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Correlation and path coefficient analysis in F_3 generation of chickpea (*Cicer arietinum* L.)

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Abstract

Nineteen F_3s + one check variety of chickpea were grown at Pulses Research Station, Junagadh Agricultural University, Junagadh during *rabi* 2016-17 for correlation and path analysis for 11 traits (days to 50% flowering, days to maturity, plant height (cm), number of branches per plant, number of pods per plant, first pod bearing node (cm), number of seeds per pod, 100-seed weight (g), seed yield per plant (g), biological yield per plant (g) and harvest index%). The seed yield per plant had significant and positive correlation with number of branches per plant, 100-seed weight at genotypic level while, harvest index significant and positive correlated with seed yield per plant at both genotypic and phenotypic levels. Path coefficient analysis revealed that harvest index, biological yield per plant, number of branches per plant, days to 50% flowering, days to maturity, first pod bearing node, number of seeds per pod, 100-seed weight, and exhibited high and positive direct effects on seed yield per plant in F_3 generation of chickpea. Hence, more emphasis should be given to these traits through selection programme for yield improvement in chickpea.

Keywords: Correlation, path analysis, chickpea

Introduction

Chickpea (*Cicer arietinum* L.) is the third most important grain legume in the world. The identification of important characters and their interrelationship would be useful for developing improved genotypes. Improvement in yield may be brought through selection based on yield component characters. Analysis of correlation coefficients between characters contributing directly or indirectly towards seed yield is a matter of considerable importance in exercising the selection programme. The path analysis is an effective measure to find out direct and indirect effects of component characters contributing to 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, present investigation was undertaken to study correlation and path analysis in F_3 generation of chickpea.

Material and Methods

Nineteen F_3 generation + 1 check of chickpea were evaluated in randomized block design with three replications during at Pulses Research Station, Junagadh Agricultural University, Junagadh under irrigated condition. Each F_3 population was accommodated in two rows of 4 m length with line-line and plant-plant spacing of 45 × 15 cm. Recommended practices were followed to raise a good crop. The data were collected on 20 randomly selected and tagged plants for plant height (cm), number of branches per plant, number of pods per plant, first pod bearing node (cm), number of seeds per pod, seed yield per plant (g), biological yield per plant (g) and harvest index (%). The observations for days to 50% flowering, days to maturity and 100-seed weight were recorded on plot basis. The phenotypic and genotypic correlation coefficients of all the pair of characters were worked out as per Al-Jibouri *et al*. (1958) [2], while path coefficient analysis was carried out according to the method suggested by Dewey and Lu (1959) [5].

Table 1: Genotypic (r_g) and phenotypic (r_p) correlation coefficient among eleven characters of 19 F_3 generation + 1 check variety of chickpea

Characters		Seed yield per plant (g)	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of pods per plant	First pod bearing node (cm)	Number of seeds per pod	100- seed weight (g)	Biological yield per plant (g)	Harvest index (%)
Seed yield per plant (g)	r_g	1.000	-0.075	-0.105	0.410	0.461*	-0.196	0.303	-0.269	0.500*	0.137	0.469*
	r_p	1.000	-0.125	-0.095	0.284	0.025	-0.190	0.179	-0.002	0.315	0.040	0.525*
Days to 50% flowering	r_g		1.000	-0.206	0.153	0.210	0.537*	0.421	0.128	-0.107	0.192	-0.263
	r_p		1.000	-0.218	0.186	0.254	0.333	0.334	-0.095	-0.186	0.095	-0.151
Days to maturity	r_g			1.000	-0.194	-0.237	-0.068	-0.110	0.415	-0.334	-0.086	0.017
	r_p			1.000	-0.131	-0.144	-0.054	-0.222	0.130	-0.143	-0.059	-0.011
Plant height (cm)	r_g				1.000	0.720**	0.254	0.701**	-0.111	0.605**	0.022	0.204
	r_p				1.000	0.269	0.199	0.325	-0.109	0.260	0.021	0.136
Number of branches per plant	r_g					1.000	0.538*	0.561**	-0.464*	0.439	0.142	0.136
	r_p					1.000	0.291	0.145	-0.102	0.100	0.090	-0.007
Number of pods per plant	r_g						1.000	0.278	-0.255	-0.118	-0.159	0.070
	r_p						1.000	0.172	-0.121	-0.067	-0.103	0.006
First pod bearing node (cm)	r_g							1.000	-0.659**	0.404	0.586**	-0.347
	r_p							1.000	-0.337	0.270	0.343	-0.179
Number of seeds per pod	r_g								1.000	-0.679**	-0.059	-0.115
	r_p								1.000	-0.282	0.038	-0.050
100- seed weight (g)	r_g									1.000	0.072	0.208
	r_p									1.000	0.074	0.091
Biological yield per plant (g)	r_g										1.000	-0.810**
	r_p										1.000	-0.818**
Harvest index (%)	r_g											1.000
	r_p											1.000

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

Results and Discussion

The association analysis (Table 1) revealed that in general the value of genotypic correlation indicating the inherent association among the traits. Similar findings were also reported by Sharma and saini (2010) [11] and Jivani *et al*. (2013) [6]. In the present study, seed yield per plant had significantly and positive correlation with number of branches per plant and 100-seed weight at genotypic level. Such positive interrelationships between seed yield and these attributes have also been reported in chickpea by Renukadevi and Subbalakshmi (2006) [10] and Kuldeep *et al*. (2014) [7]. While, harvest index had significant and positive correlation with seed yield per plant at both genotypic and phenotypic level. Similar results reported by Jivani *et al*. (2013) [6], Adnan *et al*. (2017) [1] and Sohail *et al*. (2017) [12].

