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Genetic variability, correlation and path analysis for yield and it's component traits in chickpea (*Cicer arietinum* L.)

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Abstract
The present experiment carried out on 27 Chickpea genotypes including 3 checks *Viz*. PUSA 3043, PBG-5, PBG-9 were carried out under Agriculture Research Farm, Dept. of Genetics and Plant Breeding, Lovely Professional University, Phagwara, Punjab. This experiment was conducted in RBD with three replications. All the observations recorded for 11 characters *viz*., Days to First Flowering, Days to 50%Flowering, Days to maturity, Plant height (cm), Number of Primary Branches, Number of Secondary Branches, Biological Weight (g), Harvest index (%), Number of Pods Per Plant, Test weight (g), Yield per plant (g). The data so obtained were subjected to analysis of variance, estimation of different variability parameters, correlation and path analysis for all 11 characters. GCV and PCV found moderate for plant height, number of pods per plant, primary branches, yield per plant, harvest index and test weight also recorded high heritability coupled with high genetic advance. Traits such as harvest index, number of pods per plant, primary branches, plant height and test weight exhibited significant positive correlation with seed yield per plant, whereas harvest index followed by biological weight had positive and greater direct effects on seed yield per plant.

Keywords: Variability, correlation, chickpea, *Cicer arietinum* L.

Introduction
Pulses are an important crop commodity providing protein for human health second only to cereals. Pulses contain 2 per cent to 40 per cent protein on dry weight basis, which is nearly twice or thrice the value found in cereals. Among pulses, chick pea (*Cicer arietinum* L.) is preferred to food legumes because of its multiple uses for growing population across the world is considered as "The poor man's meat". Chickpea (*Cicer arietinum* L.) which is the third most important pulse crop grown during rabi season. It is a self-pollinated diploid (2n=16) grain legume with a genome size of 740 Mb. According to Vavilov (1926), South West Asia and the Mediterranean region are the two primary centers of origin and Ethiopia is the secondary center of origin for chickpea. The cultivated chickpea is mainly divided into two groups based on plant characteristics, seed size, shape and colouration as 'kabuli' and 'desi'. As it is an important source of protein, dietary fibre and micronutrients, chickpea is key to nutritional security in the near future. More than 80,000 chickpea germplasm accessions are being conserved in 30 gene banks across the world, but only a few have been used for chickpea improvement, which is also the major reason for its low productivity as compared to that in other countries. The narrow genetic base of cultivated chickpea warrants systematic collection, documentation and evaluation of chickpea germplasm, particularly wild annual Cicer species for effective and efficient use in chickpea breeding programmes. Limited or lack of genetic variability is important factor for the limited progress achieved in increasing the productivity of grain legumes including chickpea (Ramanujam, 1975).
Seed yield is a complex character, which is affected by a large number of yield components. Careful selection of desirable components may lead to the discovery of lines with higher yield than the original variety. The effectiveness of selection of plants with higher yield depends upon the extent to which the variability in yield is dependent on genetic factors. Environment has a great effect upon many of the economically important characters, which are often controlled by many genes. Thus, it becomes difficult to judge what portion of the observed variability is heritable and what portion is environmental.

The progress of a breeding program is conditioned by the influence of environment, magnitude and inter relationship of genotypic and environmental variations in the plant characters. It then becomes necessary to partition the observed variability into its heritable and non-heritable components with the help of suitable genetic parameters such as genetic co-efficient of variation, heritability estimates, genetic advance etc. Therefore, a basic understanding of the nature and magnitude of correlation among component traits towards yield is essential. Correlation coefficient and path analysis offers a means of determining the important traits influencing the dependent trait such as seed yield and it also helps in the determination of the selection criteria for simultaneous improvement of various characters along with economic yield. The present study was undertaken to study genetic variability, heritability, genetic advance and correlation and path analysis of various characters of chickpea.

