

**RESEARCH PAPER**

Studies on the genotypic co-efficient of variation and phenotypic co-efficient of variation in chickpea (*Cicer arietinum* L.) germplasm for yield-attributing characters

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Abstract : The magnitude of the genotypic co-efficient of variation (GCV) and phenotypic co-efficient of variation (PCV) in chickpea germplasm was observed high for characters like seed yield per plant followed by number of pods per plant, 100 seed weight, plant height, number of secondary branches per plant and number of primary branches per plant. The characteristics viz., seed yield per plant showed high GCV and PCV, moderate heritability and high genetic advance as a per cent of the mean. The characters viz. number of pods per plant, 100 seed weight, harvest index, number of secondary branches per plant and plant height recorded a highly positive significant correlation with seed yield at both genotypic and phenotypic levels. This indicates the simultaneous improvement of these characters through the selection of chickpeas.

Key Words : Chickpea, GCV, PCV, Correlation, Yield attributing characters

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INTRODUCTION

Chickpea (*Cicer arietinum* L.), also known as Gram, Bengal Gram, Garbanzo bean and Egyptian pea is a autogamous legume crop with chromosome no. $2n = 14$ or $2n = 16$. Chickpea is an important protein-rich pulse crop with considerable diversity present among 44 known annual *Cicer* species. A large collection of chickpea germplasm including wild *Cicer* species has been conserved in different gene banks globally.

Legume crops have a unique place in Indian agriculture due to their ability to maintain and restore

soil fertility, as well as their nutritious importance. The development of chickpea varieties is possible with the availability and use of divergent genetic material in this crop. Therefore, the magnitude of the genotypic co-efficient of variation and phenotypic co-efficient of variation in this crop was studied in the present investigation.

MATERIAL AND METHODS

The present investigation was conducted during *Rabi* season of 2021-2022 at the College of

Agriculture, VNMKV, Badnapur, Maharashtra, India to estimate the genetic diversity. The experimental material consisted of 41 diverse genotypes of chickpea including with five standard checks *viz.* Akash (BDNG-797), Digvijay, Vijay, Phule Vikram and JAKI 9218. These chickpea genotypes were evaluated in Randomized Block Design (RBD) with two replications. The chickpea genotypes were sown in a row of 4 m length with a spacing of 45 cm for row to row and 10 cm for plant to plant. Observations were recorded for ten traits *viz.*, days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of secondary branches per plant, number of pods per plant, number of seeds per pod, 100 seed weight, seed yield per plant and harvest index. The analysis of divergence was carried out by D2 statistics proposed by Mahalanobis (1928 and 1936) and described by Rao (1952).

RESULTS AND DISCUSSION

The magnitude of the phenotypic co-efficient of variation (PCV) was higher than the genotypic co-efficient of variation (GCV) in chickpea genotypes for all the characters studied, indicating that the apparent variation is not only due to genotypes but also due to the environmental effect. The analysis of variance and variability parameters are shown in Tables 1 and 2.

The GCV was maximum for seed yield per plant (33.66%) followed by the number of pods per plant (23.76%), 100 seed weight (22.97%) and plant height (22.38%). The PCV was maximum for seed yield per plant (35.80%) followed by the number of pods per plant (25.80%), 100 seed weight (23.49%) and plant height (22.83%). The PCV was generally greater than the GCV.

The estimates of heritability ranged from 51.60% to 96.10%. Maximum heritability was observed for plant

Table 1 : Analysis of variance for ten quantitative characters in chickpea

Sources of variation	d.f.	Mean sum of squares									
		Days to 50% flowering	Days to maturity	Plant height (cm)	No. of Primary branches/plant	No. of Secondary branches/plant	No. of pods/plant	No. of seeds/pod	100 seed weight (g)	Harvest index (%)	Seed yield/plant (g)
Replications	1	8.89	7.02	2.25	0.04	0.98	10.18	0.001	4.55	1.85	0.53
Genotypes	40	33.79**	60.20**	229.34**	0.28	8.61	788.41**	0.068	59.93**	25.22**	107.05*
Error	40	2.79	2.52	2.69	0.02	0.96	64.70	0.01	1.34	8.06	3.52

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 2 : Estimates of variability parameters for ten quantitative characters in chickpea

