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GENETIC VARIABILITY AND ASSOCIATION STUDY OF SOME QUANTITATIVE TRAITS IN CHICKPEA (*CICER ARIETINUM* L.)

Muhammad Ashfaq[1*], Abdul Rashid[1], Muhammad Saleem Haider[1], Amna Ali, Muhammad Shahzad[1], Muhammad Ali[1], Farah Khan[3], Hafiz Umar Farooq[1] and Urooj Mubashar[2]

[1]*Institute of Agricultural Sciences, University of the Punjab, Lahore, Pakistan.*
[2]*Government Elementary Teachers Education College GhakkharMandi, Gujranwala, Pakistan.*
[3]*Department of Botany, Lahore College for Women University, Lahore, Pakistan.*
Corresponding Author Email: ashfaq.iags@pu.edu.pk

ABSTRACT

Twenty chickpea varieties were assessed for days to flowering, days to maturity, plant height, primary branches, secondary branches, and pods per plant, 100-seed weight and grain yield per plant. Different traits were studied on genetic parameters and their correlations. Analysis of variance showed significant differences among the genotypes for all the characters. Broad sense heritability estimates for various traits ranged from 23.2-89.3 %. Grain yield per plant showed highly significant positive correlation with secondary branches and plant dry weight (r = 0.416**, r = 0.247**) and highly significant negative correlation with number of primary branches and 100-seed weight (r= - 0.890**, r = - 0.315**). The study provides the information regarding genetic variability among the genotypes which may be helpful for further investigation and their utilization for the production of new high yielding varieties through breeding strategies.

Keywords: Chickpea, genotype, phenotypic characters, genetic parameters

INTRODUCTION

Chickpea *(Cicer arietinum* L.) is the most important grain legume crop of Pakistan and serves as a major source of vegetable protein in the daily diet. This principal rabi pulse crop is predominantly grown in the vast rain-fed areas of the country. Pakistan ranks second to India in terms of acreage under chickpea which is 992 thousand hectares with an annual production of 751 thousand tones (Anonymous, 2013). It is rich in protein. The average yield of this crop in Pakistan is generally low because of drought, susceptibility to diseases and low yield potential of varieties. The profitable yield can only be obtained through genetic improvement for resistance to biotic and abiotic stresses and high yield potential. Genetic improvement is a prerequisite for such improvement (Arshad *et al.*, 2002). Selection on the basis of grain yield, a polygenic ally controlled complex character, is usually not very efficient, but selection based on its component characters could be more efficient. A survey of genetic variability with the help of suitable parameters such as genetic coefficient of variation, heritability estimates and genetic advance are absolutely necessary to start an efficient breeding programme. Some of the characters are highly associated among themselves and with seed yield. The analysis of the relationships among these characters and their associations with seed yield is essential to establish selection criteria. When more characters are involved in correlation study it becomes difficult to ascertain the characters which really contribute toward yield.

MATERIALS AND METHODS

The experimental material consisted of 20 chickpea genotypes table 1 including five standard cultivars. The experiment was conducted during Rabi 2007-08 at Experimental Area of Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. The genotypes were sown in a plot size of 4 m x 1.2 m in three replications using a randomized complete block design. The plant-plant distance and row-row distances were 15 and 30 cm, respectively. At maturity 10 guarded plants were selected at randomly to record data on plant height (cm), primary branches, secondary branches, pods per plant, 100-seed weight (g) and grain yield per plant (g). The mean data were subjected to analysis of variance to test the level of significance among the genotypes for different characters according to Steel and Torrie (1980). Genotypic and phenotypic variances, genotypic and phenotypic coefficient of variability, broad sense heritability and correlation coefficients were computed according to the method suggested by Singh and Chaudhary (1985).

RESULTS AND DISCUSSIONS

In the present investigation, genetic parameters of chickpea yield and their parameters were studied.

