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Genetic Variability and Association Analyses for Yield and its Components in Chickpea (*Cicer arietinum* L.)

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ABSTRACT

The present investigation was carried out to study the extent of genetic variability and associations of yield and yield components of *desi* chickpea. Wider genetic variability with high heritability and high genetic advance as per cent of mean was observed for 100-seed weight, biological yield and seed yield per plant indicating additive gene action. Seed yield was significantly and positively correlated with plant height, number of primary branches, number of secondary branches, number of pods per plant, 100-seed weight, harvest index and biological yield per plant. Path coefficient analysis indicated that number of pods per plant, biological yield and 100-seed weight had high positive direct effect on seed yield. Direct selection through these traits for improvement of seed yield shall be highly effective.

Key words : Chickpea, Correlation Coefficient, Path Analysis,Variability

A wide spectrum of variability will enhance the chances of selecting desired genotypes. Correlation studies will establish the extent of association between yield and yield components. Path coefficient analysis is important along with correlation studies to identify the direct effect and indirect effects of the component characters through which yield improvement could be obtained. Therefore, present investigation was undertaken to study genetic variability, correlation and path analysis, in desi genotypes of chickpea.

MATERIAL AND METHODS

The experimental material consisted of thirty *desi* genotypes of chickpea, evaluated in complete randomized block design with three replications during *rabi* 2007-08 at Regional Agricultural Research Station (RARS) Lam, Guntur. Each genotype was sown in single row plot of 4 meter length with a spacing of 30 x 10 cm. Ten competitive plants of each genotype in each replication were randomly tagged to record observations on plant height, number of primary branches, number of pods per plant 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 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 as per Johnson *et al*.(1955).

Correlation and path coefficient analysis were worked out according to the methods Falconer (1964) and Dewey and Lu (1959).

RESULTS AND DISCUSSION

The study revealed high phenotypic and genotypic coefficients of variation (Table 1) for 100-seed weight (24.75, 23.85), biological yield per plant (24.80, 22.63) and seed yield per plant (28.35, 25.53) indicating ample scope for genetic improvement of these traits through direct selection. Similar results were reported by Raval and Dobariya (2003), Jeena *et al.* (2005) and Ajinder Kaur *et al.* (2004) for 100-seed weight and Meena *et al.* (2006) for seed yield.

High heritability coupled with high genetic advance as per cent of mean was observed for number of primary branches, number of secondary branches, number of pods per plant,100-seed weight, biological yield and seed yield per plant indicating the possibility of improvement of these traits through selection (Table 1). These results are in conformity with those of Nimbalkar (2000) and Raval and Dobariya (2003) for number of pods, 100-seed weight, biological yield and seed yield per plant. Protein content showed high heritability coupled with moderate genetic advance as per cent of mean. Arun Kumar and Ramakrishna (1998) also reported similar results.

Seed yield was significantly and positively correlated with plant height (r_p = 0.25* and r_g = 0.33**), number of primary branches (r_p= 0.55** and r_g = 0.53**), number of secondary branches (r_p = 0.78** and r_g = 0.83**), number of pods per plant

Table 1 Estimation of variability, heritability, genetic advance and genetic advance as per cent of mean in 30 genotypes of desi chickpea (*Cicer arietinum* L.)

Character	PCV (%)	GCV (%)	Heritability (%)	Genetic advance	Genetic advance as per cent of mean (GAM)
Days to 50% flowering	8.34	8.00	92.10	9.70	15.82
Days to maturity	5.06	4.93	94.90	11.21	9.90
Plant height (cm)	11.51	9.39	66.50	8.73	15.77
No. of primary branches plant^{-1}	18.65	14.53	60.70	0.66	23.32
No. of secondary branches plant^{-1}	18.29	14.83	65.80	3.30	24.78
No. of pods plant^{-1}	17.01	15.15	79.30	16.37	27.79
100- seed weight(g)	24.75	23.85	92.90	11.78	47.34
Harvest index (%)	13.05	9.40	51.80	7.88	13.93
Biological yield plant^{-1} (g)	24.80	22.63	83.30	12.18	42.55
Protein content (%)	11.59	10.17	76.90	4.24	18.37
Seed yield plant^{-1}	28.35	25.53	81.10	6.10	47.37

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

Table 2. Phenotypic and genotypic correlations between yield and yield components in desi chickpea genotypes (*Cicer arietinum* L.)