Sr. No.	Name of the characters	Range	Mean	σ^2_g	σ^2_p	GCV (%)	PCV (%)	h^2 (b.s.) (%)	G.A.% (5%)	G.A.% (1%)	G.A.as % of mean (5%)	G.A.as % of mean (1%)
1.	Daysto 50% flowering	41.00-57.00	50.54	15.50	18.29	7.78	8.46	84.70	7.46	9.56	14.77	18.93
2.	Days to maturity	94.00-116.50	107.21	28.83	31.36	5.00	5.22	92.00	10.60	13.59	9.89	12.67
3.	Plant height (cm)	18.15-73.55	47.35	112.3	116.9	22.38	22.83	96.10	21.40	27.43	45.19	57.92
4.	Number of primary branches per plant	1.90-3.50	2.49	0.13	0.15	14.48	15.81	83.90	0.68	0.87	27.31	35.00
5.	Number of secondary branches per plant	7.00-16.10	10.63	3.82	4.79	18.38	20.58	79.80	3.59	4.61	33.82	43.35
6.	Number of pods per plant	44.20-120.30	80.04	361.85	426.56	23.76	25.80	84.80	36.09	46.25	45.09	57.78
7.	Number of seeds per pod	1.00-1.70	1.23	0.030	0.039	13.97	16.08	75.50	0.31	0.39	25.00	32.05
8.	100 seed weight(g)	13.20-36.00	23.56	29.30	30.64	22.97	23.49	95.60	10.90	13.97	46.27	59.30
9.	Harvest index(%)	29.16-44.91	38.81	8.58	16.64	7.54	10.51	51.60	4.33	5.55	11.16	14.31
10.	Seed yield per plant(g)	8.45-41.52	21.05	50.24	56.81	33.66	35.80	88.40	13.73	17.59	65.21	83.57

height (96.10 %) followed by 100 seed weight (95.60 %), days to maturity (92.00 %), seed yield per plant (88.40%), numbers of pod per plant (84.80%), days to 50 % flowering (84.70%), number of primary branches per plant (83.90%), number of secondary branches per plant (79.80 %), numbers of seed per pod (66.70%) and harvest index (51.60 %).

The estimates of genetic advance ranged from 0.31 % to 36.09 % at 5% level of significance and 0.39 % to 46.25 % at 1% level of significance. At 5% level of significance and at 1% level of significance the maximum estimate observed in case of number of pods per plant was 36.09 % and 46.25 % followed by plant height (21.40 %) and (27.43 %), seed yield per plant (13.73 %) and (17.59 %), 100 seed weight (10.90 %) and (13.97 %), days to maturity (10.60 %) and (13.59 %), days to 50 % flowering (7.46 %) and (9.56 %), harvest index (4.33 %) and (5.55 %), number of secondary branches per plant (3.59 %) and (4.61 %), number of primary branches per plant (0.68 %) and (0.87 %) and number of seeds per pod at 0.31 % and 0.39 %, respectively.

The estimates of genetic advance as per cent of mean ranged from 9.89 % to 65.21 % at 5% level of

significance and 12.67 % to 83.57 % at 1% level of significance. At 5% level of significance and at 1% level of significance the highest estimate recorded in case of seed yield per plant was 65.21 % and 83.57 % followed by 100 seed weight (46.27 %) and (59.30 %), plant height (45.19 %) and (57.92 %), number of pods per plant (45.09 %) and (57.78 %), number of secondary branches per plant (33.82 %) and (43.35 %), number of primary branches per plant (27.31 %) and (35.00 %), number of seeds per pod (25.00%) and (32.05%), days to 50% flowering (14.77 %) and (18.93 %), harvest index (11.16 %) and (14. 31 %), and days to maturity(9.89 %) and (12.67 %).

For days to 50% flowering and days to maturity both the genotypic and phenotypic coefficient of variation was lowest. Earlier workers, Gumber *et al.* (2002) reported the highest values of phenotypic coefficient of variation (PCV) for seed yield per plant. Dwivedi and Gaibriyal (2009) reported the highest values of the genotypic co-efficient of variation (GCV) and phenotypic co-efficient of variation (PCV) for traits like 100 seed weight and number of pods per plant.

