh[2], Jitendra Kumar[3], Gyanendra Singh[4], Rahul Tomar[1], Arti Dahiya[1]

1. Department of Botany, J.V.College,Baraut – 250611 (Bagpat) Uttar Pradesh,India
2. Department of Agriculture J.V.College, Baraut-250611(Bagpat) Uttar Pradesh, India
3. Principal Scientist of Division of Genetics, IARI New Delhi-110012 India
4. Principal Scientist of DWR Karnal Haryana India

Abstract : 50 genetically diverse genotypes of chickpea were studied for Variability Heritability, and Genetic advance in 10 quantitative characters Days to 50 % flowering, Days to maturity, Plant height, No. of branches, Number of pods/plant, No. of seed/pod, 100 seed weight (g), Biological yield/plant, Seed yield per plant and Harvest index. In the vary late sowing condition (E3 and E6) five traits, days to flowering, plant height, total branches, seeds per pod and 100 seed weight showing high estimates of PCV. It was also concluded that days to flowering, plant height, pods/plant, 100 seed weight and harvest index showed high heritability coupled with high EGA. The influence of changing plantings dates was significant on various parameters of variability.

Keyword : Variability, Heritability, Genetic advance

Abbereviation : PCV- Phenotypic coefficient of variation, EGA-Expected genetic advance

INTRODUCTION

India is the largest pulses producing nation in the world. Pulses are mainly grown in rainfed area. India has 35 per cent of the world area and 21.2 per cent of the production of chickpea (*Cicer arietinum* L.) and is the major grain legume crop of the country. It is grown over an area of 6.50 million hectares and produces 5.32 million tones. Some favorable trends have been observed in recent past as the production of pulses was 13.00 million tons in 2001-2002 and the productivity was 603 kg per hectare.

Genetic variability is very important for the improvement of crop plants. More the variability in the population the greater are the chances for producing desired plant types. Heritability estimates and genetic advance in a population provides information about the expected gains in the following generations. The most important function of heritability estimates in the genetic studies of quantitative characters is their predictive role possible advances through selection based on phenotypic values can be predicated only from knowledge of the degree of correspondence between phenotypic and genotypic values.

Variability may be created after hybridization if this is not present among Genetic the parents in self-pollinated crops to the desired extent. Coefficient of variability is an important parameter used to measure variability (phenotypic and genotypic) in the breeding material.

Since all characters are not influenced by environment to the same extent, the observed total or phenotypic variability is not a true indicator of the genetic variability present in the material for measuring the progress that is possible by affecting selection in the genetically diverse material. Hence a valuable guiding criterion for a plant breeder is an estimation of genetic advance.

MATERIAL AND METHOD

The present investigation was carried out at Department of Botany, J.V College, Baraut (Bagpat) Uttar Pradesh. The experiment material consisted of 50 divergence genotypes of chickpea. The genotypes were obtained from IARI New Delhi Pusa.

Fifty genotypes of chickpea were evaluated in a randomized complete block design with three replications during rabi seasons of 2006 -2007 and 2007-2008. In each of the two year, the experiments were repeated over three dates of sowing. The three dates of sowing were 20 October, 05November, 20 November. In each of the six experiments (3 sowing dates x 2 years), each genotype will be raised in a plot of 1.8 m2 (4 rows x 4m length x 40cm inter row distance) with a plant to plant distance 20 cm. in each replication. All the recommended agronomic practices were followed to raise a good crop. The observations were recorded on five competitive and random plants per replication and mean values expressed per plant basis, at harvest stage. The single plant observations were recorded on different groups of cultivars during both the years both the plantings, respectively. For analysis of seed yield and its component traits, non-destructive sampling was reported at harvesting stage.

The observations on ten morphological traits were recorded on the cultivars at harvest stages Days to 50 % flowering, Days to maturity, Plant height, No. of branches, Number of pods/plant, No. of seed/pod, 100 seed weight (g), Biological yield/plant, Seed yield per plant and Harvest index .

RESULT AND DISCUSSION

Statistically, the total variability is expressed in terms of phenotypic coefficient of variation (PCV) and the genotypic variability is expressed in terms of genotypic coefficient of variation (GCV). These parameters of variability are particularly very informative when a breeder is interested in having a stock of the comparative account of variability present in different traits, which might have been measured in different units.

