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Phenotypic screening of chickpea (Cicer arietinum L.) germplasm for Genetic Variability and Character Association for seed yield and attributing traits.

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Abstract

Present study was conducted at the research farm of FASAI, Rama University, Mandhana, Kanpur to using 25 elite germplasm of chickpea to access the variability and trait association for seed yield and its attributing traits. The experiment has been conducted in RBD design with three replications. Analysis of variance of variance for almost all the traits exhibited Positive and significant variability among the traits. Number of pods per plant showed relatively high GCV and PCV estimates. High estimates of heritability were observed for days to 50% flowering, days to maturity, seed index, biological yield and numbers of pods per plant. Hence, high heritability and high genetic advance as per % of mean were observed for number of plants per plant, seed yield per plant and days to 50h flowering. Seed yield per plant positively correlated at genotypic & phenotypic level with number of primary branches per plant, bio yield per plant and number of plants per pod per plant. These characters can serve as selection indices for improved chickpea yield.

Key words: *Chickpea, Variability, Germplasm, Correlation*

Introduction:

Chickpea is a cool season food legume and belongs to Fabaceae family. it is a true diploid (2 n = 2 x = 16) species, self- pollinated, with 738 Mbp genome size and contains 28269 genes. It is being grown worldwide, including the Indian subcontinent, Africa, Middle-East and Europe, etc. Eastern Region east of the Mediterranean Sea was the most accepted primary centre of origin.

Chickpea is a highly nutritious crop that ranks second after dry beans in world production, more than 17 million tonnes (MT) were produced in 2022 (**FAOSTAT, 2023**). The

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cultivation area, production and yield of chickpeas in the world have been reported to be 14.8 million hectare (M ha), 15.1 MT, and 1016 kg/ha, respectively . Annually, more than 2.3 MT of chickpeas are introduced into the global market, fulfilling the requirements of nations that cannot satisfy their demand solely from domestic cultivation. The Indian subcontinent, encompassing India, Pakistan, Myanmar, Bangladesh, and Nepal, holds a prominent position in chickpea production. India, in particular, emerges as the global leader in chickpea cultivation, contributing a staggering 68% of the world's production and dedicating approximately 69% of its cultivated area to this vital crop. Notably, Australia, Canada, and Argentina emerge as the forefront leaders in chickpea exports.

India is the largest chickpea producing country with a share of 67% in the area and 66% production of chickpea in the world. In India, chickpea production reached 13.75 MT from a cultivated area of 10.91 M ha with a productivity of 1260 kg/ka. It plays a pivotal role in India's pulse production, contributing nearly 50% to the total pulse output. The major chickpea-producing states in the country include Maharashtra, which contributes 25.97% of national production, followed by Madhya Pradesh at 18.59%, Rajasthan at 20.65%, Gujarat at 10.10%, and Uttar Pradesh at 5.64%. However, there is a huge difference in productivity level in different states in the country. Higher productivity has been recorded in Gujarat (1908 kg/ha) while low productivity in Karnataka (689 kg/ha). Many factors affect chickpea yield in the country including rainfed cultivation on marginal soil, biotic and abiotic stresses, low input and other management.

Based on the importance of chickpea in dietary supplement and helping in fighting the protein malnutrition situation of developing countries it is prerequisite to develop climate resilient, high yielding and resistance variety which could help in yield enhancement so that it could help in feeding the fastest growing Indian population. Before starting any judicious plant breeding activity, it is very essential to access the magnitude of genetic variability and character association of yield related traits.