Character	Days to 50% flowering	Days to maturity	Plant height	Number of primary branches plant^{-1}	Number of secondary branches plant^{-1}	Number of pods plant^{-1}	100-seed weight	Harvest index (%)	Biological yield plant^{-1}	Protein content (%)	Seed yield plant^{-1}
Days to 50% flowering	—	0.93**	0.21	-0.06	-0.29**	-0.35**	-0.11	-0.25*	-0.19	0.34**	-0.31**
Days to maturity	0.93**	—	0.31**	-0.04	-0.24*	-0.31**	-0.01	-0.21	-0.14	0.34**	-0.22*
Plant height	0.27**	0.40**	—	0.07	-0.12	0.13	0.28**	0.00	0.26*	0.13	0.25*
Number of primary branches plant^{-1}	-0.06	-0.02	0.11	—	0.46**	0.41**	0.50**	-0.04	0.56**	-0.32**	0.55**
Number of secondary branches plant^{-1}	-0.38**	-0.31**	-0.11	0.46**	—	0.71**	0.55**	0.24*	0.73**	-0.20	0.77**
Number of pods plant^{-1}	-0.42**	-0.35**	0.17	0.31**	0.79**	—	0.40**	0.29**	0.76**	-0.27**	0.85**
100-seed weight	-0.12	-0.01	0.36**	0.53**	0.61**	0.38**	—	0.20	0.73**	0.04	0.76**
Harvest index (%)	-0.34**	-0.28**	0.02	0.03	0.46**	0.49**	0.30**	—	-0.01	-0.26**	0.31**
Biological yield plant^{-1}	-0.22**	-0.15	0.33**	0.53**	0.80**	0.77**	0.73**	0.11	—	0.00	0.89**
Protein content (%)	0.43**	0.40**	0.18	-0.31**	-0.24*	-0.29**	0.11	-0.37**	0.07	—	-0.17
Seed yield plant^{-1}	-0.36**	-0.24**	0.33**	0.53**	0.83**	0.86**	0.78**	0.49**	0.92**	-0.15	—

* = Significant at 5% level
** = Significant at 1% level

Above diagonal values are phenotypic correlations
Below diagonal values are genotypic correlations

(r_p = 0.85** and r_g = 0.86**), 100-seed weight (r_p = 0.76** and r_g = 0.78**), harvest index (r_p = 0.31** and r_g = 0.49**) and biological yield (r_p = 0.89** and r_g = 0.92**) at both the levels (Table 2).

Among the other characters days to 50 % flowering exhibited significant positive association with days to maturity and protein content (Jeena and Arora, 2001; Nether Pal Singh *et al*., 2001 and Aslin Joshi *et al.,* 2006) at both the levels. Days to maturity showed positive significant association with plant height (Singh *et al.,* 1990 and Raval and Dobariya, 2003) and protein content (Singh *et al.,* 1990) at both the levels. Plant height exhibited positive significant phenotypic association with 100-seed weight and biological yield per plant. Number of primary branches showed positive significant phenotypic association with number of secondary branches, number of pods per plant, 100-seed weight and biological yield per plant. Raval and Dobariya (2003) and Aslin Joshi *et al.* (2006) reported similar results. Number of secondary branches per plant had significant association with number of pods, 100-seed weight and biological yield per plant. Number of pods, 100-seed weight and biological yield were significantly and positively associated among themselves. These findings are in accordance with Raval and Dobariya (2003), Jeena *et al.* (2005) and Aslin Joshi *et al.* (2006). Harvest index showed positive significant association with number of pods per plant.

The results obtained for direct and indirect effects of different characters are presented inTable 3. Path analysis indicated that number of pods per plant, biological yield and 100-seed weight exerted high and positive direct effect for seed yield per plant. While selecting for high yield main importance should be given for these characters. These results are in accordance with Raval and Dobariya (2003) and Kashyap Kumar Dubey *et al.* (2007) for number of pods and Kanaka Durga *et al.*(2007) for 100-seed weight.

Negative direct effect on seed yield was recorded by days to 50 % flowering at both phenotypic and genotypic levels, in agreement with Raval and Dobariya (2003) and Renukadevi and Subbalakshmi (2006). Plant height, number of primary branches per plant and number of secondary branches per plant had low positive phenotypic direct effects but, supplemented yield indirectly through biological yield and number of pods per plant.

Therefore, by considering the genetic variability parameters, correlation and path analysis an ideal plant in chickpea should be with high biological yield, number of pods, 100-seed weight, harvest index and profuse branches accompanied with early flowering and maturity.

LITERATURE CITED

Ajinder Kaur, Gupta S K and Kuldip Singh 2004. Genetic variability in *Desi* chickpea (*Cicer arietinum* L.) under normal and late sown conditions. Journal of Research, Punjab Agricultural University 41(4): 425-428.

Allard R W 1960. Principles of Plant Breeding. John Wiley and Sons Inc., New York pp. 485.

Arun Kumar and Ram Krishna 1998. Heritability and genetic advance in gram (*Cicer arietinum* L.) genotypes of diverse origin. Indian Journal of Agricultural Sciences 68(11): 747-749.