Variability in population, especially in respect to the characters for which improvement is sought, is a prerequisite for successful selection. The population under study was therefore examined to assess the amount of variability presented among different cultivars in respect to a number of metric traits.

In the present study, a wide range of variation was displayed by different traits across the environment. The success of selection depends on the extent of genetic variability present for the trait in the vary late sowing condition (E3 and E6) five traits, days to flowering, plant height, total branches, seeds per pod and 100 seed weight showing high estimates of PCV. Suggested that adequate variability is present for these traits and hence there is a scope for employing suitable breeding programs for bringing about improvement in these traits under late sown condition.

Data in Table Revealed that heritability estimates in environment (E1) were highest for 100 seed weight (95.10) and lowest value for heritability were found for the trait days to flowering (50.20). In E2, heritability varied from biological yield (29.80) to 100 seed weight (86.50). In very late sowing of first year (E3) the heritability was lowest (41.40) for seed yield per plant and highest for seeds per pods (92.00). On the other hand, the estimates of heritability in early sowing in second year E4 varied from 84.90 for days to flowering to 93.30 for 100 seed weight. In E5, the lowest value of heritability was recorded for the trait biological yield (87.50) and the highest value was recorded for the total branches (92.70). In E6, the values varied from 6.16 for biological yield to 91.0 for seeds per pods.

The estimates of heritability in relation to plant height were changing from environment to environment between the ranges of 95.10 to 50.20 per cent which indicated the influence of varying environmental conditions on the expressivity of the heritability of this trait. It is pertinent to mention that GCV, PCV and GA for plant height under varying environments were of low magnitude which shows that varying environments has negligible influence on these parameters of variability.

It is interesting to note that when these parameters were studied on the basis of pooling of data the magnitude was also of low order. High estimates of heritability were also reported by Chandra (1968), Mishra *et al.* (1988), Mishra (1991), Sandhu and Mandal (1989), Sharma *et al.* (1990) and Rao *et al.* (1994) for this character.

Thus, it is evident that pant height was influenced by change in planting dates.

The heritability estimates for number of branches under all the environments were observed between 73.20 to 92.70 per cent which suggest that heritability was influence by environmental changes. The PCV for this trait was observed between 8.77 to 11.19 in different environments which again show some marginal influence of environmental changes for this trait. Genetic advance for this trait, it was of very low magnitude with some marginal difference from environment to environment. On pooling basis the heritability estimates were of medium range and GCV, PCV and GA were of low magnitude. The low heritability estimates were reported by **Rao *et al.* (1994)** and high by Mathur and Mathur (1996) for this trait. High genetic advance was reported by Mishra *et al.* 1988, Rao *et al.* (1994) Thus, it was suggested that changing environmental conditions played major role in the expressivity of this trait.

Data in table Indicate that estimates of expected genetic advance (EGA) in E1 or early sowing of first year varied from 0.29 for seeds per pod to 7.11 for plant height, whereas in second year early sowing E4 it's ranged from 0.23 for seeds per pod to 16.86 for plant height similar as (E1). In E2 second date of sowing of first year the EGA varied from 0.09 for seeds per pod to 7.18 for days to flowering whereas, in E5 second date of sowing of second year the expected genetic advance varied from seeds per pod (0.23) to plant height (12.82). In E3 it's varied from 0.46 for seeds per pod to 13.03 for plant height whereas, in E6 the lowest EGA value was recorded as 0.46 for seeds per pod and the highest EGA was recorded for the trait plant height 13.39.

In the present study the value of EGA was high for four traits in all the six environments. High value of genetic advance for these traits, such as days to flowering, plant height, pods per plant and 100 seed weight shows that these characters are governed by additive gene action and selection will be rewarding for improvement of such traits. If the value of genetic advance is low, it indicates that the character is likely to be governed by non-additive gene action and the heterosis breeding may be useful for such traits. Similar result obtained by **Rao *et al.* (1994)** and high by Mathur and Mathur (1996) for this trait. High genetic advance was reported by Mishra *et al.* 1988, Rao *et al.* (1994) Thus, it was suggested that changing environmental conditions played major role in the expressivity of this trait.

