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Phenotypic Diversity for Quantitative Characters in Chickpea (*Cicer arietinum L.*)

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Abstract **– High estimates of genotypic coefficient of variation and phenotypic coefficient of variation were observed for seed yield per plant followed by biological yield and number of pods per plant. High heritability coupled with high genetic advance was recorded for economical yield suggesting greater role of non-additive gene action in their heritance. On the basis of mean performance of the genotypes, CSJ-1093 was recorded high yield among 22 genotypes under study. Characters such as economical yield, biological yield should be given top priority for effective selection. The present investigation revealed that the plant height, pods per plant, seed index and harvesting index shown positive correlation with seed yield.**

Keywords **– Chickpea, Genetic Variability, GCV, PCV, Heritability and Phenotypic Diversity.**

I. INTRODUCTION

It is defined as a topic or area for which missing or insufficient information limits the ability to reach a conclusion for a question. A research need is defined as gap that limits the ability of decision makers to take the decision. India remains a net importer of Chickpea Despite contributing to more than 60% to global Chickpea area and production. This phenomenon is due to high national demand. Therefore there is need to select diverse parents with desirable characters for further hybridization for chickpea yield improvement. The present investigation was undertaken involving twenty two diverse and elite genotypes of chickpea with following objectives the characterization of chickpea germplasm for morphological characters and association between yield and its component traits in chickpea.

The word **Cicer** is a derivative from the **Greek** word **kiros** referring to a well-known roman family Cicero. Arietinum is derived from the Latin word arise meaning ram which refers to the ram's head shape of the chickpea (**Singh, 1985**).

Chickpea is one of the important food legumes in the World. Globally, it is cultivated in more than 57 countries and ranks second in acreage after dry bean. However, it stands third in production following dry bean and peas with the productivity of about 913 kg ha^{-1} (**FAO, 2017**). South and Southeast Asian countries account for more than two third of the total chickpea production. It is known to have originated in Western Asia. Chickpea is the only cultivated species under the genus '*Cicer*', and has 2n = 14 chromosomes with relatively small genome size of 738.09 Mbp (**Varshney *et al.*, 2013**).

Pulses maintain the soil fertility by fixing atmospheric nitrogen and improved soil structure. Pulses also play on important role in rainfed agriculture improving physical, chemical and biological properties of soils so considered excellent crop for natural resources management environmental crop diversification and consequently for viable agriculture. A healthy crop of chickpea can fix up to 141 kg nitrogen per hectare. **(Khan *et al.*, 2006)**.

II. Materials and Methods

The experimental material for the present investigation consisted of 22 genotypes obtained from Rajasthan Agriculture Research Institute, Jaipur, Rajasthan. the present experiment was conducted in randomized block design at Field Experimentation Centre, Department of Genetics and Plant Breeding, SHUATS, Prayagraj, U.P. during *Rabi* 2018-19. Each genotype was sown in a 3 rows of 1 m length with spacing of 30 cm between rows and 10 cm between plants. Recommended cultural practices were followed to raise healthy crop. Five competitive plants from each genotype were randomly selected for recording observations on eleven characters, viz., days to 50 per cent flowering, days to 50 per cent pod setting, days to maturity, plant height, number of primary branches per plant, pod length, number of pods per plant, seed index (g), biological yield, seed yield per plant and harvest index. Analysis variance **(Fisher, 1936)**, genetic variability **(Burton, 1952)**, estimation of heritability **(Burton and Devane, 1953)**, genetic Advance **(Johnson *et al*., 1955)**, genotypic and phenotypic correlation **(Al Jibouri *et al.*, 1958)** were computed utilizing respective components of variance and co-variance.

III. Results and Discussion

The variation in days to 50 per cent flowering ranged between 79.00 to 84.00 days. Genotype CSJ-1087 flowered in (84.00) days and CSJ-1082 flowered in less number of days (79.00) while CSJ-1087 flowered late (84 days). Mean value for this character was 81.45 days. The variation in days to 50 per cent pods setting ranged between 102.00 to 106.00 days. The plant height was maximum in case CSJ-1083 while it was minimum in case of CSJ-1098. The value recorded for maximum height was 56.60 cm while minimum height was 48.40 cm. Mean value for this character was 52.20 cm. Number of primary branches per plant ranged from 2.67 (CSJ-1081) to 3.40 (CSJ-1097). Mean value for this character was 3.0. Number of pods per plant ranged from 43.70 to 53.60. Genotype CSJ-1075 recorded lowest while CSJ-1093 had maximum number of pods per plant. 17 genotypes were with more number of pods per plant than the mean performance. Mean value for this character was 46.72. Pod lengths ranged from 1.40 to 1.58. The genotype CSJ-1075 recorded low, while CSJ-1103 had maximum pod lengths. 11 genotypes were with higher pods length than the mean performance. Mean value for this character was 1.49 cm. The variation for 100 seed weight ranged between 17.33 g to 21.00 g. Genotype CSJ-1090 (17.33gm) was with the lowest while CSJ-1082 (21.00 g) with highest 100 seed weight and mean value for this character was 19.03 g. The variation for harvest index ranged between 37.82% to 55.47%. The low harvest index was recorded in case of CSJ-1099 while maximum in case of CSJ-1093 and the mean value for this character was 46.56.

