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Estimation of Genetic Variability, Correlation and Path Analysis for Seed Yield Characters in Chickpea (*Cicer arietinum* L.)

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A B S T R A C T

The experimental material comprised of 21 chickpea genotypes and the experiment was laid out in Randomised Complete Block Design with three replications, during *rabi*, 2017 Maximum GCV and PCV were recorded for seed yield per plant and harvest index. High genetic advance as percent of mean recorded for seed yield per plant. Seed yield per plant showed high positive significant correlation with harvest index and pods per plant at phenotypic and genotypic levels. Biological yield and Harvest index exhibited high direct positive effect on seed yield per plant at phenotypic and genotypic levels. Genotypes C138, C108, C201 and C1021 of chickpea were found to be superior for seed yield per plant.

Introduction

The word Cicer is a derivative from the Greek word kiros referring to a well-known Roman family Cicero. Arietinum is derived from the Latin word arise meaning ram which refers to the ram's head shape of the chickpea (Singh, 1985). Chickpea is an important *Rabi* season legume having extensive geographical distribution. Chickpea plays an important role to improve soil fertility by fixing atmospheric nitrogen with the help of root nodules (Anabessa *et al.*, 2006). Genetic variability refers to the presence of difference among the individual of plant population the existing variability is essential for improvement of genetic material (Nimbalkar *et al.*, 2000). However, it is only genetic variation which is heritable and hence important in any selection programme. Correlation coefficient gives an ideal about the various associations existing between yield components. As yield is a complex character direct selection for this character as such becomes a difficult task without knowledge of relationship between yield and its various components. The path analysis model has two types of effects. The first is the direct effect and the second is the indirect effect. When the exogenous variable has an arrow directed towards the dependent variable, then it is said to be the direct effect. When an exogenous variable has an effect on

the dependent variable, through the other exogenous variable, we have to add the direct and indirect effect. One variable may not have a direct effect, but it may have an indirect effect as well (Statistics solutions).

Research gap

India remains a net importer of Chickpea Despite contributing to more than 60% to global Chickpea area and production. This phenomenon is due to high national demand. To meet the demands of increasing population, there is need to develop high yielding varieties. Therefore it is need to use genetic variability, correlation, and path analysis as a tool in crop improvement programme

The present investigations were therefore undertaken to study the genetic variability, correlation and path analysis in chickpea with the following objectives.

To estimate the extent of variability for yield and contributing characters in Chickpea

To study the association between different characters

To find out direct and indirect effects of component characters on yield in chickpea

Materials and Methods

The present investigation was carried out at the Field Experimentation Centre, Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, U.P. (India) during *Rabi*-2017. The experimental materials consist of 21 genotypes obtained from Dept. of GPB, SHUATS. The experiment was laid out in Randomized Complete Block Design with three replications. The genotypes were sown by hand dibbling in each plot by imposing randomization in each replication along with check Uday. The spacing of row to row 30cm and plant to plant 10cm was maintained. The fertilizer dose of 20:40:40 NPK kg/ha is applied as Nitrogen as two splits, phosphorus and potassium as basal dose. All recommended package of practices were followed during the cropping period to raise a good crop. Observations were recorded in each plot and replication by taking five plants randomly for nine quantitative characters *viz*. Mean data for nine characters *viz*., days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of pod per plant, biological yield, harvest index, seed index and seed yield per plant. The data was subjected to the statistical analysis the correlation coefficients and are estimated as suggested by Al Jibouri *et al.,* (1958), path coefficient analysis (Dewey and Lu, 1959).

Results and Discussion

The analysis of variance revealed highly significant to significant differences among the genotypes for all the nine characters studied (Table 1). In the present study variation among the characters are estimated by Genotypic Coefficient of Variation (GCV) and Phenotypic Coefficient of Variation (PCV). The PCV was slightly higher than the GCV for few characters indicates the interaction of genotypes with the environment (Table 2). High GCV and PCV were recorded for seed yield per plant (21.27 and 21.27) followed by harvest index (19.51 and 20.60). Estimates of heritability are a good index for predicting the transmission of characters from parents to their offspring (Falconer, 1981). High heritability (broad sense) was recorded for characters i.e., seed index and days to maturity (97 %) followed by pods per plant (92 %). The genotypic and phenotypic correlation coefficient and path analysis were computed among 9 characters (Table 3).

Table.1 Estimates the Genetic parameters for nine quantitative characters in chickpea genotypes

S. No.	Characters	Range		Grand Mean	Genotypic Coefficient of variance (GCV)	Phenotypic Coefficient of variance (PCV)	Heritability (broad sense) (%)	Genetic Advance as percent mean
		Minimum	Maximum					
1	Days to 50 % flowering	69.00	82.00	74.95	4.44	5.68	86	8.50
2	Days to maturity	104.66	127.66	113.79	5.59	5.68	97	11.31
3	Plant height	33.80	62.93	48.73	15.05	16.00	88	29.14
4	Number of primary branches	2.20	3.13	2.67	7.20	13.61	28	7.85
5	Pods/plant	22.46	47.40	32.83	18.08	18.82	92	35.79
6	Biological yield	15.38	31.36	22.38	17.22	19.00	82	32.16
7	Harvest index %	38.65	80.64	58.52	19.51	20.60	90	38.07
8	Seed index	15.00	25.76	20.23	15.59	15.79	97	31.71
9	Seed yield/plant	10.54	20.60	13.03	21.27	21.27	86	40.70

