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Correlation study and path coefficient analysis for seed yield and its contributing traits in chickpea (*Cicer arietinum* L.)

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Abstract
The present study was undertaken for estimation of correlation and path analysis in 380 chickpea genotypes on seven important agronomic traits of chickpea. Correlation study revealed number of pods per plant, number of seeds per plant and hundred seed weight having significant and positive association with seed yield per plant. Pods per plant and seeds per plant showed significant positive correlation with each other. Path analysis indicated significant direct effect on seed yield by hundred seed weight, pods per plant and seeds per plant. High indirect effects on seed yield per plant was by number of pods per plant through number of seeds per plant. Thus, hundred seed weight, number of seeds per plant and number of pods per plant can be considered while choosing component traits for effective selection and enhancement of seed yield in chickpea.

Keywords: Correlation, path analysis, chickpea, seed yield

Introduction
Chickpea (*C. arietinum* L.) is an important ancient crop first grown in India about 4000 B.C. Originated in South West Asia, chickpea accounts for 18% of the pulse production (Tiwari and Shivhare, 2016) [14]. In the global scenario, India is the largest chickpea producing country in the world with 8.3 Mha chickpea grown area that accounts for 67% of the global area and produces 7.8 Mt of chickpea annually (FAOSTAT, 2016). It provides a good amount of dietary protein and helps in biological nitrogen fixation thereby contributing to crop rotation and sustaining soil productivity. Chickpea flour has a high content of protein, fat, ash and fiber (Hulse, 1994 and Khan *et al*., 1995) [7].

Increasing overall chickpea production is a current necessity as India still imports a large amount of chickpea annually though India is the top producer of the legume in the world. But *per se* selection for yield by the breeders is very difficult as it is a complex trait with low heritability. Improvement will be realized through indirect selection for component traits. Correlation studies helps to understand the association between different traits which is helpful in selection of any particular trait which may affect related traits in bringing desirable or undesirable changes. Correlation study also assess the relation of a trait on genotype and genotype x environment interaction. Path coefficient analysis is a useful statistical tool uniquely designed to understand the inter-relationships of different components. Through this method, yield-contributing trait components can be ranked and useful traits producing a given correlation coefficient can be revealed. Correlation and path study will help in realizing maximum gain through selection to propel an effective breeding programme. The present investigation was undertaken to study correlation and path analysis for important chickpea traits to understand the association among the traits and their direct and indirect effects towards yield in chickpea.

Materials and methods
Panels of 380 genotypes including germplasm lines, land races from WANA (West Asia and North Africa) region procured through ICARDA, training population developed by ICRISAT and released varieties, breeding lines from different institutes were used for the study. The field experimental layout was done using Randomized Complete Block Design (RCBD) at Division of Genetics, Indian Agricultural Research Institute (IARI), New Delhi during the rabi

season in three replications. The spacings were given at 30x30 cm row to row and 10x10 cm plant to plant. Phenotypic data were recorded for three consecutive years (2014-15,2015-16,16-17) for three seasons on seven important chickpea traits viz., Days to flowering (DTF), days to maturity (DTM), plant height (PH), pods per plant (P/Pl), seeds per plant (S/Pl), 100 seed weight (100 SW) and seed yield per plant (SY/Pl). Data for seven traits were recorded on 5 random plants except for grain yield which was taken on row basis. Correlation coefficients were estimated according to Singh and Chaudhary (1977) [13] and path coefficient analysis was carried out according to Dewey and Lu (1959) [3].