Coefficients of variation were generally found to be low (below 10%) except pods per plant (CV: 19.45 %) had high coefficient of variability. The Phenotypic coefficients of variation were also found lower for days to flowering (1.04 %) and days to maturity (1.374 %), secondary branches per plant (2.82 %), plant height (4.64 %), plant dry weight (3.60), number of seeds per pod (3.19 %), 100-seed weight (2.98 %) and grain yield per plant (4.42 %). It was moderate for number of primary branches per plant (7.72) and number of pods per plant (12.12 %). Genetic coefficients of variability were observed lower for days to flowering (2.13 %), days to taken to maturity (2.49 %), number of secondary branches per plant (5.39%) and 100-seeds weight (5.61 %), while it was moderate for plant height (9.58 %), plant dry weight (6..83 %), primary and seed per pod (12.30 and 6.62 %), grain yield per plant (7.61 %) and pods per plant (22.92 %) (Table 2).The higher value of heritability for grain yield per plant, number of grains per plant and pods per plant indicates that these characters can be used as the genetic parameters for the improvement and selection of the high yielding genotypes. In this studies 50 % plants were flowered (days to flowering) and 90 % pods per plant matured (maturity) on plot basis. Ali *et al.* (2008) computed high genotypic coefficient of variability for number of pods per plant. Hassan *et al.* (2005) reported high coefficient of variability for grain yield per plant. All the genotypes showed significant genetic differences with each other on the basis of all the morphological traits studied (table 3). Such types of genetic variation provide raw material for further selection and screening of diverse genotypes that is the basis for evolution of new varieties. Different association results of different morphological traits in (Table 4) revealed that genotypic correlation of grain yield per plant with days to flowering, plant height, number secondary branches per plant, number dry plant weight and number of pods per plant was positive and highly significant (r = 0.185**, r = 0.127**, r = 0.416**, r = 0.216). Genotypic correlation of 100-seed weight with number of days taken to flowering, number of pods per plant and number of seeds per pod was positive and significant (r = 0.560**, r = 0.252**, r = 0.163**). Highest Positive and significant genotypic correlation was also found between number of seeds per pod and total plant dry weight (r = 0.823**), While genotypic correlation of number of pods per plant with days to maturity, plant height, number of secondary branches per plant and plant dry weight was positive and significant (r = 0.252**, r = 0.147, r = 0.576**, r = 0.439**). On the other hand, genotypic correlation of plant dry weight with days to flowering, days to maturity and number of secondary branches per plant was found to be positive and highly significant (r = 0.539**, r = 0.092**, r = 0.296**), while secondary and primary branches per plant had positive and significant association (r = 0.034**, r = 0.117**) with primary branches and days to flowering) (Table 4). Plant height had positive significant association with days to flowering and days to maturity (r= 0.239**, r = 0.137**), while genotypic correlation between days to maturity and days to flowering found positive and significant (r = 0.808**).

Table 1. Germplasm material used for the research work.

Sr.No	Genotypes	Check varieties/Advance lines	Origin
1	CM-98	Check varieties	AARI, Pakistan
2	PB-2000	Check varieties	AARI, Pakistan
3	Bittal-98	Check varieties	AARI, Pakistan
4	AUG-786	Check varieties	AARI, Pakistan
5	Wanhar-2000	Check varieties	AARI, Pakistan
6	1036	Advance line	UAF, Pakistan
7	109	Advance line	UAF, Pakistan
8	4047	Advance line	UAF, Pakistan
9	106	Advance line	UAF, Pakistan
10	161	Advance line	UAF, Pakistan
11	635	Advance line	UAF, Pakistan
12	1201	Advance line	UAF, Pakistan
13	108	Advance line	UAF, Pakistan
14	848	Advance line	UAF, Pakistan
15	810	Advance line	UAF, Pakistan
16	406	Advance line	UAF, Pakistan
17	5008	Advance line	UAF, Pakistan
18	5006	Advance line	UAF, Pakistan
19	1002	Advance line	UAF, Pakistan
20	932	Advance line	UAF, Pakistan

All the other remaining traits showed negative significant positive interrelationship with eachother. Saleem *et al.* (2002) reported positive and significant correlation of plant dry weight with grain yield. Malik *et al.* (2002) have also reported positive and significant correlation between number of branches per plant and grain yield at the genotypic and phenotypic level. Khorgade (1995) observed that grain yield per plant had positive and significant association with biological yield per plant and pods per plant. Hassan *et al.* (2008) and Arshad *et al.* (2004) reported positive significant correlation of 100-seed weight with grain yield.