Materials and Methods

The investigation was carried out to know the genetic variability, correlation and path analysis of 27 chickpea genotypes. The experiment was carried out at Agriculture Research Farm, Department of Plant Breeding and Genetics, Lovely Professional University, Phagwara (Punjab). All the 27 genotypes were screened under field conditions by adopting randomized block design. The The genotypes were planted during November 2nd week and harvested during the last week of March. The experimental materials consisting of 27 diverse genotypes of chickpea were sown in randomized block design in three replications. Each entry was planted in a plot size of 50 x 6 m accommodating 4 rows of 2m length, keeping row to row and plant to plant distance of 45 x 30, respectively. All the recommended package of practices was followed. Data were recorded on 11 different characters, namely days to first flowering, days to 50% flowering, plant height, number of primary branches, number of secondary branches, number of pods per plant, days to maturity, biological yield, seed yield per plant and harvest index, test weight. Five plants from each replication were randomly selected from each genotype for recording observations for all the traits.

Results and Discussion

The analysis of variance showed significant differences for all the characters studied. (Table 2). Coefficient of variation at phenotypic and genotypic level was relatively moderate in was found moderate for plant height, number of pods per plant, primary branches, yield per plant and harvest index and test weight. The magnitude of PCV was higher than GCV for all the characters indicating the influence of environment of these traits.

High heritability was observed in all the characters indicating additive gene effect. the genetic advance Genetic advance as a percent of mean recorded highest in plant height, number of pods per plant, yield per plant, primary branches, harvest index, test weight.

Table 1: List of genotypes used for the experiment

Number of Genotype	Name of genotype	Check varieties
G1	KWR 108	L1-PBG-8
G2	PDE 9802-E	L2-PDG-4
G3	JG-13-14-16	
G4	ICC-3020	
G5	IPC-06-77	
G6	KPG-59	
G7	ICC-5335	
G8	IPC-97-67	
G9	ICC-244-263	
G10	BG-212	
G 11	ICC-5434	
G 12	ICC-5439	
G 13	BPM	
G 14	IPC-07-56	
G 15	RSG-913	
G 16	RVG-203	
G 17	GNG-469	
G 18	SADABAHAR	
G 19	CSJK-54	
G 20	LOCAL VARIETY	
G 21	RSG-945	
G 22	CSJ-515	
G 23	IPC-05-28	
G 24	PUSA-3043	
G 25	PBG-5	

Table 2: Genetic Parameters of 11 characters of Chickpea

S.NO	Characters	GCV	PCV	h^2 (Broad Sense)	GA 5%	GA as % of Mean 5%
1	Days to first flowering	2.11	2.15	97.1	4.55	4.299
2	Days to 50% flowering	2.00	2.03	96.9	4.50	4.066
3	Plant height	18.22	18.31	99.1	11.42	37.374
4	Primary branches	13.77	14.20	94.0	1.01	27.517
5	Secondary branches	8.93	9.37	90.8	0.996	17.529
6	Number of pods per plant	14.03	14.07	99.5	11.74	28.842
7	Biological weight	3.11	3.12	98.9	0.777	6.374
8	Harvest index	13.13	13.19	99.0	9.42	26.920
9	Days to maturity	2.44	2.90	71.0	6.27	4.251
10	Test weight	12.69	12.69	99.6	2.979	26.059
11	Yield per plant	13.69	13.75	99.1	1.199	28.081

GCV- Genotypic Coefficient of Variation, PCV- Phenotypic Coefficient of variation, H2- Broad Sense Heritability, GA-Genetic Advance

Table 3: Genotypic (below diagonal) and Phenotypic Correlation (above diagonal) between Yield and its component traits in Chickpea

	Days to First Flowering	Day to 50% Flowering	Plant Height	Primary Branches	Secondary Branches	No. of pods per plant	Biological Weight	Harvest Index	Days to maturity	Test Weight	Yield Per Plant
DFF	1.0000	0.5927	-0.004	-0.3278	-0.3282	-0.0408	0.1163	-0.2725	0.5308	-0.1693	-0.2432
DF50%	0.6107	1.0000	-0.2087	-0.1813	-0.2549	-0.0855	0.2221	-0.3408	0.7682	-0.0989	-0.2898
PH	-0.0033	-0.2125	1.0000	0.2099	0.2948	0.2377	0.5357	0.3402	-0.3551	0.2852	0.4441
PB	-0.3403	-0.1882	0.2200	1.0000	0.8572	0.6479	0.1513	0.6523	-0.3983	0.152	0.6691
SB	-0.3414	-0.2695	0.3158	0.8875	1.0000	0.4879	0.1618	0.5531	-0.4293	-0.0274	0.5746
NPPP	-0.0427	-0.0845	0.2391	0.6710	0.5134	1.0000	0.299	0.8417	-0.241	0.1688	0.8798
BW	0.1205	0.2269	0.5411	0.1569	0.1621	0.3017	1.0000	0.0341	0.1403	0.1276	0.2389
HI	-0.2796	-0.3494	0.3450	0.6827	0.5768	0.8479	0.0354	1.0000	-0.5057	0.1438	0.9784
DM	0.6236	0.9368	-0.4205	-0.4612	-0.5187	-0.2873	0.1759	-0.6079	1.0000	-0.085	-0.4673
TW	-0.1724	-0.1009	0.2885	0.1559	-0.0304	0.1695	0.1284	0.1447	-0.0949	1.0000	0.1743
YPP	-0.2492	-0.2972	0.4497	0.6998	0.5973	0.8862	0.2397	0.9785	-0.5598	0.1753	-0.2432

