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Research article

CORRELATION AND PATH COEFFICIENT ANALYSIS IN *KABULI* CHICKPEA (*CICER ARIETINUM* L.)

P.V. Padmavathi[1], S.Sreemannarayana Murthy[2], V. Satyanarayana Rao[1] and Lal Ahamed M[1].

[1]Department of Genetics and Plant Breeding, Agricultural College Bapatla 522101, Andhra Pradesh
[2]Senior Scientist (PB) Regional Agricultural Research station, Warangal

ABSTRACT: Thirty genotypes of *kabuli* chickpea were used to study the extent of genetic variability, correlation and path analysis for yield and yield contributing characters. Wider genetic variability with high heritability and high genetic advance as per cent of mean was recorded for number of primary branches per plant, biological yield per plant and seed yield per plant. Correlation studies revealed that seed yield was significantly and positively correlated with plant height, number of primary branches per plant, number of secondary branches per plant, number of pods per plant, 100-seed weight, harvest index and biological yield per plant. Path coefficient analysis indicated that biological yield per plant, number of pods per plant and harvest index had high positive direct effect on seed yield signifying the importance of these traits in improvement of seed yield.

Key words: Chickpea, variability, correlation coefficient and path analysis

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the third most important grain legume in the world. The success of any breeding programme depends on the quantum of genetic variability present in the material for exploitation and it also offers better scope for selection. (Burton 1952 and Swarup and Chaugle 1962) indicated that genetic variability together with the heritability estimates would give a better idea on the amount of genetic advance expected from selection. Yield is a complex character and is determined by many component characters. The identification of important characters and their interrelationship would be useful for developing improved genotypes. Thus effective improvement in yield may be brought about through selection based on yield component characters. The aim of correlation studies is primarily to know the association of yield component characters with yield. The path analysis is an effective measure to find out direct and indirect effects of component characters contributing to yield. Therefore, present investigation was undertaken to study genetic variability, correlation and path analysis in chickpea.

MATERIAL AND METHODS

Thirty genotypes of *kabuli* chickpea were grown in randomized block design with three replications during *rabi* 2007-08 at Regional Agricultural Research Station, Lam, Guntur, Andhra Pradesh. Each plot consisted of single row of 4 meter length with a spacing of 30x10 cm. The observations were recorded on ten competitive plants of each genotype in each replication for 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, 100-seed weight, harvest index, biological yield and seed yield per plant and mean values were used for statistical analysis. Days to 50% flowering, days to maturity, 100-seed weight, harvest index, biological yield per plant and protein content were recorded on plot basis. Phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were worked out as per (Burton 1952). Heritability was estimated as per (Allard 1960) and genetic advance was computed using the formula of Johnson *et al*. (1955). Correlation and path coefficient analysis were worked out according to the methods described by (Dewey and Lu 1959 and Falconer 1964).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the genotypes for all the characters indicating considerable magnitude of genetic variability of the material used for the study (Table-1). Higher amount of phenotypic and genotypic coefficients of variation (Table 2) was noticed for number of primary branches per plant (24.08 and 20.30), biological yield per plant (22.18 and 20.37) and seed yield per plant (26.73 and 24.23) indicating ample scope for genetic improvement of these traits through direct selection.

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Similar results were reported by (Jeena et al. 2005, Kanaka Durga et al. 2007, Lokare et al. 2007 and Abhishek Kumar et al. 2012). High heritability coupled with high genetic advance as per cent of mean was observed for days to 50% flowering, number of primary branches per plant, 100-seed weight, harvest index, biological yield and seed yield per plant indicates that these traits were governed by additive gene action and directional selection could be profitably applied on these traits in the genetically diverse material. These results were in conformity with those of (Jeena et al. 2005, Kanaka Durga et al. 2007, Lokare et al. 2007).