Aslin Joshi J, Ganeshram S and Kannan Bapu J R 2006. Association analysis and scope of selection for yield attributes in chickpea. Madras Agricultural Journal 93(1-6): 26-31.

Burton G W 1952. Quantitative inheritance in grasses. Proceedings of the 6th International Grassland Congress pp.277-283.

Dewey D R and Lu K H 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agronomy Journal 51 (9): 515 - 518.

Falconer D S 1964. An Introduction to Quantitative Genetics – Second edition. Oliver and Boyd Ltd., Edinburgh pp. 312-324.

Jeena A S and Arora P P 2001. Correlation between yield and its components in chickpea. Legume Research 24(1): 63-64.

Jeena A S, Arora P P and Ojha O P 2005. Variabiltiy and correlation studies for yield and its components in chickpea. Legume Research 28(2): 146-148.

Johnson H W, Robinson H F and Comstock R E 1955. Estimation of genetic and environm - ental variability in soybean [*Glycine max* (L.) Merrill]. Agronomy Journal 47: 314-318.

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

Kashyap Kumar Dubey, Rambir Bhanu Singh P, Puneet Solanki and Srivastava S B L 2007. Direct and indirect effects of various traits in chickpea (*Cicer arietinum* L.). International Journal of Tropical Agriculture 25(9): 513-515.

Meena H S, Kumar J and Deshnmukh P S 2006. Genetic variability and correlation studies for traits related to drought tolerance in chickpea (*Cicer arietinum* L). Indian Journal of Genetics and Plant Breeding 66(2): 140.

Table 3 Estimates of direct and indirect effects (phenotypic) of components on yield in *desi* chickpea *(Cicer arietinum L.)*

Characters	Days to 50% flowering	Days to maturity	Plant height	No.of primary branches plant^{-1}	No.of secondary branches plant^{-1}	No.of pods plant^{-1}	100-seed weight	Harvest index (%)	Biological yield plant^{-1}	Protein content (%)
Days to 50 % flowering	**-0.1019**	-0.0945	-0.0209	0.0058	0.0298	0.0359	0.0107	0.0257	0.0196	-0.0351
Days to maturity	0.0586	**0.0631**	0.0195	-0.0027	-0.0154	-0.0194	-0.0004	-0.0134	-0.0089	0.0213
Plant height	0.0100	0.0150	**0.0486**	0.0034	-0.0057	0.0064	0.0134	0.0001	0.0127	0.0061
No.of primary branches plant^{-1}	-0.0027	-0.0020	0.0034	**0.0481**	0.0221	0.0196	0.0238	-0.0019	0.0269	-0.0152
No.of secondary branches plant^{-1}	-0.0206	-0.0172	-0.0083	0.0325	**0.0706**	0.0499	0.0389	0.0171	0.0513	-0.0141
No.of pods plant^{-1}	-0.1314	-0.1150	0.0493	0.1521	0.2639	**0.3733**	0.1504	0.1100	0.2841	-0.1021
100 seed weight	-0.0294	-0.0020	0.0771	0.1384	0.1537	0.1125	**0.2792**	0.0556	0.2025	0.0117
Harvest index (%)	-0.0298	-0.0251	0.0004	-0.0045	0.0286	0.0348	0.0235	**0.1180**	-0.0013	-0.0301
Biological yield plant^{-1}	-0.0589	-0.0432	0.0801	0.1714	0.2224	0.2332	0.2223	-0.0035	**0.3064**	-0.0007
Protein content (%)	-0.0035	-0.0034	-0.0012	0.0031	0.0020	0.0026	-0.0004	0.0027	0.0000	**-0.0100**
Correlation value with seed yield plant^{-1}	-0.31**	-0.22*	0.25*	0.55**	0.77**	0.85**	0.76**	0.31**	0.89**	-0.17

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

Residual effect = 0.2197

Neter Pal Singh, Ram Krishna and Kumar R 2001. An assay of effects of different traits on chickpea grain yield. Annals of Agricultural Research 22(4): 564-569.

Nimbalkar R K 2000. Genetic variability and heritability studies and scope for improvement in chickpea. Journal of Maharashtra Agricultural Universities 25(1): 109-110.

Raval L J and Dobariya K L 2003. Yield components in improvement of chickpea (*Cicer arietinum* L.). Indian Agricultural Research New Series 24(4): 789-794.

Renukadevi and Subbalakshmi B 2006. Correlation and path coefficient analysis in chickpea. Legume Research 29(3): 201-204.

Singh K B, Bejiga G and Malhotra R S 1990. Association of some characters with seed yield in chickpea collections. Euphytica 49:80-88.

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