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Material and Method:

Present experiment was conducted at the research farm of Faculty of Agricultural Sciences and Allied Industries, Rama University, Mandhana, Kanpur. 25 diverse genotypes of chickpea collected from the Indian institute of Pulses Research; Kanpur have been evaluated in RBD field Experimental design in three different replications. Recommended plant to plant and row to row distance were maintained and all the recommended agronomic practices were done to raise the good crop. Five randomly selected plants were tagged and all the biometrical data have been recorded for nine highly heritable traits such as Days to 50% flowering, Plant height (cm), Primary branches per plant, total pods per plant, Days to maturity, biological yield (g), Seed index (g), Harvest index (%) and Seed yield per plant (g). The PCV and GCV estimates were classified into three categories: low, medium, and high, according to the study conducted by Sivasubramanian and Madhava Menon in 1973. The classification was based on the percentage values, where less than 10% was considered low, 10-20% was considered moderate, and greater than 20% was considered high. Similarly, the heritability estimates were categorized into three groups: low (0-30%), moderate (31-60%), and above high (60%), as suggested by Johnson et al. in 1955. To estimate the genetic advance, the method proposed by Johnson et al. in 1955 was adopted, and the results were categorized as high (more than 20%), moderate (10-20%), and low (10%). The correlation coefficient was estimated using the methods recommended by AL-Jibouri et al. in 1958.

Results and Discussion:

The differences among the chickpea genotypes were significant at 5% level of significance for all the nine traits. The analysis of variance showed that there were considerable inherent genetic differences among genotypes for all the characters under study. The mean squares due to blocks were non-significant for all the characters. This indicates that there is ample scope for selection of genotypes from the present gene pool for yield and its components. The presence of large amount of variability might be due to diverse source of material taken as well as environmental influence affecting the phenotypes. These findings are in accordance with the findings of Dubey and Srivastava (2007), Barshile et al., (2009), Borati et al., (2010) and Kuldeep et al., (2014) who also observed significant variability for yield and its components traits in chickpea. High variances (VG and VP) were recorded for number of pods per plant (245.61 and 342.56). Both PCV and GCV estimates were high for number of pods per plant (31.32% and 28.86%) followed by seed yield per plant (37.01% and 19.76%), number of primary branches per plant (29.87% and 16.32 %), biological yield (24.70% and 23.70%), plant height (16.26% and 11.97 %), days to 50% flowering (10.69% and 10.57%), and seed

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index (9.95% and 9.71%). Dubey and Srivastava (2007), Barshile et al., (2009), and Kuldeep et al., (2014) registered high genotypic coefficient of variation for number of pods per plant High estimates of heritability (above 60%) in broad sense were recorded for five characters, which ranged from 84.88% (number of pods per plant) to 97.78% (days to 50% flowering) (Table 2). A perusal of genetic advance for all the quantitative characters under study ranged from 1.25% (number of primary branches per plant) to 28.69% (number of pods per plant). Genetic advance as percent of mean was high for number of pods per plant (54.77) followed by biological yield (46.85), seed yield per plant (21.74) and days to 50% flowering (21.54). Durga et al., (2007) also recorded high genetic advance for days to 50 % flowering. High heritability was registered for days to 50% flowering, days to maturity, seed index, biological yield and number of pods per plant. Khan et al., (2006), Babbar et al., (2012) and Parameswara et al., (2012) recorded high heritability for days to 50 % flowering. High heritability coupled with moderate genetic advance was registered for number of pods per plant (84.88 and 28.69), suggesting predominance of additive gene action in the expression of these traits.

Seed yield per plant showed positive and significant genotypic association with number of primary branches per plant (0.999**), biological yield per plant (0.998**), number of pods per plant (0.785**), days to 50% flowering (0.498**), harvest index (0.380**) and seed index (0.322*) (Table - 3). Similar results were also reported by Ali et al., (2011), Padmavathi et al., (2013) and Kuldeep et al., (2014). Seed yield per plant exhibited significant positive correlation with biological yield per plant (0.648**) followed by number of pods per plant (0.471**), harvest index (0.455**) and primary branches per plant (0.312*) (Table 3).