Days to 50% flowering had a positive and significant association at genotypic level with number of pods per plant and the same result was noted by Bejiga *et al*. (1991) [4]. Plant height had a positive and significant association with number of branches and similar result was obtained by Ali *et al*. (2009) [3]. 100-seed weight had positive and significant correlation with plant height and such result was obtained by Rao and Kumar (2003) [9] and Yadav *et al*. (2012) [14] at genotypic level. These relationships indicated that improvement in one character would bring about the improvement in another, which in turn, automatically lead to increase in seed yield. Number of branches per plant had a positive and significant correlation with number of pods per plant and the similar result was obtained by Yadav *et al*. (2012) [14]. Number of branches per plant had a positive and significant correlation with first pod bearing node at genotypic level while, number of branches per plant had a negative and significant correlation with number of seeds per pod at genotypic level. At genotypic level, first pod bearing node had negative and significant correlation with number of seeds per pod while, with that of, biological yield per plant had a significant and positive association. Number of seeds per pod has a negative and significant correlation with 100-seed weight at genotypic level and the same result was obtained by Yadav *et al.* (2012) [14]. The present results on correlation coefficients thus, revealed that number of branches per plant, 100-seed weight and harvest index were the most important traits and may contribute considerably towards higher seed yield.

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 and phenotypic 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 harvest index and biological yield per plant have also been reported by Renukadevi and Subbalakshmi (2006) [10], Thakur and Sirohi (2009) [13], Jivani *et al.* (2013) [6] and Padmavathi *et al.* (2013) [8]. 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 higher number of branches per plant, 100-seed weight, harvest index and biological yield per plant. Therefore, more emphasis should be given to these components while making selection for higher seed yield in chickpea.

Table 2: Genotypic (G) and Phenotypic (P) path coefficient analysis showing direct (diagonal and bold) and indirect effects of different characters on seed yield in 19 F_3 generation + 1 check of chickpea

Characters		Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches per plant	Number of pods per plant	First pod bearing node (cm)	Number of seeds per pod	100- seed weight (g)	Biological yield per plant (g)	Harvest index (%)	Genotypic correlation with Seed yield per plant
Days to 50% flowering	G	0.249	-0.011	-0.020	0.063	-0.207	0.024	0.001	-0.002	0.232	-0.405	-0.075
	P	0.054	-0.002	0.007	-0.026	-0.012	-0.007	-0.003	-0.015	0.134	-0.254	-0.125
Days to maturity	G	-0.051	0.053	0.025	-0.072	0.026	-0.006	0.002	-0.006	-0.104	0.027	-0.105
	P	-0.011	0.009	-0.005	0.014	0.002	0.004	0.004	-0.011	-0.083	-0.018	-0.095
Plant height (cm)	G	0.038	-0.010	-0.131	0.218	-0.098	0.041	-0.001	0.010	0.027	0.315	0.413
	P	0.010	-0.001	0.040	-0.027	-0.007	-0.007	-0.004	0.021	0.030	0.228	0.284
Number of branches per plant	G	0.052	-0.012	-0.094	0.303	-0.208	0.033	-0.002	0.007	0.171	0.210	0.461*
	P	0.013	-0.001	0.011	-0.102	-0.010	-0.003	-0.003	0.008	0.127	-0.012	0.025
Number of pods per plant	G	0.134	-0.003	-0.033	0.163	-0.386	0.016	-0.001	-0.002	-0.192	0.109	-0.196
	P	0.018	-0.001	0.008	-0.029	-0.037	-0.003	-0.004	-0.005	-0.014	0.010	-0.190
First pod bearing node (cm)	G	0.105	-0.005	-0.092	0.170	-0.107	0.059	-0.003	0.007	0.707	-0.535	0.303
	P	0.018	-0.002	0.013	-0.014	-0.006	-0.021	-0.012	0.002	0.484	-0.300	0.179
Number of seeds per pod	G	0.032	0.022	0.014	-0.141	0.098	-0.038	0.005	-0.012	-0.071	-0.178	-0.269
	P	-0.005	0.001	-0.004	0.010	0.004	0.007	0.037	-0.023	0.054	-0.084	-0.002
100- seed weight (g)	G	-0.026	-0.017	-0.079	0.133	0.045	0.023	-0.003	0.017	0.087	0.320	0.500*
	P	-0.010	-0.001	0.010	-0.010	0.002	-0.005	-0.010	0.082	0.104	0.153	0.315
Biological yield per plant (g)	G	0.048	-0.004	-0.003	0.043	0.061	0.034	-0.001	0.001	1.205	-1.248	0.137
	P	0.005	-0.001	0.001	-0.009	0.003	-0.007	0.001	0.006	1.410	-0.370	0.040
Harvest index (%)	G	-0.065	0.001	-0.026	0.041	-0.027	-0.020	-0.001	0.003	-0.976	1.541	0.469*
	P	-0.008	-0.001	0.005	0.001	-0.001	0.003	-0.002	0.007	-1.155	1.673	0.525*

,* Significant at 5 and 1 % levels, respectively
Residual effect, R=0.052 (Genotypic)
R= 0.182 (Phenotypic

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