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Assessment of Genetic Variability, Character Association and Path Analysis in F_2 Segregating Population for Quantitative Traits in Chickpea

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A B S T R A C T

Fifteen F_2 segregating populations were grown to assess genetic variability, character association and path analysis during rabi, 2018-19. The maximum genotypic coefficient of variation estimates were noticed for test weight, number of pod yield per plant, seed yield per plant and number of secondary branches per plant. Moderate to high heritability coupled with high genetic advance as per cent of mean has been noticed for test weight, days to maturity, number of pod per plant and seed yield per plant indicating to the preponderance of additive gene action these characters. Seed yield showed highly positive significant association with pod per plant and pods per plant and test weight also exerted highest positive direct effect on seed yield Thus the Information of the genetic variability, heritability genetic advance per cent mean correlation and path analysis of various characters provides a basis to the plant breeders to breed the chickpea genotypes possessing higher yield potential.

Introduction

Chickpea (*Cicer arietinum* L.) is the most important pulse crop and mostly grown under rainfed conditions in India. India is the largest producer of chickpea contributing about 40 percent of the total pulse production occupying an area of 10.56 million hectares with a production of 11.23 million tones and with productivity of 1063 kg/ ha. Chickpea is a good source of protein (18-22%), carbohydrate (52-70%), fat (4-10%), minerals (calcium, phosphorus, iron) and vitamins. Genetic variability is the basic requirement for making progress in crop breeding. It is essential to understand the genetic architect and nature of gene action governing yield and its component traits. Yield is the resultant product of various morphological and biological components. Studies on the phenotypic and genotypic correlation of the yield components and their contribution to yield through path analysis provide information to design appropriate breeding strategy towards improvement of the crop

Materials and Methods

The present investigation was carried out in the experimental farm of College of Agriculture, Latur, Maharashtra. The materials comprised of 15 F_2 families, the experiment was laid out in Randomized Block Design with two replications. Row to row and plant to plant distance was 30 and 10 cm respectively and per plot number of rows were 5. Row length was 4 meters. The crop was raised with all recommended agronomic package of practices to maintain a good crop. Observations were recorded on sixty competitive and randomly selected plants in each replication for all the genotypes *viz*., number of primary branches per plant, number of secondary branches per plant, number of pods per plant, test weight (g) and seed yield per plant (g). Observations for days to 50% flowering and days to maturity were recorded on plot basis. The mean values were used for estimation of genotypic and phenotypic coefficients of variation, heritability in broad sense and genetic advance as percent of mean according to Johnson *et al*., (1955). Correlation and path analysis were made according to Dewey and Lu (1959).

Results and Discussion

The analysis of variance revealed significant difference for all the traits studied. The genotypic coefficient of variation, phenotypic coefficient of variation, heritability and genetic advance as percent of mean for the seven characters are given in Table 1. The analysis revealed that for all the characters phenotypic coefficient of variation (PCV) was slightly higher than the genotypic coefficient of variation (GCV), so it is evident that in expression of the characters mainly governed by the genotypes itself along with meagre effect of environment. Similar observations were made by Shivkumar *et al.,* (2013) and Pithiya and Javia (2019). The phenotypic coefficient of variation and genotypic coefficient of variation estimates were relatively high for test weight, number of pod yield per plant, seed yield per plant and number of secondary branches per plant in the decreasing order of their magnitude. These findings were in accordance with the reports of Reddy *et al.,* (2017) and Talekar *et al.,* (2017) for pods per plant, branches per plant, seed yield per plant and 100 seed weight; Raval *et al.,* (2018) for number of branches per plant, number of pods per plant and seed yield per plant; Santosh *et al.,* (2018) or pods per Plant, seed yield per plant, number of branches and test weight; Pithiya and Javia (2019) for seed yield per plant, number of pods per plant and 100-seed weight and Vekariya (2006) for number of pods per plant and seed yield per plant in F_2 segregating populations of chickpea.

In the present study moderate to high heritability coupled with high genetic advance as per cent of mean has been noticed for test weight, days to maturity, number of pod per plant and seed yield per plant indicating to the preponderance of additive gene action and selection pressure could profitably be applied on these characters for yield improvement. These result are in accordance with earlier reports of Shivkumar *et al.,* (2013) for number of pods per plant, number of seeds per plant , test weight and seed yield per plant; Telekar *et al.,* (2017) and Pithiya and Javia (2019) for number of pods per plant, seed yield per plant and 100-seed weight; Vekariya (2006) and Raval *et al.,* (2018) for number of pods per plant and seed yield per plant and Paneliya *et al.,* (2017) for 100-seed weight and seed yield per plant in F_2 segregating populations.