Table : Estimates of mean, range, phenotypic coefficient of variation, heritability and genetic advance for 10 traits of six environments in chickpea

S.No.	Traits	Environments	Parameters				
			Mean	Range	PCV	H^2	EGA
1	daDays to 50%	E1	57.26	47.06 – 63.76	7.59	50.20	4.49
	Flowering	E2	55.23	43.80 – 67.02	10.55	59.80	7.18
		E3	39.28	30.42 – 46.20	11.51	72.50	6.76
		E4	67.19	60.60 – 70.47	3.81	84.90	4.47
		E5	56.22	45.93 – 61.66	8.79	48.10	1.83
		E6	39.41	31.40 – 46.20	11.83	69.70	6.69
2	Days to maturity	E1	106.97	103.89 – 110.10	1.70	82.80	3.10
		E2	105.96	101.76 – 109.16	2.02	43.10	1.90
		E3	106.99	102.13 – 112.38	2.79	56.90	3.50
		E4	117.73	115.74 – 122.21	2.44	16.90	1.00
		E5	106.73	104.40 – 108.96	2.88	42.10	1.49
		E6	107.07	103.03 – 112.38	2.70	55.30	3.30
3	Plant height	E1	145.75	138.86 – 153.11	2.78	85.30	7.11
	(cm)	E2	144.58	140.53 – 151.10	2.32	69.80	4.81
		E3	149.51	133.33 – 163.52	4.74	89.30	13.03
		E4	153.35	134.55 – 169.15	5.70	93.70	16.86
		E5	152.22	139.31 – 166.49	4.67	55.90	12.82
		E6	149.13	137.51 – 162.29	4.86	89.70	13.39
4	Total branches	E1	7.07	5.17 – 8.08	10.72	79.10	1.24
		E2	7.70	9.02 – 5.84	10.29	77.60	1.27
		E3	5.93	4.78 – 7.00	11.19	75.00	1.03
		E4	6.72	4.84 – 7.67	9.12	73.20	0.93
		E5	6.83	5.75 – 7.68	8.77	92.70	0.82
		E6	5.92	4.53 – 7.41	11.16	82.30	1.12
5	Pods per plant	E1	32.79	24.90 – 36.36	8.54	73.00	4.21
		E2	29.81	23.85 – 36.79	9.62	75.20	4.43
		E3	29.29	22.56 – 36.99	11.54	77.50	5.40
		E4	36.29	27.37 – 44.50	14.26	88.00	9.39
		E5	33.15	29.12 – 38.53	7.24	75.44	2.82
		E6	29.23	22.56 – 33.83	10.98	80.20	5.30
6	Seeds per pod	E1	1.39	1.17 – 1.82	12.21	83.70	0.29
		E2	1.30	1.26 – 1.61	6.31	52.50	0.09
		E3	1.33	1.05 – 1.93	18.32	92.00	0.46
		E4	1.28	1.06 – 1.62	11.19	76.70	0.23
		E5	1.45	1.15 – 1.74	10.07	56.90	0.23
		E6	1.34	1.08 – 1.92	18.11	91.00	0.46
7	100 seed weight	E1	23.75	15.01 – 33.25	21.74	95.10	5.18
	(g)	E2	23.83	20.34 – 29.67	13.41	86.50	5.70
		E3	21.98	11.26 – 33.29	30.01	97.30	13.22
		E4	22.99	14.67 - 32.94	21.92	93.30	9.69
		E5	24.10	15.81 – 33.25	20.29	66.00	9.35
		E6	22.15	11.90 – 33.57	29.98	96.80	13.25
8	Biological yield	E1	29.82	23.76 – 34.56	10.74	72.00	5.18
	(g)	E2	28.63	26.24 – 30.89	5.62	29.80	0.99
		E3	27.54	24.69 – 32.03	6.36	40.10	1.45
		E4	30.64	17.71 – 46.68	13.86	85.70	7.50

		E5	30.21	27.04 – 33.96	7.79	87.50	2.71
		E6	27.49	24.69 – 32.03	6.16	41.90	1.46
9	Seed yield / plant	E1	8.96	7.22 – 10.29	7.00	81.60	1.06
	(g)	E2	9.29	7.98 – 10.26	8.28	50.90	0.81
		E3	8.28	7.45 – 9.58	7.84	41.40	0.55
		E4	8.88	7.45 – 10.34	9.52	89.40	1.56
		E5	8.31	6.53 – 9.56	10.91	40.68	0.79
		E6	8.32	7.45 – 9.58	8.44	36.80	0.53
10	Harvest Index	E1	30.35	25.31 – 36.68	11.53	78.80	5.60
	(%)	E2	32.51	27.41 – 36.10	9.31	35.10	2.19
		E3	30.21	24.85 – 35.19	10.69	47.50	3.16
		E4	29.64	17.32 – 46.59	19.04	88.60	10.31
		E5	27.69	21.40 – 33.47	13.41	17.90	3.68
		E6	30.39	24.85 – 34.59	10.93	43.70	2.99