*Significance at 0.05 level of probability ** Significance at 0.01 level of probability

Characters - DFF (Days to 50% flowering), DTM (Days to maturity), PH (Plant height), NPB (Number of primary branches), NSB (Number of secondary branches), NPP (Number of pods per plant), BW (Biological Weight), HI (Harvest index), TW (Test weight),DM (Days to Maturity), SYP (Seed yield per plant)

Table 4: Path coefficient showing direct (bold value) and indirect effects of different characters on yield in chickpea

	Days to first flowering	Days to 50% flowering	Plant Height	Primary Branches	Secondary Branches	No. of pods per plant	Biological Weight	Harvest Index	Days to maturity	Test Weight
Days to First Flowering	-0.0009	-0.0006	0.0000	0.0003	0.0003	0.0000	-0.0001	0.0003	-0.0006	0.0002
Day to 50% Flowering	-0.0160	-0.0262	0.0056	0.0049	0.0071	0.0022	-0.0059	0.0092	-0.0246	0.0026
Plant Height	-0.0001	-0.0033	0.0157	0.0034	0.0049	0.0037	0.0085	0.0054	-0.0066	0.0045
Primary Branches	-0.0057	-0.0032	0.0037	0.0168	0.0149	0.0113	0.0026	0.0115	-0.0078	0.0026
Secondary Branches	0.0008	0.0006	-0.0007	-0.0021	-0.0023	-0.0012	-0.0004	-0.0013	0.0012	0.0001
No. of pods per plant	-0.0004	-0.0007	0.0020	0.0056	0.0043	0.0083	0.0025	0.0071	-0.0024	0.0014
Biological Weight	0.0233	0.0438	0.1045	0.0303	0.0313	0.0583	0.1932	0.0068	0.0340	0.0248
Harvest Index	-0.2675	-0.3343	0.3301	0.6531	0.5518	0.8111	0.0339	0.9567	-0.5816	0.1385
Days to maturity	0.0179	0.0269	-0.0121	-0.0133	-0.0149	-0.0083	0.0051	-0.0175	0.0287	-0.0027
Test Weight	-0.0006	-0.0003	0.0010	0.0005	-0.0001	0.0006	0.0004	0.0005	-0.0003	0.0034
Yield per plant	-0.2492	-0.2972	0.4497	0.6998	0.5973	0.8862	0.2397	0.9785	-0.5598	0.1753

R SQUARE = 0.9997 RESIDUAL EFFECT = 0.0158

Correlation Coefficient analysis

seed yield exhibited positive significant correlation with harvest index, number of pods per plant, primary branches and secondary branches, plant height and negative significant correlation with days to maturity and negative non- significant correlation with days to 50% percent flowering and days to first flowering at both Phenotypic and genotypic levels.

Days to first flowering showed positive significant correlation with days to maturity and days to 50% flowering and negative significant correlation was observed with harvest index and negative non-significant correlation with plant height. Days to 50% flowering showed positive significant correlation with days to maturity and biological weight and negative significant correlation with harvest index, secondary branches and negative non-significant correlation with primary branches and test weight. plant height exhibited positive significant correlation with biological weight and secondary branches and harvest index, number of pods per plant, test weight and primary branches and negative non-significant correlation with days to maturity. Primary branches exhibited positive significant correlation with secondary branches, number of pods per plant, and harvest index and negative significant correlation with days to maturity. Secondary branches exhibited positive significant correlation with harvest index and number of pods per plant and negative significant correlation with days to maturity. Number of pods per plant exhibited positive significant correlation with biological weight and harvest index and negative significant correlation with days to maturity. Biological weight exhibited positive non- significant correlation with days to maturity and test weight. Harvest index exhibited negative significant correlation with days to maturity and positive non- significant correlation with test weight. Days to maturity exhibited negative non-significant correlation with test weight.

