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Estimates of Variability and Correlations for Quantitative Traits in *Cicer arietinum*

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ABSTRACT

Twenty elite chickpea lines were studied for variability and correlation for traits like number of days to flowering, number of days to maturity, number of primary branches per plant, number of secondary branches per plant, plant height and seed yield per plant (g). Varietal differences among the genotypes were significant (P<0.01). Phenotypic and genotypic variances were higher for plant height (33.29 & 32.45) and seed yield per plant (13.47 & 13.11). Broad sense heritability estimates were the highest for plant height (97.4) and seed yield per plant (97.3). Genetic advance was higher for seed yield per plant (27.42) and plant height (14.51). High heritability for both the traits coupled with high genetic advance revealed that additive genetic effects were important for these characters. Positive genotypic correlation was detected between seed yield and number of primary branches per plant (0.76), while at phenotypic association was highly significant (0.63). To conclude, plant height and number of primary branches would be the appropriate selection criteria for better seed yield in chickpea.

Key Words: *Cicer arietinum* L.; Variability; Correlations; Quantitative traits

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is an important food legume providing protein in human diet. It has the ability to fix atmospheric nitrogen and improve soil fertility with low added cost of production. The national average yield of chickpea is low as compared to other chickpea growing countries (Anonymous, 2006). Although, major crop improvements have been made in the recent years through the evolution of high yielding and disease resistant chickpea cultivars, breeding for improved types is a continuous process and requires strenuous efforts by breeders. Availability of genetic variability is crucial for any breeding program, which provides an opportunity for selection of desirable genotypes. The information on correlations among various economic traits provides the basis of selection and synthesis of improved cultivars. Chavan *et al.* (1994) recorded greatest genetic variability for branches per plant, high genetic advance for seed yield. High genetic advance combined with high heritability for seed yield, indicated the importance of additive genetic action. Seed yield is shown to be positively correlated both phenotypically and genotypically with days to flowering, days to maturity and branches per plant (Vijayalakshmi *et al.*, 2000; Saleem *et al.*, 2002b).

Subhash *et al.* (2001) studied various parameters of variability in 33 chickpea genotypes grown in five environments and confirmed that data on days to 50% flowering and to maturity, plant height and number of primary and secondary branches per plant. Phenotypic coefficients of variation were higher than genotypic coefficients of variation values in all the environments for all the characters. High genetic advance observed for number of secondary branches per plant and its associated high heritability indicated the predominance of additive gene effects, which indicates high genetic gain from selection for these traits. Bhaduoria *et al.* (2003) studied 46 genetically diverse chickpea genotypes from various parts of the of India and observed significant positive correlation between pods per plant and primary branches per plant, pods per plant and seeds per pod; primary branches per plant and seeds per pod, pods per plant and days to 100% podding.

Many researchers reported that high heritability of secondary branches and biological yield coupled with high genetic advance have additive gene effects in determining these characters (Khan & Sharma, 1999; Subhash *et al.*, 2001; Saleem *et al.*, 2002a; Bakhsh *et al.*, 2004; Singh *et al.* 2004). These studies suggest that grain yield had a positive and significant correlation with plant height, number of pods per plant, 100-seed weight and biological yield. Tripathi (1998) and Yucel *et al.* (2006) found positive relationships between seed yield per plant and plant height, secondary branches and number of full pods and seeds per plant.

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Genotypic variance was the highest for 1000 seed weight followed by seed number per plant. Present study was an attempt to determine genetic variability and correlations between various quantitative traits in chickpea for the selection of desirable genotypes in segregating populations.

MATERIALS AND METHODS

The present study was conducted in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during the year, 2005-2006. The experimental material comprised 20 elite chickpea genotypes viz; BRC-27, CS-30, 102, 114, 209, 549, 576, 660, 777, 836, 930, 1011, 1012, 1084, 1117-1, 1129, 1230, 5002, Bittal-98 (check) and Paidar-91 (check). These varieties were grown in a Randomized Complete Block Design replicated thrice. Ten equally competitive plants were ear marked from each genotype for recording data on number of days to flowering, number of days to maturity, number of primary branches per plant, number of secondary branches per plant, plant height and seed yield per plant (g). Phenotypic and genotypic correlation coefficients were calculated according to Kwon and Torrie (1964). Variance and covariance were worked out following Fisher (1958) coefficient of variability was worked out according to Steel *et al.* (1996).