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In the present study the value of EGA was high for four traits in all the six environments. High value of genetic advance for these traits, such as days to flowering, plant height, pods per plant and 100 seed weight shows that these characters are governed by additive gene action and selection will be rewarding for improvement of such traits. If the value of genetic advance is low, it indicates that the character is likely to be governed by non-additive gene action and the heterosis breeding may be useful for such traits. Similar result obtained by Rao *et al.* (1994) and high by Mathur and Mathur (1996) for this trait. High genetic advance was reported by Mishra *et al.* 1988, Rao *et al.* (1994) Thus, it was suggested that changing environmental conditions played major role in the expressivity of this trait.

From Table it can be seen that the high estimates of heritability and EGA were observed for the traits: days to flowering, plant height, pods / plant, 100 seed weight and harvest index in all the environments which suggested that selection may be effective for these traits for all the six environments. In contrast high estimates of heritability coupled with low expected genetic advance were observed for the traits: days to maturity, no of total branches, biological yield and seed yield / plant indicating non-additive gene action.

In very late sowing (E3 and E6) the three traits days to flowering, plant height, pods/plant, 100 seed weight and harvest index showed high heritability coupled with high EGA, indicating that considerable improvement in these three traits may be achieved through selection in this environment.

The heritability estimates for this trait indicated that under normal and late plantings it was of higher and moderate magnitude, respectively. Thus, the influence of normal and late plantings was clearly visible in case of heritability for seed yield. When data was pooled the heritability estimates were approximately of moderate range and in case of GCV, PCV and GA, this range was of medium order in all the environments and also on pooling basis. The same pattern of heritability and genetic advance were reported by Rao *et al.* (1994). However, Mathur and Mathur (1996), Jahagirdar (1996) and Mandal and Bahal (1983) observed low genetic advance for seed yield.

Thus, it is important to mention that most of the quantitative traits have significantly superior performance under normal plantings in comparison to late plantings. It was also concluded that days to flowering, plant height, pods / plant, 100 seed weight and harvest index showed high heritability coupled with high EGA, indicating that considerable improvement in these three traits may be achieved through selection in (E3 and E6) environment.. Therefore, it was suggested that these two traits are stable in nature and selection can be exercise for these two traits at any point of generation advancement. The influence of changing plantings dates was significant on various parameters of variability.

REFERENCES

Chandra, S. (1968). Variability in gram (Cicer arietinum L.). Indian J. Genet., **28**:205-210.

Jahagirdar, J.E., Patil, R.A. and Dhond, V.M. (1996). Genetic variability and its relevance in chickpea improvement. PKV Res. J., **20**(1): 13-14.

Mandal,A.K.and Bahl,P.N.(1983).Genetic variability and correlation of harvest index in chickpea.Internat. chickpea newslett. **8**:11-12.

Mathur, R. and Mathur, M.L. (1996). Estimation of genetic parameters and interrelationship of quantitative traits in chickpea. Madras Agric. J., **83**(1); 9-11.

Mishra, R, Rao, S. K. and Koutu, L. K, (1988). Genetic variability, correlation studies and their implications in selection of high yielding genotypes in chickpea. Indian J. Agri. Res. **22** : 51 – 57.

Misra, R.C. (1991). Stability of heritability, genetic advance and character association estimates in chickpea (Cicer arietinum L). Internat. Chickpea Newslett, **25**: 10-11.

Rao, S.S., Sinha, R. and Das, G.K. (1994). Genetic variability, heritability,expected genetic advance and correlation studies in chickpea. Indian J. Pulses Res., **7**(1): 25-27..

Sandhu, S.K. and Mandal, A.K. (1989). Genetic variability and character association in chickpea (Cicer arietinum L). Genetic Ka, **21**(2): 135-139.

Sharma, B.D., Sood, B.C. and Malhotra, V.V. (1990). Study of variability, heritability and genetic advance in chickpea. Indian J. Pulses Res., **3**(1): 1-6.