The genotypic coefficient variation was high for harvesting index (27.50) followed by pods per plant (21.00) and seed index (7.7). The phenotypic coefficient of variance ranged from 1.25 to 30.30. Harvesting index recorded high for phenotypic coefficient of variance (30.30) followed by pods per plant (26.72) and seed index (13.70). The estimates of genetic advance ranged from 0.06 to 49.07 with the high estimate in case of harvesting index (49.07) followed by pods per plant (32.33) and seed index (4.2). The heritability was high for harvesting index (90.4%) followed by pods per plant (78.34) and seed index (32.15).

It revealed that harvesting index (0.713**), seed index (0.611**) and pods/plant (0.981**) showed positive significant correlation with seed yield while days to 50% pods setting (-0.273*), primary branches/plant (-0.312*) and days to 50% flowering (-0.312**) had negative significant correlation with seed yield per plant at phenotypic level. It revealed that harvesting index (0.793**), seed index (0.622**) and pods/plant (0.994**) showed positive

significant correlation while days to 50% pods setting (-0.244*), primary branches per plant (-0.297*) and days to 50% flowering (-0.342**) had negative significant correlation with seed yield per plant at genotypic level.

Borate *et al.* (2010) studied population parameters such as range, mean, phenotypic and genotypic variances, PCV and GCV, heritability and genetic advance for 13 agronomic characters in a set of 30 chickpea genotypes. Range of variability was appreciable for days to first flowering, secondary branches, plant height, dry matter and grain yield per plant. Values of genotypic and phenotypic variances were highest for number of pods, while lowest for number of seeds per pod. PCV showed higher values than GCV for all characters. High heritability coupled with high genetic advance was observed for grain yield. Plant height, dry matter, days to first flowering and days to maturity indicated high additive gene effects.

Gul *et al.* (2013) studied that 20 chickpea genotypes in which broad sense heritability estimates were highest for pods per plant, primary branches per plant, 100 seed weight, seed yield per plant and secondary branches per plant. Genetic advance was higher for pods per plant, seed yield per plant, primary branches per plant and secondary branches per plant. Seed yield per plant showed highly significant genetic as well as phenotypic correlation with pods per plant, number of primary branches per plant, secondary branches per plant and 100 seed weight in positive direction. They concluded that pods per plant, number of primary branches, number of secondary branches and 100 seed weight would be the appropriate selection criteria for better seed yield in chickpea.

Kumar *et al.* (2017) studied genetic variability, correlation and path analysis for seed yield and its component characters in 29 chickpea genotypes sown under heat stress environment and the analysis of variance result revealed significant differences among the genotypes for all the traits indicating presence of sufficient variability among the genotypes for various traits. The high GCV and PCV were observed for disease reaction to wilt, number of pods per plant, 100-seed weight and grain yield. High heritability with high genetic advance as percentage of mean was noticed for number of pods per plant, 100-seed weight and disease reaction to wilt. On the basis of seed yield, Phule G-13110 (2080 kg / ha), RKG 11-155 (2038 kg / ha), PBC 501(1920 kg / ha) and CSJ (1907 kg / ha) were identified as promising heat tolerant genotypes.

Khan (1999) studied genetic divergence among 36 geographically diverse chickpea genotypes by using D^2 statistic. The genotypes were grouped into eight clusters on the basis of yield and yield components. It was concluded that hybridization among the genotypes from cluster I and II may result in high yielding varieties.

Table I. Estimates of variability parameters for 11 quantitative characters in chickpea.

Sr. No.	Characters	GCV	PCV	Heritability (%)	GA of Mean	GA as % of Mean
1	Days to 50% flowering	1.33	2.01	43.51	1.47	1.81
2	Days to 50% pods setting	0.76	1.25	37.22	1.00	0.96
3	Days to maturity	0.95	1.27	56.71	1.82	1.48
4	Plant height	3.40	6.48	27.53	1.92	3.67
5	Primary branches/plant	3.78	6.81	30.86	0.13	4.33
6	Pods/plant	21.00	26.72	78.32	49.07	41.49
7	Pod length	2.91	4.06	51.31	0.06	4.29

Sr. No.	Characters	GCV	PCV	Heritability (%)	GA of Mean	GA as % of Mean
8	Biological yield	7.08	12.55	31.82	3.17	8.22
9	Seed index	7.77	13.70	32.15	4.22	9.07
10	Harvesting index	27.50	30.34	90.4	32.33	49.33

GCV = Genotypic Coefficient of Variation.