RESULTS AND DISCUSSION

The differences among the genotypes were highly significant (P<0.01) for all the traits (Table I). Estimates of different measures of variability, heritability and genetic advance for various traits are presented in Table II and correlation coefficients are given in Table III. The magnitude of phenotypic and genptypic variance were highest for plant height followed by seed yield per plant, number of days to flowering, number of days to maturity, number of secondary and primary branches per plant. Phenotypic coefficient of variability and genotypic coefficient of variability were highest for seed yield per plant (16.05%, 15.84%) than other traits. Chavan *et al.* (1994) observed sufficient genotypic variability for seed yield, plant height, branch number and days to flowering and Khan and Sharma (1999) reported highest genotypic coefficient of variability for secondary branches per plant followed by grain yield.

Among the six traits, estimate of broad sense heritability was highest for plant height (97.4%), followed by seed yield per plant (97.3%), number of secondary branchesper plant (80.2%), number of days to flowering (77%), number of primary branches per plant (70%) and number of days to maturity (63.2%). Chavan *et al.* (1994) and Tripathi (1998) reported high estimate of heritability for seed yield per plant and number of secondary branches per plant. Khan and Sharma (1999), Subhash *et al.* (2001), Saleem *et al.* (2002a) and Bakhsh *et al.* (2004) reported similar results. Genetic advance expressed as percent of means provides relatives comparison of traits, which were highest for seed yield per plant (27.42%) followed by plant height (14.51%), number of secondary branches per plant (5.50%), number of primary branches per plant (4.07%) and number of days to flowering (2.52%). It was lowest for number of days to maturity. High estimates of broad sense heritability coupled with high genetic advance values indicated sufficient scope for selection of seed yield per

Table I. Analysis of variance for various quantitative traits in chick

Source of variation	DF	NDF	NDM	NPB	NSB	PLH	SYP
Replications	2	4.61**	0.42	0.123	1.45	0.2288	0.17
Genotypes	19	4.36**	2.71**	0.34**	5.05**	39.54**	37.88**

** = Highly significant, NDF = Number of days to flowering, NDM = Number of days to maturity, NPB = Number of primary branches per plant, NSB = Number of secondary branches per plant, PLH = Plant height, SYP = Seed yield per plant.

Table II. Estimates of different measures of variability for various quantitative traits

Characteristics	NDF	NDM	NPB	NSB	PLH	SYP (g)
Phenotypic variance (Vp)	4.74	3.29	0.006	0.056	33.29	13.47
Genotypic variance (Vg)	3.65	2.08	0.004	0.045	32.45	13.11
Phenotypic coefficient of variability (PCV %)	1.87	1.11	3.33	3.96	8.49	16.05
Genotypic coefficient of variability (GCV%).	1.64	0.88	2.79	3.55	8.38	15.84
Heritability in broad sense (%)	77	63.2	70	80.2	97.4	97.3
Genetic advance (expressed as percent).	2.52	1.23	4.07	5.50	14.51	27.42

Table III. Genotypic (rg) and phenotypic (rp) correlation coefficients of seed yield with quantitative traits

Association	rg	rp
Seed yield vs Number of days to flowering	-0.63*	-0.54**
Seed yield vs Number of days to maturity	0.003	0.03
Seed yield vs number of primary branches per plant	0.76*	0.63**
Seed yield vs Number of secondary branches per plant	0.10	0.09
Seed yield vs Plant height	0.002	0.004

* = Significant, **= Highly significant

plant and other traits especially plant height number of primary and secondary branches and number of days flowering.

Number of days to flowering and number of primary branches per plant were positively associated with seed yield both at the genotypic and phenotypic levels (Table III). Genotypic and phenotypic correlations were positive with seed yield except of number of days to flowering, while number of primary branches showed significant negative correlation with seed yield. However, Chavan *et al.* (1994) reported positive phenotypic and genotypic correlation of seed yield with days to flowering, days to maturity and branches per plant. Vijayalakshmi *et al.* (2000) reported positive correlation of seed yield with primary and secondary branches per plant (Bhaduoria *et al.*, 2003), while Yucel *et al.* (2006) investigated positive association of seed yield with plant height.

In view genotypic coefficient of variability (GCV) and genetic advance (GA) values as well as the interrelationships of traits, selection for plant height and number of days to maturity appeared to improve seed yield per plant.

In conclusion, highest PCV% and GCV% for plant height, highest broad sense heritability was evident for plant height followed by number of secondary branches per plant and the greatest value of genetic advance for plant height. The results also indicated that plant height and number of primary branches would be the appropriate selection criteria for better seed yield in chickpea.

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