Table.2 Estimation of Genotypic and Phenotypic correlation coefficients between yield characters of chickpea

Characters		Days to maturity	Plant height	Primary branches/plant	Pods/ plant	Biological yield	Harvest index	Seed index	Seed yield/ plant
Days to 50% flowering	G	0.994**	0.136	0.189*	0.012	0.058	0.173	0.080	0.222*
	P	0.904**	0.078	-0.008	0.035	0.031	0.162	0.072	0.185*
Days to maturity	G	1.000	0.055	0.137	-0.023	0.022	0.137	0.002	0.133
	P	1.000	0.072	0.118	-0.010	0.020	0.115	0.005	0.113
Plant height	G		1.000	-0.060	-0.127	0.331**	-0.350**	-0.077	-0.019
	P		1.000	-0.036	-0.116	0.259**	-0.299**	-0.072	-0.018
Primary branches /plant	G			1.000	-0.067	-0.761**	0.605**	0.305**	-0.099
	P			1.000	-0.039	-0.217*	0.205*	0.166	0.011
Pods/ plant	G				1.000	0.505**	0.116	-0.361**	0.568**
	P				1.000	0.457**	0.116	-0.345**	0.525**
Biological yield	G					1.000	-0.367**	-0.143	0.542**
	P					1.000	-0.371**	-0.108	0.538**
Harvest index	G						1.000	0.567**	0.565**
	P						1.000	0.528**	0.548**
Seed index	G							1.000	0.405**
	P							1.000	0.385**

G=Genotypic correlation coefficient P= Phenotypic correlation coefficient. *Significant at 5% level, **Significant at 1% level.

Table.3 Estimation of genotypic and phenotypic path analysis between yield characters of chickpea

Characters		Days to 50% flowering	Days to maturity	Plant height	Primary branches/plant	Pods/ plant	Biological yield	Harvest index	Seed index	Seed yield/ plant
Days to 50% flowering	G	**-1.655**	-1.646	-0.225	-0.313	-0.020	-0.097	-0.286	-0.133	0.222
	P	**0.114**	0.103	0.009	-0.001	0.004	0.003	0.018	0.008	0.185
Days to maturity	G	1.547	**1.555**	0.085	0.213	-0.036	0.035	0.213	0.003	0.133
	P	-0.092	**-0.102**	-0.007	-0.012	0.001	-0.002	-0.011	-0.0005	0.133
Plant height	G	-0.011	-0.004	**-0.087**	0.005	0.011	-0.028	0.030	-0.008	-0.019
	P	0.002	0.002	**0.028**	-0.001	-0.003	0.007	-0.007	-0.008	-0.018
Primary branches /plant	G	0.122	0.088	-0.039	**0.645**	-0.043	-0.492	0.391	0.197	-0.099
	P	-0.0002	0.003	-0.001	**0.026**	-0.001	-0.005	0.005	0.004	0.011
Pods/ plant	G	-0.001	0.003	0.019	0.010	**-0.155**	-0.078	-0.018	0.056	0.568
	P	0.003	-0.001	-0.011	-0.003	**0.098**	0.045	0.011	-0.034	0.525
Biological yield	G	0.087	0.034	0.493	-1.132	0.751	**1.486**	-0.546	-0.213	0.542
	P	0.024	0.016	0.205	-0.172	0.361	**0.790**	-0.293	-0.085	0.538
Harvest index	G	0.123	0.102	-0.261	0.450	0.086	-0.273	**0.744**	0.422	0.565
	P	0.127	0.090	-0.235	0.161	0.091	-0.291	**0.784**	0.414	0.548
Seed index	G	0.005	0.0002	-0.005	0.020	-0.023	-0.009	0.037	**0.065**	0.405
	P	0.005	0.0004	-0.005	0.013	-0.027	-0.008	0.042	**0.080**	0.385

G = Genotypic path analysis, P = Phenotypic path analysis

Seed yield per plant had showed high positive significant correlation with harvest index and pods per plant at phenotypic and genotypic levels. Biological yield and days to maturity exhibited high direct positive effect on seed yield per plant at phenotypic and genotypic levels. Genotypes C138, C108, C201 and C1021 of Chickpea was found to be superior for seed yield per plant.

By considering the nature and extent of correlation coefficients and path analysis it can be concluded that improvement of Chickpea seed yield is brought through simultaneous selection of harvest index, pods per plant, biological yield and days to maturity.

The results from present study concluded among 21 genotypes C138, C108, C201 and C1021 of chickpea were found to be superior for seed yield per plant. High GCV and PCV observed for seed yield per plant and harvest index. High heritability coupled with high genetic advance as percent of mean was registered for number of pods per plant. Hence these parameters could be used for selection. Seed yield per plant shows high positive significant association with harvest index, biological yield, pods per plant at phenotypic, genotypic levels. Biological yield, harvest index exhibited high positive direct effect on seed yield at phenotypic and genotypic levels. Thus, priority should be given to these characters during selection for yield improvement in chickpea.

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