Table 2. Genetic parameters for various physio-morphological traits in chickpea.

Traits	CV%	PCV%	GCV%	H^2bs
Days to flowering	1.85	1.04	2.13	84.0
Days to maturity	2.95	1.37	2.49	39.3
Primary branches per plant	9.58	7.72	12.30	89.3
Secondary branches per plant	4.60	2.82	5.39	27.4
Plant height (cm)	8.38	4.64	9.58	83.5
Plant dry weight (g)	5.81	3.60	6.83	27.8
Pods per plant	19.45	12.12	22.92	87.9
Seeds per pod	5.80	3.19	6.62	23.2
100-seed weight (g)	4.75	2.98	5.61	88.2
Seed yield per plant (g)	6.20	4.42	7.61	83.8

Table 3. Analysis of variance of various morphological traits of Chickpea.

SOV	D.F	Traits									
		DF	DM	PB/P	SB/P	PH	PDW	NP/P	NS/P	100SW	SY/P
Genotypes	19	9.039**	4.97**	0.029**	0.895**	61.55**	51.93**	195.69**	0.013**	2.78**	16.04**
Replication	2	7.817	3.65	0.005	0.061	32.26	0.464	30.50	0.018	3.70	3.08
Error	38	4.641	2.65	0.014	0.466	20.90	24.11	90.38	0.007	1.28	6.34

DF: Days to flowering; DM: Days to maturity; PB/P: Primary branches per plant; SB/P: Secondary branches per plant; PH: Plant height (cm); PDW: Plant dry weight (g); NP/P: Pods per plant; S/P: Seeds per pod; 100SW: 100-seed weight (g); SY/P: Seed yield per plant (g)

Table 4. Genotypic and phenotypic correlation matrix.

Variables	**Days taken to flowering**	**Days taken to maturity**	**Plant height**	**No. of primary branches / plant**	**No. of secondary branches/ plant**	**Plant dry weight**	**No of pod/plant**	**No. of seed/pod**	**100 seed weight**
Days taken to flowering									
G	1.00**								
P									
Days taken to maturity									
G	0.808**								
P	-0.077								
Plant height									
G	0.239**	0.137**							
P	0.026	-0.209							
Pri. branches									
G	0.117**	-0.175**	-0.044**						
P	-0.078	0.077	-0.051						
Sec. branches									
G	-0.397**	-0.116**	-0.551**	0.034**					
P	-0.308	0.159	-0.262	0.049					
Plant dry weight									
G	0.539**	0.092**	-0.211**	-0.1524**	0.296**				
P	0.057	-0.041	0.083	7.240	0.022				
No. of pods/ plant									
G	0.252**	-0.207**	0.147**	-0.355**	0.576**	0.439**			
P	0.0022	-0.241	0.004	0.102	0.237	0.054			
No. of seeds/pod									
G	-0.752**	0.078**	-0.577**	0.407**	0.489**	0.823**	-0.535**		
P	0.019	-0.058	-0.086	0.099	0.189	0.029	0.186		
100 seed weight									
G	0.56**	-0.221**	-0.341**	-0.163**	-0.677**	-0.452**	0.252**	0.1632**	
P	0.0171	0.013	0.075	-0.075	-0.204	-0.131	-0.035	0.075	
Grain yield									
G	0.185**	-0.432**	0.127**	-0.890**	0.416**	0.247**	0.091**	-0.276**	-0.315**
P	0.133	0.287	0.121	-0.328	0.183	-0.018	0.932	-0.161	-0.131

* Significant, ** Highly Significant G= Genotypic, P= Phenotypic Correlation

NDF=Number of days taken to flowering, NDM= Number of days taken to maturity, PH= Plant height, NBP= Number of primary branches, NSP= Number of secondary branches, PDW= Plant dry weight, NPP= Number of seeds per pod, HSW= 100-seed weight, GY= Grain yield per plant

CONCLUSION

From above study, it is concluded that by increasing the number of secondary branches per plant and plant dry weight may enhance grain yield per plant. Plant height and 100-seed weight could be also used as basis of selection.

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