PCV = Phenotypic Coefficient of Variation.

GA = Genetic Advance.

Table II. Correlaton coefficients between seed yield and other yield component traits in chickpea at genotypic and phenotypic level.

Characters		Days to 50% pods setting	Days to maturity	Plant height	Primary branches/Plant	Pods /plant	Pods length	Biological yield	Seed index	Harvesting index	Seed yield /plant
Days to 50% flowering	G	0.494**	0.167	-0.375**	0.454**	0.267*	0.405**	-0.303*	0.130	-0.537**	-0.342**
	P	0.277*	0.147	-0.432**	0.554**	0.253	0.399**	-0.213*	0.129	-0.491**	-0.312**
Days to 50% pods setting	G	**1.000**	-0.255*	-0.063	-0.133	0.00 7	0.250*	-0.130	-0.032	-0.194	-0.244*
	P	**1.000**	-0.135	-0.019	-0.188	0.039	0.210*	-0.138	-0.039	-0.213	-0.273*
Days to maturity	G		**1.000**	0.041	-0.435**	0.158	-0.346**	0.044	-0.093	-0.010	-0.127
	P		**1.000**	0.021	-0.487**	0.079	-0.312**	-0.032	-0.093	-0.021	-0.131
Plant height	G			**1.000**	-0.432**	-0.236	-0.524**	0.250*	0.117	0.904**	0.633**
	P			**1.000**	-0.410**	-0.108	-0.542**	0.251*	0.117	0.981**	0.618**
Primary branches/plant	G				**1.000**	-0.262*	0.195	0.439**	-0.458**	-0.002	-0.297*
	P				**1.000**	-0.197*	0.195	0.413**	-0.469**	-0.012	-0.312*
Pods/plant	G					**1.000**	0.057	-0.254*	0.778**	-0.109	0.994**
	P					**1.000**	0.054	-0.268*	0.617**	-0.121	0.981**
Pod length	G						**1.000**	-0.047	-0.151	-0.499**	-0.467**
	P						**1.000**	-0.009	-0.213	-0.412**	-0.512**
Biological yield	G							**1.000**	-0.836**	0.337**	-0.074
	P							**1.000**	-0.669**	0.312**	-0.113
Seed index	G								**1.000**	0.897**	0.622**
	P								**1.000**	0.987**	0.611**
Harvesting index	G									**1.000**	0.793**
	P									**1.000**	0.713**

* and ** represent significant levels at 5% and 1% respectively.

IV. Conclusion

High estimates of genotypic and phenotypic coefficient of variation were observed for harvest index. Harvesting index recorded high heritability (90.4%) followed by pods per plant (78.32%). Genetic Advance is high for pods per plant (49.07). Harvest index, seed index and pods/ plant exhibited positive significant correlation with seed yield per plant at genotypic and phenotypic levels.

References

[1] Borate, V.V., Dalvi, V.V. and Jadhav, B.B. (2010). Estimates of genetic variability and heritability. *Journal of Maharashtra Agriculture University,* 35(1): 47-49.
[2] Fisher, R.A. and Yates, F. (1943). Statistical tables for Biological, Agricultural and Medical Research. Edinburgh and London: Oliver and Boyd.
[3] Gul, R., Khan, H., Bibi, M., Ain, Q. U. and Imran, B. (2013). Genetic analysis and interrelationship of yield attributing traits in chickpea. *Journal of Animal and Plant Sciences,* 23(2): 521-526.

[4] Johnson, P.L., Sharma, R.N. and Nanda, H.C. (2015). Genetic diversity and association analysis for yield traits chickpea (*Cicer arietinum* L.) Under rice based cropping system. *The Bioscan,* 10(2): 879-884.
[5] Kumar, S., Kumar, A., Kumar, A., Kumar, R.R., Roy, R.K. and Agrawal, T. (2017). Genetic Variability of Chickpea Genotypes under Heat Stress Condition: Character Association and Path Coefficient Based Analysis. *Indian Journal of Ecology*, 44(4): 59-64.
[6] Khan, H., Ahmad, S.Q., Forhad, A., Khan, M.S. and Nayar, Iqbal (2006). Genetic variability and correlation among quantitative traits in chickpea germplasm. *Sarhad Journal Agriculture,* 22(1): 55-59.
[7] Khan, M.A., Ammar, M.H., Migdadi, H.M., El-Harty, E.H., Alfaifi, S.A., Farooq, M. and Alghamdi, S.S. (2016). Field performance and genetic diversity of chickpea genotypes. *International Journal of Agriculture & Biology,* 18(4): 683-688.
[8] Singh, K. B., Bejiga, G. and Malhotra, and R. S. (1990). Association of some characters with seed yield in chickpea collections. *Euphytica,* 49(18): 83-88.

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