The results from present study concluded that all thirteen genotypes of Chickpea showed significant genetic variability. High heritability and genetic advance observe for days to 50% flowering, number of pods per plant, biological yield per plant, days to maturity and hence these parameters could be used as for selection. Number of primary branches per plant showed highly significant and positive correlation with seed yield per plant at genotypic level, and biological yield showed highly significant and positive correlation with seed yield per plant at phenotypic level, indicate that these characters can be used as selection parameters for chickpea improvement.

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Table.1 Analysis of variance for nine different quantitative characters in Chickpea

SN.	Characters	Mean sum of squares		
		Replications	**Treatments**	**Error**
		df = 3	df = 25	df = 75
1.	Days to 50 % flowering	1.897	257.631*	1.939
2.	Plant height	89.147	152.131*	33.495
3.	No. of primary branches per plant	4.224	6.641*	2.919
4.	Number of pods per plant	36.391	726.490*	40.715
5.	Days to maturity	0.276	82.609*	0.942
6.	Seed index	38.706	60.103*	26.651
7.	Biological yield	41.373	44.193*	20.116
8.	Harvest index	14.853	204.953*	5.714
9.	Seed yield per plant	0.177	13.384*	0.218

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Table.2 Genetic parameters for nine quantitative characters in chickpea

S. N.	Characters	Vg	Vp	**GCV (%)**	**PCV (%)**	**h^2 (bs) (%)**	**GA**	**GA as % of mean**
1.	Days to 50 % flowering	85.23	87.17	10.57	10.69	97.78	18.81	21.54
2.	Plant height	39.55	73.04	11.97	16.26	54.14	9.53	18.14
3.	Number of primary branches per plant	1.24	4.16	16.32	29.87	29.83	1.25	18.36
4.	Number of pods per plant	245.61	342.56	28.86	31.32	84.88	28.69	54.77
5.	Days to maturity	27.22	28.16	4.15	4.22	96.65	10.57	8.41
6.	Seed index	4.39	4.61	9.71	9.95	95.28	4.21	19.52
7.	Biological yield	66.41	72.13	23.70	24.70	92.08	16.11	46.85
8	Harvest index	11.15	37.80	8.00	14.74	29.50	3.74	8.95
9.	Seed yield per plant	8.03	28.14	19.76	37.01	28.52	3.12	21.74

Table.3 Correlation coefficient between yield and its related traits in chickpea genotypes at genotypic level

Characters	Plant height	Primary branches per plant	Pods per plant	Days to maturity	Seed index	Biological yield	Harvest index	Seed yield per plant
Days to 50 % flowering	0.058	0.833**	0.737**	0.497**	0.283*	0.403**	0.268	0.498**
Plant height	1.00	-0.035	-0.238	0.114	0.500**	0.102	0.530**	0.219
Primary branches per plant		1.00	0.995**	0.185	0.332*	0.996**	0.284*	0.999**
Pods per plant			1.00	0.464**	0.078	0.733**	-0.071	0.785**
Days to maturity				1.00	0.569**	0.042	0.196	0.116
Seed index					1.00	0.179	0.375**	0.322*
Biological yield						1.00	0.116	0.998**
Harvest index							1.00	0.380**

*and ** significant at 5% and 1% probability

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Table.4 Correlation coefficient between yield and its related traits in chickpea at phenotypic level

Characters	Plant height	Number of primary branches per plant	Number of pods per plant	Days to maturity	Seed index	Biological yield	Harvest index	Seed yield per plant
Days to 50 % flowering	0.063	0.443**	0.676**	0.474**	0.282*	0.372**	0.117	0.267
Plant height	1.00	0.275*	-0.080	0.057	0.356**	0.140	0.231	0.225
No. of primary branches per plant		1.00	0.477**	0.033	0.136	0.514**	0.204	0.312*
No. of pods per plant			1.00	0.415**	0.044	0.628**	0.015	0.471**
Days to maturity				1.00	0.535**	0.056	0.116	0.078
Seed index					1.00	0.152	0.152	0.117
Biological yield						1.00	0.122	0.648**
Harvest index							1.00	0.455**

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References:

Ali, M. Mishra, Singh and Kumar (2011). Exploitation of genetic variability for grain yield improvement in chickpea. International Journal of Agriculture and Biology, 4(1): 149-152.

