Genetic variability and interrelationship of various agronomic traits using correlation and path analysis in Chickpea (*Cicer arietinum* L.)

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ABSTRACT

The present study was carried out for estimation of genetic variability and interrelationship of various yield component traits by using path analysis and correlation analysis in 20 genotypes of chickpea (*Cicer arietinum* L.) under irrigated conditions. It was found that characters under study, harvest index and number of seeds per plant had a significant and positive association with seed yield. The path analysis was done by using seed yield as dependent variable, revealed that maximum positive direct toward seed yield was exerted by number of pods per plant (0.4451) with 52.87% ratio. Correlation coupled with path coefficient analysis revealed that number of pods per plant had a direct relationship with seed yield. This research suggests that for improvement of seed yield the selection upon number of pods per plant will provide favorable results in chickpea.

**Key words:** Chickpea, *Cicer arietinum*, interrelationship, path coefficient analysis, seed yield.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is known as third most important pulse crop in world (Padminavathi et al., 2013). It covers an area of 1083 thousand hectares with an average of 471 kg ha(-1)yield (Anonymous, 2011-12). It is a desirable crop due to its good nutritional value as it contain on an average of 4.5% fat, 8% crude fiber, 22% protein, 63% carbohydrate and 2.7% ash (Wood and Grusak, 2007). Besides its nutritional value, it is an important contributor to soil fertility as it provides nitrogen to soil due to nitrogen fixation ability with help of bacteria (*Rhizobium* sp.) (Gul et al., 2011).

Seed yield is an important character that is polygenic in nature and significantly influenced by environmental conditions (Singh et al., 2014). Due to complex nature of this character, direct selection for seed yield could not be much effective since there is presence of quantitative interaction; hence the importance should be given to yield contributing traits for selection of high yielding cultivars (Singh, 2006). The share of different traits towards yield is different from each other so it is important to identify those characters which would give out more yield and hence more effective for selection procedure. The path coefficient analysis enables us to determine the direct and indirect contribution of various traits toward yield and correlation analysis provides information of associations among yield components. In view to overcome this reason, research had been made using correlation and path analysis with many field crops.

Previous studies on chickpea have revealed the presence of considerable variation for seed yield days to maturity, 100 seed weight, pods per plant and biomass yield (Aslamshad et al., 2009; Malik et al., 2009) for number of primary and secondary branches per plant, plant height (Ali et al., 2008; Aslamshad et al., 2009). Furthermore, for assessment of genetic variation, heritability of important traits, is necessary for effective breeding strategy. High
broad sense heritability had already been reported in chickpea for seeds per plant and 100-seed weight (Ali and Ahsan, 2012), seed yield and secondary branches plant−1(Malik et al., 2009), plant height and days to flowering (Khan et al., 2011).

The present study was conducted to estimate the genetic variation; to find out heritability of selected agronomic traits. Other objective was to determine the association of different characters with seed yield, direct and indirect influence of characters towards yield and yield contributing traits and their involvement to define seed yield.

MATERIALS AND METHODS

The experiment was done at the vicinity of experimental area of the Department of Plant Breeding and Genetics, in the University of Agriculture, Faisalabad during the year 2014-2015. The experimental materials comprised of 20 elite breeding lines of chickpea obtained from Department of pulses, University of Agriculture, Faisalabad named 1010, 1134, 1004, 880, 1286, 100,1017,CM-98,1015,1003, 2004,Wanhar-2000,1114,7050,1009,1231,1050,5009,1014 andC-530. Two check varieties were used (CM-98 and Wanhar-2000). The genotypes were sown in RCBD with three replications. All cultural practices were carried out throughout crop growing season. Number of days to flowering was recorded at the appearance of first flower on 50% plants. Days taken to maturity were calculated from sowing date to the date when 90% plants turned brown and were ready for harvest. The data was analyzed statistically according to Steel et al. (1997) for the traits to ascertain the differences among various genotypes for variability and co-variability. Genotypic, phenotypic variances and coefficient of variation were estimated according to Singh and Chaudhary (1985). The estimation of heritability and genetic advance were calculated as described by Falconer (1989). Calculation for mean and coefficient of variability were made according to standard statistical techniques given by Steel et al. (1997). Genotypic and phenotypic correlation coefficients among the characters under study were estimated according to the statistical techniques given by Kwon and Torrie (1964). Path coefficient analysis was performed according to the method given by Dewey and Lu (1959) in yield related traits keeping grain yield as resultant variable.