Results and discussion

The phenotypic correlation coefficient of seven traits are given in Table 1. Number of pods per plant (0.816), number of seeds per plant (0.825) and hundred seed weight (0.381) showed significant positive correlation with seed yield per plant but the association between seeds per plant and pods per plant with hundred seed weight was negative. This indicates that selection for more number of seeds per plant would directly affect the hundred seed weight as the limited photosynthates are available at the source and have to be distributed over increased seed number thereby reducing hundred seed weight. The negative linkage between seed number and hundred seed weight can be broken by maintaining a large population size so that transgressive segregants that have higher seeds per plant and hundred seed weight can be selected. The other approach is to select for other component traits that have indirect positive effect on seed weight to increase the overall seed yield. Since the association between these three traits with seed yield is positive and high, seeds per plant, pods per plant and hundred seed weight should be considered as important component traits to select genotypes with high seed yield in chickpea. Such association between seeds per plant, pods per plant and hundred seed weight with seed yield was also reported by Renukadevi and Subbalakshmi (2006) [11], Vaghela *et al*. (2009), Gohil and Patel (2010), Yucel and Anlarsal (2010) [17], Pandey *et al*. (2013) [9], Desai *et al*. (2015) [2], Kumar *et al*. (2016) [8] and Salgotra (2016) [12].

Days to flowering was positively and significantly correlated to days to maturity (0.594) and plant height (0.269) and negatively correlated with pods per plant (-0.264), seeds per plant (-0.284), hundred seed weight (-0.450) and seed yield (-0.520) which was in accordance with result obtained by Salgotra (2016) [12]. Number of pods per plant was significantly and positively correlated with number of seeds per plant (0.971) indicating that increase in the number of pods in the plant would automatically increase the number of seeds per plant. Days to maturity was significantly but negative with seed yield per plant (-0.281), number of pods per plant (-0.206) and number of seeds per plant (-0.223). The result indicates that though increase in days to maturity gives a proper time for seed setting in chickpea and usually with longer the days to maturity higher the seed set is expected but due to the terminal heat and drought experienced in the northern parts of India, the seed sets were poor. Similar association was also reported by Ramanappa *et al*. (2013) [10].

Table 2 shows estimates of path analysis and direct and indirect relations of important chickpea traits on seed yield. Study on path coefficient analysis revealed seeds per plant, hundred seed weight and pods per plant had significant direct effect on seed yield. These characters also showed positive and significant association with seed yield per plant indicating a rewarding direct selection on these characters for increase yields. These findings were in similarity with those of Uddin *et al*. (1990) [15], Yucel *et al*. (2006) [18] and Ali *et al*. (2008) [1] for direct effects of number of seeds per plant and Ali *et al*. (2008) [1] for direct effects of number of pods per plant and hundred seed weight on seed yield.

Number of pods per plant had high indirect effects on seed yield per plant through number of seeds per plant. This result was in conformity with the findings by Yucel *et al*. 2006 [18]. Since pods per plant also have significant positive correlation with seed yield and therefore improvement through direct selection or indirect selection through seeds per plant would be possible for this trait. Therefore in a strategic improvement of seed yield per plant in chickpea it would be advantageous to consider component traits like hundred seed weight, number pods per plant and number of seeds per plant for indirect selection for seed yield and make this parameters an integral part of effective selection criteria leading to yield enhancement in chickpea.

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Table 1: Phenotypic correlation among seven important traits in 380 chickpea genotypes

	Days to maturity	Plant height	Pods per plant	Seeds per plant	100 Seed weight	Seed yield per plant
Days to flowering	0.594*	0.269*	-0.264*	-0.284*	-0.450*	-0.520**
Days to maturity		0.299*	-0.206*	-0.223*	-0.097	-0.281**
Plant height			-0.022	-0.039	0.045	-0.035*
Pods per plant				0.971*	-0.144*	0.816**
Seeds per plant					-0.151*	0.825**
100 Seed weight						0.381**

*at 5% level of significance, **at 1% level of significance

Table 2: Estimates of direct and indirect effects of six chickpea traits on seed yield

Traits	DTF	DTM	PH	P/Plt	S/Plt	100SW	Correlation with SY/plt
DTF	-0.037	-0.006	-0.002	-0.030	-0.211	-0.234	-0.520**
DTM	-0.019	-0.022	-0.005	-0.030	-0.143	-0.062	-0.281**
PH	-0.010	-0.015	-0.013	-0.042	0.024	0.021	-0.035**
P/Plt	0.009	0.019	0.000	0.124	0.731	-0.067	0.816**
S/Plt	0.010	0.002	0.000	0.117	0.769	-0.073	0.825**
100SW	0.022	0.007	-0.001	-0.019	-0.117	0.489	0.381**

