Electronic Journal of Plant Breeding, 4(2): 1167-1170 (Jun 2013)
ISSN 0975-928X

Research Note

Correlation and path coefficient analysis in Chickpea (*Cicer arietinum* L.)

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(Received: 11 Mar 2013; Accepted: 14 May 2013)

Abstract
A set of 105 diverse genotypes of chickpea was used to estimate correlation and path coefficient analysis for seed yield per plant and its ten component characters. The seed yield per plant had significant and positive correlation with number of pods per plant, biological yield per plant and harvest index at both genotypic and phenotypic levels. Among the component traits, biological yield per plant had significant and positive association with plant height, number of pods per plant and 100-seed weight. Path coefficient analysis revealed that the maximum positive direct effect was observed for harvest index, followed by biological yield per plant, number of pods per plant, and 100-seed weight towards seed yield and were considered to be the most promising traits for selection for higher seed yield in chickpea.

Keywords: Correlation, path analysis, yield components, chickpea.

Various components of seed yield very often exhibit varying degree of associations with seed yield as well as among themselves. Analysis of correlation coefficients between characters contributing directly or indirectly towards seed yield is a matter of considerable importance in exercising the selection programme. A study of correlation alone is not enough to provide an exact picture of relative importance of direct and indirect influences of each of the component traits on seed yield. In this context, path coefficient analysis is an important tool for plant breeders in partitioning the total correlation coefficients into direct and indirect effects of independent variables on dependent variable i.e. seed yield per plant. Therefore, an attempt was made to study correlation and path coefficient analysis in 105 genotypes of chickpea (*Cicer arietinum* L.).

One hundred and five diverse genotypes of chickpea, collected from various states of India, were sown in randomised block design with three replications at Pulses Research Station, Junagadh Agricultural University, Junagadh, Gujarat during *Rabi* season of 2009-10. Each entry was sown in a single row plot of 4.0 m length with a spacing of 45x10 cm. All the recommended agronomical practices and necessary plant protection measures were followed timely to raise healthy crop. The observations were recorded on five randomly selected plants in each entry and in each replication on 11 characters and the mean values were used for statistical analysis. The phenotypic and genotypic correlation coefficients of all the pair of characters were worked out as per Al-Jibouri *et al.* (1958), while path coefficient analysis was carried out according to the method suggested by Dewey and Lu (1959).

The analysis of variance revealed that mean square due to genotypes was highly significant for all the eleven characters indicating the presence of sufficient amount of variability among the genotypes. The association analysis (Table 1) revealed that in general the values of genotypic correlations were higher than their phenotypic correlations indicating the inherent association among the traits. Similar findings were also reported by Jivani and Yadavendra (1988); Singh *et al.* (1999); Raval and Dobariya (2003); and Vaghela *et al.,* (2009). In the present study, seed yield per plant had significant and positive correlation with number of pods per plant, harvest index and biological yield per plant at both the genotypic and phenotypic levels. Thus, these three attributes can serve as selection indices for seed yield improvement in chickpea. Such positive interrelationships between seed yield and these attributes have also been reported in chickpea by Maloo and Sharma (1987), Mishra *et al.* (1988), Jadhav and Mane (1991), Khorgade *et al.* (1995), Bakhsh *et al.,* (1998) and Vaghela *et al.* (2009).

Days to 50% flowering, which had significant and positive association with days to maturity,is an important component in identifying and deciding the duration of the crop. Both these traits had positive interrelationship with plant height, number of branches per plant and biological yield per plant at genotypic level. Such relationship may bring collective improvement in different characters and in turn the seed yield. Plant height had significant and positive correlation with 100-seed weight and biological yield per plant at both levels, which is in accordance with the findings of Jadhav and Mane (1991) and Jethwa (1994) in chickpea. Significant and positive association of number of pods per plant was observed with biological yield per plant and harvest index, which are akin to results reported by Jivani and Yadavendra (1988), Deshmukh and Patil (1995) and Chand and Singh (1997). Likewise, 100-seed weight had significant and positive correlation with biological yield per plant at both levels.

The results of path coefficient analysis of direct and indirect effects of different characters on seed yield are presented in Table 2. The residual effect was of low magnitude suggesting that the majority of the yield attributes have been included in the path analysis.

The genotypic path coefficient analysis revealed that biological yield per plant and harvest index exhibited high and positive direct effects on seed yield per plant. Both these characters turned out to be the major component of seed yield. The maximum and positive direct effects of biological yield per plant and harvest index have also been reported by Singh *et al.* (1990), Khorgade *et al.* (1995), Yadav *et al.* (1999), Thakur and Sirohi (2009) and Vaghela *et al.*, (2009).The traits number of pods per plant, days to maturity and 100-seed weight also recorded positive and low direct effects. Similar results were obtained by Khorgade *et al.* (1995), Yadav *et al.* (1999), Thakur and Sirohi (2009), and Vaghela *et al.* (2009).