RESULTS AND DISCUSSION

Correlation analysis

The correlation coefficient analysis is used to find out extent and nature of association among characters of any crop. It determines magnitude and degree of relationship between two characters, which is due to linkage between genes or by pleiotropic gene effect, or both (Kumar, 2013). In present study, the correlation was find out at genotypic and phenotypic level between seed yield and yield components is presented in Table 1.

Significant and positive correlation was found between seed yield with plant height (rp=0.2355, rg=0.3092), 100 seed weight (rp=0.5652, rg=0.6779), pods per plant (rp=0.4453, rg=0.4765), seeds per plant(rp=0.4654, rg=0.4974) and seeds per pod (rp=0.4344, rg=0.4812) at both levels i.e., genotypic and phenotypic level. Similar results already been reported by Ahmad et al. (2006) Yucel et al. (2006), Ali et al. (2008), Yucel and Anlarsal (2010) and Ali et al. (2011) and Jadhav et al. (2014). The positive but non-significant correlation was shown by biological yield per plant (rp=0.0785, rg=0.0673) and days to maturity (rp=0.0334, rg=0.0450) with seed yield at both phenotypic and genotypic levels. The negative and non-significant association was observed for days to 50% flowering (rp= -0.0045, rg=-0.0076) at both phenotypic and genotypic level with seed yield.

It can be observed that the magnitude of genotypic correlation is greater than phenotypic correlation which might be due to environmental masking influence on the genotypic expression. Findings of Ali et al. (2011) and Padmavathi et al. (2013) are in support with our findings.

Correlation coefficient analysis shown positive and significant correlation was found between seed yield and pods per plant, branches per plant, 100 seed weight, seeds per plant and harvest index. Therefore, these traits can be used in direct selection for improvement of seed yield in chickpea breeding program.

Path coefficient analysis

Chickpea plant has complex mechanism for manifestation of seed yield per plant as this character is resultant of interactions between many of its components. Each yield component has a positive or negative contribution to overall expression of yield. Further, the influence of yield component could be indirect or direct through other component character. Magnitude of effect of these characters may also be not the same than what is found by simple correlations. The direct and indirect effects of various yield components towards yield are shown in Table 2. It was revealed that the traits like pods per plant (0.2063), plant height (0.0348), days to maturity (0.1421), total weight of plant (0.0221), primary branches per plant (0.1981), seeds per plant (0.0742), harvest index (0.1926) and 100-seed weight (0.2342) revealed positive direct influence on seed yield, whereas days to 50% flowering showed negative direct effect (-0.0298) on seed yield per plant. Our results have similarity with the findings of Yucel et al. (2006), Yucel and Anlarsal (2010), Ali et al. (2011) and Jadhav et al. (2014) in chickpea.

Complete understanding of all the yield components is
not practical in the field of plant breeding due to merge interaction of environment and intra genic interaction between yield components. A residual effect tells us about the share of all other possible independent variables. The residual effects observed in present study were 0.5965 for genotypic path coefficient analysis. The information obtained from path analysis revealed that pods per plant, harvest index, 100 seed weight, and branches per plant had high positive direct effect on grain yield at both genotypic and phenotypic levels. Thus, these traits may be used as effective selection parameters for obtaining high yield in breeding programme for yield enhancement in Chickpea.

## References


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