Zeeshan *et al.* (2012) found high heritability for 100

Table 3 : Phenotypic correlation co-efficients for seed yield per plant with its components in chickpea

Characters	Days to 50 % flowering	Days to maturity	Plant height (cm)	Number of primary branches/Plant	Number of secondary branches/plant	Number of pods/plant	Number of seeds/pod	100 seed weight (g)	Harvest index (%)	Seed yield /plant (g)
	1	2	3	4	5	6	7	8	9	10
Days to 50% flowering	1.000	0.5824**	0.1877	-0.2471*	-0.0734	-0.0971	0.2810*	-0.0857	0.0791	-0.1278
Days to maturity		1.000	0.3944**	-0.1376	-0.0412	-0.0299	0.1361	0.2213	0.2303*	0.0969
Plant height (cm)			1.000	-0.1068	0.1609	0.1750	0.1411	0.4754**	0.2072	0.3480**
Number of primary branches per plant				1.000	0.2127*	-0.2106	0.0402	-0.0837	-0.1271	-0.1476
Number of secondary branches per plant					1.000	0.2815*	0.0474	0.1183	0.1052	0.3623**
Number of pods Per plant						1.000	-0.2364*	-0.0586	0.2563*	0.6488**
Number of seeds per pod							1.000	0.0837	-0.1188	-0.1316
100 seed weight (g)								1.000	0.4736**	0.6065**
Harvest index (%)									1.000	0.5174**
Seed yield per plant (g)										1.000

* and * indicate significance of values at P=0.05 and 0.01, respectively

Table 4 : Genotypical correlation co-efficients for seed yield per plant with its components in chickpea

Characters	Days to 50 % Flowering	Days to maturity	Plant height (cm)	Number of primary branches/Plant	Number of secondary branches/plant	Number of pods/plant	Number of seeds/pod	100 seed weight (g)	Harvest index (%)	Seed yield /plant (g)
	1	2	3	4	5	6	7	8	9	10
Days to 50% flowering	1.000	0.6581*	0.2139	-0.2971*	-0.0992	-0.1255	0.3477**	-0.0938	0.2148	-0.1400
Days to maturity		1.000	0.4170**	-0.1889	-0.920	-0.0667	0.1684	0.2391	0.3801**	0.0906
Plant height(cm)			1.000	-0.1203	0.1909	0.1743	0.1441	0.5077**	0.3349*	0.3649**
Number of primary branches per plant				1.000	0.2186*	-0.2417	0.0614	-0.0838	-0.2417	-0.1613
Number of secondary branches per plant					1.000	0.2552**	-0.0076	0.1639	0.0643	0.3662**
Number of pods Per plant						1.000	-0.3462**	-0.0627	0.3527**	0.6096**
Number of seeds per pod							1.000	0.1234	-0.2844*	-0.2133
100 seed weight (g)								1.000	0.6343**	0.6664**
Harvest index(%)									1.000	0.7310**
Seed yield per plant (g)										1.000

* and ** indicate significance of values at P=0.05 and 0.01, respectively

seed weight and plant height. These findings are supported by similar observations of Kumar *et al.* (2002) for the number of pods per plant, Akhtar *et al.* (2011) for the number of pods per plant and 100 seed weight, Jadhav *et al.* (2012) for 100 seed weight, Padmawati *et al.* (2013) for number of primary branches per plant, Gul *et al.* (2013) for number of pods per plant and Suyog *et al.* (2018) seed yield per plant.

The values of phenotypical correlation co-efficients are shown in Table 3 and genotypical correlation co-efficients in Table 4. The seed yield per plant had significant positive correlation with number of pods per plant ($p=0.6488$; $g=0.6096$), 100 seed weight ($p=0.6065$; $g=0.6664$), harvest index ($p=0.5174$; $g=0.7310$), number of secondary branches per plant ($p=0.3623$; $g=0.3662$) and plant height ($p=0.3480$; $g=0.3649$) at both phenotypic and genotypic level.

Earlier studies too have indicated such a positive significant correlation for number of pods per plant by Guler *et al.* (2001). Arshad *et al.* (2004) found that seed yield had a positive and significant correlation with number of pods per plant, plant height and 100 seed weight. Vaghela *et al.* (2009) found that seed yield per plant has

a significant and positive correlation with number of pods per plant, number of primary branches per plant, harvest index and 100 seed weight at genotypic as well as phenotypic levels.

Conclusion :

The magnitude of the genotypic co-efficient of variation and phenotypic co-efficient of variation in chickpea crop is important for the development of chickpea varieties when the divergent genetic material is used.

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Conflict of Interest:

There is no conflict of interest

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