Estimation of correlation coefficients at phenotypic and genotypic levels were presented in Table 3. The values of genotypic coefficients were higher than phenotypic coefficients revealed the influence of environment on the phenotypic expression. Seed yield was significantly and positively correlated with plant height (r_p= 0.43** and r_g = 0.68**), number of primary branches (r_p= 0.40** and r_g = 0.52**), number of secondary branches (r_p= 0.21* and r_g = 0.29**), number of pods per plant (r_p= 0.66** and r_g = 0.63**), 100-seed weight (r_p= 0.56** and r_g = 0.64**), harvest index (r_p= 0.40** and r_g = 0.52**) and biological yield per plant (r_p= 0.74** and r_g = 0.89**) at both the levels. Such association indicates the possibility of selection of genotypes with higher plant height, number of primary branches, number of secondary branches, number of pods per plant, 100-seed, harvest index and biological yield. Similar results were reported by Jeena *et al.* (2005) and Aslin Joshi *et al.* (2006), Kanaka Durga *et al.* (2007), Shiv prakash Singh (2007), Sanjay Thakur and Anil Sirohi (2009) and Abhishek Kumar *et al.* (2012).

Table 1: Analysis of variance for yield and yield contributing characters in 30 genotypes of *kabuli* chickpea (*Cicer arietinum* L.).

Source of variations	df	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of primary branches/ plant	No. of secondary branches/plant	No. of pods/plant	100-seed weight (g)	Harvest index(%)	Biological yield/plant (g)	Protein content (%)	Seed yield/plant (g)
	MSS											
Replications	2	4.23	2.74	0.41	0.08	0.54	6.80	3.39	1.71	4.44	1.79	0.35
Genotypes	29	80.40**	58.79**	48.74**	0.72**	5.98**	109.34**	107.14**	122.12**	123.78**	7.69**	35.80**
Error	58	1.61	1.19	12.36	0.09	1.49	25.45	2.95	13.97	7.19	0.92	2.42

** Significant at 1 % level df = Degrees of freedom

Table 2: Estimates of variability, heritability and genetic advance as per cent of mean of *kabuli* chickpea (*Cicer arietinum* L.)

S.No.	Character	Mean	Range		PCV (%)	GCV (%)	Heritability (%)	Genetic advance as % of mean (5 % GAM)
			Min	Max				
1.	Days to 50% flowering	47.40	36.67	60.67	11.14	10.81	94.20	21.62
2.	Days to maturity	90.12	81.67	98.67	5.01	4.86	94.20	9.72
3.	Plant height (cm)	45.68	37.30	51.57	10.83	7.62	49.50	11.05
4.	No. of primary branches/plant	2.27	1.43	3.90	24.08	20.3	71.10	35.25
5.	Number of secondary branches/plant	12.14	9.43	15.40	14.24	10.08	50.10	14.70
6.	No. of pods/plant	45.16	35.17	57.53	16.18	11.71	52.40	17.45
7.	100-seed weight (g)	30.03	13.52	40.87	20.44	19.62	92.20	38.81
8.	Harvest index (%)	44.89	32.16	61.58	15.76	13.38	72.10	23.39
9.	Biological yield/plant (g)	30.6	19.00	50.00	22.18	20.37	84.40	38.55
10.	Protein content (%)	18.52	16.63	23.82	9.62	8.11	71.00	14.08
11.	Seed yield/plant (g)	13.77	8.31	21.93	26.73	24.23	82.10	45.24

PCV = Phenotypic coefficient of variation GCV = Genotypic coefficient of variation

To know the direct and indirect effects of these traits on seed yield correlations were further partioned into direct and indirect effects through path coefficient analysis (Table 4). The path analyses revealed that biological yield, number of pods per plant and harvest index exerted high and positive direct effect for seed yield. These results were in accordance with (Kashyap Kumar Dubey et al.2007, Kanaka Durga et al. 2007), Shiv prakash Singh (2007) and Sanjay Thakur and Anil Sirohi (2009). Biological yield had positive indirect effects through number of pods per plant and 100-seed weight whereas number of pods per plant had positive indirect effects through biological yield and harvest index. The trait harvest index had positive indirect effect through number of pods per plant. The results of variability, correlation and path analysis indicated that biological yield; number of pods per plant and harvest index were the major yield contributing characters as they showed positive and significant association with seed yield and also had high positive effects. Thus these characters could be considered as the most important for selection in order to improve the seed yield in chickpea.