Al-Jibouri A., Miller, P.A and Robinson, H. F. (1958). Genotype tube and environmental variation and covariationin cotton crops of interspecific origin. Journal of Agronomy, 50: 625-636.

Babbar, A., V. Prakash, P. Tiwari, M. A. Iquebal (2012). Genetic variability for chickpea (Cicer arietinum L.) under late sown season. Legume Research, 35(1): 1-7.

Barshile, J.D., S.G. Auti and Apparao. (2009). Genetic enhancement of chickpea through induced mutagenesis. Journal of Food Legumes, 22(1): 26-29.

Burton, G.W. (1952). Qualitative inheritance in grosses production. 6th International Grassland Congress Journal, 227-283.

Burton, G.W. and Devane, E.M. (1953). Estimating heritability in tall fesses from replicated clone material. Journal of Agronomy, 45 (3): 474- 481.

Choudhary P., Khanna S.M., Jain P.K., Bharadwaj C., Kumar J., Lakhera, P.C and Srinivasan, R (2012). Genetic structure and diversity analysis of the primary gene pool of chickpea using SSR markers. Genetics and Molecular Research,11(2): 891-905.

Croser J. S., Ahmad F., Clarke, H. J and Siddique K. H. M. (2003). Utilization of wild Cicer in chickpea improvement-progress, constraints, and prospects. Australian Journal Agricultural Research 54: 429-444.

Dubey, K. K. and Srivastava, S. B. L. (2007).Analysis of genetic divergence for yield determinants in chickpea (Cicer arietinum L.). Plant Archives, 7(1): 153-155.

Durga, K.K., Murthy, S.S.N., Roa Y.K. and Reddy, M.V. 2007. Genetics studies on yield and yield components of chickpea. Agricultural Science Digest, 27(3):201-203

FAOSTAT (2014). Food and Agricultural Organization Statistical Databases, Rome.

Gil J., Nadal S., Luna D., Moreno, M and de Haro, A. (1996).Variability of some physicochemical characters in Desi and Kabuli chickpea types. Journal Science Food Agricultural, 71:179–184.

Johanson, H.W., Robinson, H.K. and Comstock (1955). Estimates of genetic and environmental variability in chickpea. Agronomy Journal, 47: 314-318.

ISSN PRINT 2319 1775 Online 2320 7876

Research Paper **© 2012 IJFANS. All Rights Reserved** UGC CARE Listed (Group -I) Journal Volume 10, Iss 03, 2021

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.

Kuldeep RK, Pandey S, Babbar A and Mishra DK. (2014). Genetic variability, character association and path coefficient analysis in chickpea grown under heat stress conditions. Electronic Journal of Plant Breeding 5(4): 812-819.

Padmavathi, C., Katti G, Sailaja V, Padmakumari AP, JhansilakshmiV, Prabhakar M, and Prasad YG. (2013). Temperature thresholds and thermal requirements for the development of the rice leaf folder, Cnaphalocrocis medinalis. Journal of Insect Science 13(1).

Parameshwarappa, S. G. and P. M. Salimath (2012). Field screening of chickpea genotypes for drought resistance. Karnataka J. Agric. Sci., 21(1): 113- 114.

Sivasubramanin, S. and Madhava, M.P. (1973). Genotypic and phenotypic variability in rice. Madras Agricultural Journal, 60, 1093-1096.

Van der Maesen, L. J. G. (1984). Distribution and evolution of chickpea and its wild relatives. In Genetic Resources and their Exploitation-Chickpea, Faba bean and Lentils, 57 pp.95-104, (J. R. Witcombe and W. Erskine, eds.). Maritinus Nijhoff/ Dr. W. Junk Publisher, The Hague and ICARDA.