Considering the correlation and path coefficient analysis for seed yield per plant and its component traits, an ideal plant type in chickpea would be one with high biological yield per plant, high harvest index, number of pods per plant, and high 100-seed weight. Therefore, more emphasis should be given to these components while making selection for higher seed yield in chickpea.

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Table 1. Genotypic (r_g) and phenotypic (r_p) correlations coefficients among 11 characters in chickpea

Characters		Days to 50% flowering	Days to maturity	Reproductive phase duration (days)	Plant height (cm)	No. of branches /plant	No. of pods per plant	100 Seed weight (g)	Biological yield/plant (g)	Harvest index (%)	Protein content (%)
Seed yield per plant (g)	r_g	-0.155	-0.065	0.146	0.038	-0.157	0.870**	0.154	0.716**	0.789**	-0.013
	r_p	-0.143	-0.022	0.135	0.093	-0.017	0.858**	0.177	0.665**	0.731**	-0.028
Days to 50% flowering	r_g		0.817**	-0.290**	0.241*	0.423**	-0.160	-0.041	0.142	-0.284**	-0.072
	r_p		0.600**	-0.445**	0.113	0.192*	-0.154	-0.081	0.079	-0.237*	-0.046
Days to maturity	r_g			0.315**	0.293**	0.364**	-0.067	0.057	0.258**	-0.261*	0.050
	r_p			0.449**	0.210*	0.139	-0.126	0.016	0.186	-0.163	-0.009
Reproductive phase duration (days)	r_g				0.090	-0.092	0.152	0.162	0.195*	0.035	0.202*
	r_p				0.110	-0.059	0.143	0.109	0.120	0.082	0.042
Plant height (cm)	r_g					0.094	-0.022	0.357**	0.327**	-0.121	0.060
	r_p					0.107	0.087	0.255**	0.293**	-0.091	0.021
No. of branches per plant	r_g						-0.019	-0.250	0.084	-0.150	-0.265**
	r_p						0.053	-0.097	0.129	-0.071	-0.118
No. of pods per plant	r_g							-0.193*	0.608**	0.706**	-0.009
	r_p							-0.088	0.595**	0.628**	-0.012
100 Seed weight (g)	r_g								0.206*	0.073	0.069
	r_p								0.204*	0.082	0.031
Biological yield per plant (g)	r_g									0.194	-0.005
	r_p									0.052	-0.033
Harvest index (%)	r_g										0.001
	r_p										0.003

*,** significant at 5% and 1% levels, respectively

Table 2. Genotypic path coefficient analysis showing direct (diagonal and bold) and indirect effects of different characters on seed yield in chickpea

Characters	Days to 50% flowering	Days to maturity	Reproductive phase duration (days)	Plant height (cm)	No. of branches per plant	No. of pods per plant	100 Seed weight (g)	Biological yield/plant (g)	Harvest index (%)	Protein content (%)	Genotypic correlation with seed yield
Days to 50% flowering	-0.147	0.136	0.029	-0.017	-0.050	-0.028	-0.002	0.075	-0.154	0.003	-0.155
Days to maturity	-0.120	0.166	-0.032	-0.021	-0.043	-0.012	0.002	0.137	-0.141	-0.002	-0.065
Reproductive phase duration (days)	0.043	0.052	-0.100	-0.006	0.011	0.026	0.006	0.103	0.019	-0.008	0.146
Plant height (cm)	-0.035	0.049	-0.009	-0.070	-0.011	-0.004	0.013	0.173	-0.065	-0.002	0.038
No. of branches per plant	-0.062	0.050	0.009	-0.007	-0.118	-0.003	-0.009	0.045	-0.081	0.010	-0.157
No. of pods per plant	0.024	-0.011	-0.015	0.002	0.002	0.172	-0.007	0.322	0.382	0.000	0.870**
100 Seed weight (g)	0.006	0.009	-0.016	-0.025	0.030	-0.033	0.038	0.109	0.039	-0.003	0.154
Biological yield per plant (g)	-0.021	0.043	-0.020	-0.023	-0.010	0.105	0.008	0.529	0.105	0.000	0.716**
Harvest index (%)	0.042	-0.043	-0.003	0.008	0.018	0.122	0.003	0.103	0.541	0.000	0.789**
Protein content (%)	0.011	0.008	-0.020	-0.004	0.031	-0.001	0.003	-0.003	0.001	-0.038	-0.013

Residual effect, R= 0.0254 *,** significant at 5% and 1% levels, respectively