Path Coefficient analysis

Path coefficient analysis reveals that the relative contribution of causal factor towards the grain yield per plant. By partitioning the phenotypic and genotypic correlations, the direct effect of studied traits towards grain yield per plant and its indirect effect through other characters were computed and presented in Table 4. Out of 11 characters, harvest index showed positive and direst effect on grain yield, biological weight, days to maturity, number of pods per plant, primary branches, plant height, test weight, while, days to first flowering, days to 50% flowering secondary branches showed negative direct effect on grain yield. Days to first flowering showed positive indirect effect on grain yield on biological yield and days to maturity and negative indirect effect on harvest index, primary branches, and days to 50 percent flowering, number of pods per plant. secondary branches and plant height. (Bhavani *et al*., 2008) [5] Days to 50% flowering showed positive indirect effect on days to maturity and biological weight and negative indirect effects on harvest index, primary branches and secondary branches, Plant height showed positive indirect effect on biological weight, harvest

index, primary branches, negative indirect effects on number of pods per plant, days to maturity. Primary branches showed positive indirect effect on harvest index, biological weight, days to 50% flowering and plant height, number of pods per plant.Secondary branches showed positive indirect effect on harvest index, and biological weight, primary branches, days to 50 percent flowering, number of pods per plant and negative indirect effect on days to maturity.Number of pods per plant showed positive indirect effect on harvest index, biological weight, secondary branches, primary branches, negative indirect effect on days to maturity.Biological weight showed positive indirect effect on harvest index, days to maturity, and negative indirect effects on days to 50% flowering..Harvest index showed positive indirect effect on all the characters except on days to maturity.Days to maturity showed positive indirect effect on biological weight, secondary branches and negative indirect effects on harvest index. Test weight showed positive indirect effect on harvest index, biological weight, primary branches and days to 50% flowering, plant height, number of pods per plant and negative indirect effect on days to maturity. The results found are similar to the findings of Arif *et al*. (2014) [1] and Jivani *et al*. (2013) [11] and Malik *et al*. (2014) [14]

Conclusion

The finding will help to a great extent in maintenance breeding, quality seeds production, seed certification and seed testing program. It also used for screening of genotypes for quality and high yield. Identification is key at seed and plant levels may be useful for discrimination and verification of varieties and maintenance of genetic purity during seed production and certification program at seed and plant levels conforming to the original characteristics of the varieties. Quality test of chickpea protein has been found useful to screen the genotypes. In each analysis, sufficient variability was exhibited by all the traits which revealed that extent of variability can be increased by involving diverse parents in hybridization program. Analysis of variance revealed highly significant variances for all the traits studied depicting greater variability in the existing material. The PCV was higher than the GCV for all the characters. GCV and PCV was found moderate for plant height, number of pods per plant, primary branches, yield per plant and harvest index and test weight. Low for days to 50 percent flowering and days to first flowering, days to maturity, biological weight and secondary branches, which suggests greater phenotypic and genotypic variability among the genotypes and responsiveness of the attributes for making further improvement by selection. The association studies indicated that the advantages of upgrading chickpea genotypes through simultaneous selection for Seed yield per plant was by with harvest index, number of pods per plant, primary branches and secondary branches, plant height and negative significant correlation with days to maturity. Path coefficient analysis revealed that highest consideration should be given to Harvest Index, biological weight, days to maturity, number of pods per plant, primary branches, plant height, test weight.