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Table 3: Phenotypic and genotypic correlations between yield and yield components in chickpea genotypes (*Cicer arietinum* L.)

Genotype	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of primary branches/ plant	Number of secondary branches/ Plant	Number of pods/ plant	100-seed weight (g)	Harvest index (%)	Biological yield/plant (g)	Protein content (%)	Seed yield/ plant (g)
Days to 50% flowering	--	0.90**	0.04	0.09	-0.10	-0.09	0.11	0.01	-0.01	0.08	-0.02
Days to maturity	0.91**	–	0.16	0.07	-0.12	-0.16	0.22*	-0.01	0.02	0.02	-0.01
Plant height (cm)	0.05	0.24**	--	-0.07	0.08	0.25*	0.40**	0.36**	0.32**	-0.10	0.43**
Number of primary branches/ plant	0.13	0.09	-0.09	–	0.12	0.35**	0.22*	0.13	0.46**	0.03	0.40**
Number of secondary branches/plant	-0.21*	-0.21*	0.27*	0.24*	--	0.21*	0.03	0.06	0.16	-0.36**	0.21*
Number of pods/plant	-0.10	-0.19	0.51**	0.62**	0.41**	--	0.18	0.42**	0.31**	-0.07	0.66**
100-seed weight (g)	0.12	0.24*	0.62**	0.22*	0.06	0.24*	--	0.01	0.65**	0.11	0.56**
Harvest index (%)	0.02	0.00	0.54**	0.07	0.20	0.72**	0.01	--	-0.09	-0.05	0.40**
Biological yield/plant (g)	-0.01	0.04	0.41**	0.55**	0.24*	0.45**	0.73**	-0.06	--	-0.01	0.74**
Protein content (%)	0.08	0.02	-0.18	0.02	-0.49**	-0.18	0.11	-0.06	-0.02	--	-0.01
Seed yield/plant (g)	-0.01	0.02	0.68**	0.52**	0.29**	0.63**	0.64**	0.52**	0.89**	-0.06	--

* Significant at 5% level ** Significant at 1% level
Above diagonal values are phenotypic correlation values
Below diagonal values are genotypic correlation values

Table 4: Estimates of direct and indirect effects (phenotypic) of yield components on seed yield in chickpea genotypes (*Cicer arietinum* L.)

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	100-seed weight (g)	Harvest index (%)	Biological yield/plant (g)	Protein content (%)
Days to 50 % flowering	**-0.14**	-0.13	-0.01	-0.01	0.01	0.01	-0.02	0.00	0.00	-0.01
Days to maturity	0.16	**0.18**	0.03	0.01	-0.02	-0.03	0.04	0.00	0.00	0.00
Plant height (cm)	0.00	-0.01	**-0.07**	0.00	-0.01	-0.02	-0.03	-0.02	-0.02	0.01
Number of primary branches/plant	-0.01	-0.01	0.01	**-0.12**	-0.01	-0.04	-0.03	-0.02	-0.06	0.00
Number of secondary branches/plant	0.00	-0.01	0.00	0.01	**0.05**	0.01	0.00	0.00	0.01	-0.02
Number of pods/plant	-0.03	-0.06	0.09	0.13	0.08	**0.36**	0.07	0.15	0.11	-0.03
100-seed weight (g)	0.01	0.01	0.03	0.01	0.00	0.01	**0.06**	0.00	0.04	0.01
Harvest index (%)	0.00	-0.01	0.13	0.05	0.02	0.15	0.00	**0.35**	-0.03	-0.02
Biological yield/plant	-0.01	0.01	0.22	0.32	0.11	0.21	0.45	-0.06	**0.69**	0.00
Protein content (%)	0.00	0.00	-0.01	0.00	-0.02	0.00	0.01	0.00	0.00	**0.05**
Correlation value with seed yield /plant	-0.02	-0.01	0.43**	0.40**	0.21*	0.66**	0.56**	0.40**	0.74**	-0.01

* Significant at 5% level ** Significant at 1% level
Bold and diagonal values are direct effects Residual effect = 0.37

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