References

1. Ali MA, Nawab NN, Rasool G, Saleem M. Estimates of Variability and Correlations for Quantitative Traits in *Cicer arietinum*. Journal of Agricuture and Social Sciences. 2008; 4(4):177-179.
2. Desai K, Tank CJ, Gami RA, Patel AM, Chauhan RM. Genetic variability in indigenous collection of chickpea (*Cicer arietinum* L.) genotypes for seed yield and quality traits. Journal of progressive agriculture, 2015, 6(10).
3. Dewey DR, Lu K. A correlation and path-coefficient analysis of components of crested wheatgrass seed production. Agronomy journal. 1959; 51(9):515-518.
4. Gohil DP, Patel JD. Character association and path analysis in chickpea (*Cicer arietinum* L.) under conserved soil moisture. Legume Research. 2015; 33(4):283-286.
5. http://faostat.fao.org/site/
6. Hulse JH. Nature, composition, and utilization of food legumes. In Expanding the production and use of cool season food legumes. Springer, Dordrecht, 2015, 77-97.
7. Khan MA, Akhtar N, Ullah I, Jaffery S. Nutritional evaluation of desi and kabuli chickpeas and their products commonly consumed in Pakistan. International Journal of Food Sciences and Nutrition. 1995; 46(3):215-223.
8. Kumar M, Kushwaha S, Dwivedi VK, Dhaka SS. Genetic variability and correlation analysis of various traits in chickpea genotypes (*Cicer arietinum* L.) under rainfed condition in western Uttar Pradesh. International Journal of Advanced Engineering Research and Science (IJAERS). 2016; 9(3):2349-6495.
9. Pandey Avinash, Gupta Sanjay, Kumar Amit, Thongbam PD, Pattanayak A. Genetic divergence, path coefficient and cluster analysis of chickpea (*Cicer arietinum*) cultivars, in the mid-altitudes of Meghalaya. Indian Journal of Agricultural Sciences, 2013, 83(12).
10. Ramanappa TM, Chandrashekara K, Nuthan D. Analysis of variability for economically important traits in chickpea (*Cicer arietinum* L.). International Journal of Research in Applied, Nature and Social Sciences. 2013; 1:133-140.
11. Renukadevi P, Subbalakshmi B. Correlations and path coefficient analysis in chickpea. Legume Research. 2006; 29:201-204.
12. Salgotra SK. Association Studies for Seed Yield and Its Attributing Traits in Desi Chickpea (*Cicer arietinum* L.) Varieties. Legume Genomics and Genetics. 2016; 7(2):30-32.
13. Singh RK, Choudhary BD. Biometrical Methods in Quantitative Genetics Analysis. Kalyani Publishers, New Delhi, 1977.
14. Tiwari AK, Shivhare AK. Pulses in India: Retrospect and prospects. Directoriate of Pulses Development, Publication 1(2), Vindhyachal Bhavan, Bhopal, Madhya Pradesh, 2016.
15. Uddin MJ, Hamid MA, Rahman ARMS, Newaz MA. Variability, correlation and path analysis in chickpea (*Cicer arietinum* L.). Bangladesh Journal of Plant Breeding and Genetics, 1990.
16. Vaghela MD, Poshiya VK, Savaliya JJ, Davada BK, Mungra KD. Studies on character association and path analysis for seed yield and its components in chickpea. Legume Research. 2010; 32(4):245-249.
17. Yucel DO, Anlarsal AE. Determination of selection criteria with path coefficient analysis in chickpea (*Cicer arietinum* L.) breeding. Bulgarian Journal of Agricultural Science. 2010; 16(1):42-48.
18. Yucel DO, Anlarsal AE, Yucel C. Genetic variability, correlation and path analysis of yield, and yield components in chickpea (*Cicer arietinum* L.). Turkish Journal of Agriculture and Forestry. 2006; 30(3):183-188.