In this study the genotypic correlation coefficient were higher than the phenotypic correlation coefficient of F_2 population of chickpea, suggesting strong inherent association among the characters studied (Table 2). Seed yield exhibited highly positive significant association with pod per plant at phenotypic and genotypic level. Hence selection for these characters would possible be helpful in improving the yield potential of this crop. Similar kind of association of seed yield with pods per plant in segregating generation of chickpea earlier reported by Vekariya (2006), Gaikwad and Monpara (2011), Shivakumar *et al*., (2015), Telekar *et al.*, (2017) and Santosh *et al.*, (20018).

The inter relationship was positive and significant among the yield contributing traits like, number of secondary branches per plant with pods per plant, whereas, it were negative and significant among the traits like number of secondary branches per plant with test weight and pods per plant with test weight. Similar kind of interrelations was reported by Guler *et al.*, (2001) for number of pods per plant and 100 seed weight and Bhanu *et. al.*, (2017) for number of secondary branches per plant with pods per plant and 100 seed weight.

The path analysis gives a more realistic relationship of characters and helps to identify the effective components of seed yield in chickpea. A perusal of path coefficient (Table 3) among the characters of F_2 population of chickpea showed that pods per plant and test weight exerted highest positive direct effect on seed yield and also had positive correlation, suggesting, that the prime importance to selection of these characters for improving seed yield in chickpea. This is in agreement with findings of Vekariya (2006), Shivakumar *et al*., (2015) and Telekar *et al.*, (2017) for pods per plant and test weight.

Table.1 Parameters of genetic variability for yield and yield contributing characters F_2 population of chickpea

Sr. No.	Parameters	Mean	GCV (%)	PCV (%)	Heritability (B.S.)%	Genetic Advances as % of mean
1	Days to 50% flowering	45.10	3.56	4.24	70.55	2.78
2	Days to maturity	94.15	2.97	3.01	97.75	5.70
3	No of primary branches per plant	2.60	9.85	10.88	81.98	0.47
4	Number of secondary branches per plant	6.98	17.53	19.67	79.37	2.24
5	Number of pods per plant	41.69	28.30	30.07	88.57	22.87
6	Test weight per plant(g)	31.27	29.86	30.06	98.68	19.11
7	Seed yield per plant(g)	12.66	24.85	26.61	87.18	6.05

Table.2 Estimates of genotypic and phenotypic correlations for yield and yield contributing traits in F_2 population of chickpea

Sr. No.	Name of character		Number of primary branches per plant	Number of secondary branches per plant	Number of pods per plant	Test weight(g)	Seed yield per plant(g)
1	Number of primary branches per plant	G	1.0000	0.0204	0.0840	-0.0379	0.1039
		P	1.0000	0.0063	0.0767	-0.0488	0.0930
2	Number of secondary branches per plant	G		1.0000	0.4772*	-0.6229**	0.0643
		P		1.0000	0.4445*	-0.5775**	0.0496
3	Number of pods per plant	G			1.0000	-0.5755**	0.6438**
		P			1.0000	-0.5524**	0.6393**
4	Test weight(g)	G				1.0000	0.2139
		P				1.0000	0.2125
5	Seed yield per plant(g)	G					1.0000
		P					1.0000

Table.3 Direct and Indirect effects of yield component on seed yield in F_2 population of chickpea

Sr. No.	Name of character		Number of primary branches per plant	Number of secondary branches per plant	Number of pods per plant	Test weight (g)	Correlation with seed yield per plant
1	Number of primary branches per plant	G	**0.0348**	0.0007	0.0029	**-0.0013**	0.1039
		P	**0.0453**	0.0003	0.0035	**-0.0022**	0.0930
2	Number of secondary branches per plant	G	0.0023	**0.1104**	0.0527	0.0687	0.0643
		P	0.0006	**0.0957**	0.0425	0.0552	0.0496
3	Number of pods per plant	G	0.0977	0.5549	**1.1630**	-0.6693	0.6438**
		P	0.0847	0.4903	**1.1030**	-0.6094	0.6393**
4	Test weight(g)	G	-0.0309	-0.5081	-0.4695	**0.8158**	0.2139
		P	-0.0375	-0.4440	-0.4247	**0.7688**	0.2125

Residual effects= 0.2570, 0.3500

From the results from the present investigation, it can be concluded that the characters like number of pods per plant, seed yield per plant and 100-seed weight exhibited high genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability (broad-sense) and genetic advance expressed as percent of mean. Number of pods per plant had highly positive significant association with seed yield per plant and also exerted highest positive direct effect on seed yield. Hence, direct selection for these traits would therefore be most effective and should be taken into consideration for the improvement of seed yield in segregating generations of chickpea.

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