References

1. Aarif M, Rastogi NK, Johnson PL, Chandrakar PK. Genetic analysis of seed yield and its attributing traits in chickpea (*Cicer arietinum* L.). Journal of Food Legumes. 2014;27(1):24-27
2. Ali Q, Ahsan M. Estimation of Genetic Variability and Correlation Analysis for Quantitative Traits in Chickpea (*Cicer arietinum* L.). International Journal for Agro Veterinary and Medical Sciences. 2011;6(4):241-249.
3. Al-Jibouri HA, Miller PA, Robinson HF. Genotypic and environmental variance in upland cotton of interspecific origin. Agronomy Journal. 1958;50:633-63.
4. Burton GW. Quantitative inheritance in grasses. Proceedings of 6th International Grassland Congress. 1952;1:227-283.
5. Bhavani AP, Sasidharan N, Shukla YM, Bhatt MM. Correlation studies and path analysis in chickpea (*Cicer arietinum* L.). Research on Crops. 2008;9(3):657-660.
6. Chopdar DK, Bharti B, Sharma PP, Dubey RB, Brajendra Meena BL. Studies on genetic variability, character association and path analysis for yield and its contributing traits in chickpea [*Cicer arietinum* (L.)]. Legume Research. 2017;40(5):824-829.
7. Devasirvatham V, Tan DKY, Gaur PM, Raju TN, Trethowan RM. High temperature tolerance in chickpea and its implications for plant improvement. Crop and Pasture Science. 2013;63(5):419-428.
8. Dewey DR, Lu KH. A correlation and path coefficient analysis of components of wheat grass seed production. Agronomy Journal. 1959;51:515-518.
9. Fisher RA. The correlation amount relatives on the supposition of Mendelian Inheritance. Trance Royal Society, Edinburg. 1918;52: 99-433.
10. Gaur RS, Tiwari A, Mishra SP. Correlation and path coefficient analysis for seed yield and its components in chickpea (*Cicer arietinum* L). Trends in Biosciences. 2014;7(1):54-57.
11. Jivani JV, Mehta DR, Vaddoria MA, Raval L. Correlation and path coefficient analysis in chickpea (*Cicer arietinum* L.). Electronic Journal of Plant Breeding. 2013;4(2):1167-1170.
12. Johnson HW, Robinson HF, Comstock RE. Estimation of genetic and environmental variability in soybean. Agronomy Journal. 1955;47:314-318.
13. Kumar R, Kuldeep Pandey S, Babbar A, Mishra DK. Genetic variability, character association and path coefficient analysis in chickpea grown under heat stress conditions. Electronic Journal of Plant Breeding. 2014;5(4):812-819.
14. Malik SR, Shabbir G, Zubir M, Iqbal SM, Ali A. Genetic diversity analysis of morpho-genetic traits in desi chickpea (*Cicer arietinum* L.). International Journal of Agriculture and Biology. 2014;116(5):956-960.
15. Priyadarsini L, Singh PK, Chatterjee C, Sadhukhan R, Biswas T. Estimation of genetic variability of nodulation characters and their association with different agromorphic characters and yield in chickpea (*C. arietinum* L.). International Journal of Current Microbiology and Applied Sciences, 2017.
16. Samyuktha SM, Geethanjali S, Kannan Bapu JR. Genetic diversity and correlation studies in chickpea (*Cicer arietinum* L.) Based on Morphological Traits. Electronic Journal of Plant Breeding. 2017;8(3):874-8846(9):1928-35.
17. Singh AK, Sharma MM, Sharma AK. Genetic variability, heritability relationships and stability analysis in chickpea (*Cicer arietinum* L.). Environment and Ecology, 2012;30(3B):988-994.

18. Singh V, Singh P, Kumar A, Nath S. Estimation of genetic variability parameters in chickpea (*Cicer arietinum* L.) germplasm. Journal of Pharmacognosy and Phytochemistry. 2018;7(2):1204-1206
19. Thakur NR, Toprope VN, Phanindra KS. Estimation of genetic variability, correlation and path analysis for yield and yield contributing traits in chickpea (*Cicer arietinum* L.), International Journal of Current Microbiology and Applied Sciences. 2018;7(2):2298-2304.
20. Wright S. Correlation and causation. Journal of agriculture Research. 1921;20:557-587.
21. Yadav P, Tripathi DK, Khan KK, Yadav AK. Determination of genetic variation and heritability estimates for morphological and yield traits in chickpea (*Cicer arietinum* L.) under late sown conditions. The Indian Journal of Agricultural Science. 2015;85(7):157-162.
22. Yadav S, Yadav AK, Yadav RK. Characters association and path analysis studies for seed yield and its components in chickpea. Biochemical and Cellular Archives. 2014;14(1):141-144.