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Studies on the component approach of selection in chickpea (*Cicer arietinum* l.) genotypes

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Abstract
The present investigation consists of 31 genotypes of Chickpea including one check, which were grown in the Field Experimentation Centre of the Department of Genetics and Plant breeding, SHUATS, Prayagraj during *Rabi* 2019-20 following RBD with three replications. The data were recorded on 13 characters to study the amount of genetic variability, heritability, association of yield contributing components with yield and direct and indirect effects of yield contributing component with yield and direct and indirect effects of yield contributing components in the chickpea genotypes. Based on the mean performance genotype Phule-4-5 followed NBEG-3, IPC-06-11, IPC-97-29 and CSJ-515 were identified as best genotypes for seed yield per plant. High significant variation was obtained for all characters studies. High heritability estimates were observed for No of seeds per plant followed by No of Pods per Plant, No of Secondary Branches, No of Primary Branches, Harvest Index, Seed Yield per plant, No of seeds per pod, Biological yield, Days to 50% Flowering, 100 Seed weight. Plant height, Days to Maturity and Days to 50% Pod setting. High values for heritability indicates that it may be due to higher contribution of genotypic components. High genetic advance as percent of mean was recorded high for No of seeds per plant, No of pods per plant while moderate genetic gain is observed for Biological yield, Seed yield per plant, Harvest Index, No of Primary branches, No of Secondary Branches, No of seeds per pod, 100 seed weight. Traits exhibiting high heritability coupled with genetic advance as percent of mean suggest that the traits are governed by additive gene action, equal Contribution of additive and non-additive gene action respectively. Genotypic and Phenotypic correlation coefficient analysis revealed that Seed yield per plant showed highly significant and positive association with Days to maturity (0.905**) and Number of pods per plant (0.554**). The Phenotypic path coefficient analysis results showed that positive and direct effect on Seed yield was exhibited by Days to maturity, No of Primary branches, No of secondary branches, No of pods per plant, 100 Seed weight, Biological yield, Harvest index. The Genotypic path coefficient analysis results showed that positive and direct effect on Seed yield was exhibited by Days to 50% Pod setting, Days to maturity, No of Primary branches, No of secondary branches, Biological yield, Harvest index.

Keywords: chickpea (*Cicer arietinum* l.), gcv, pcv, heritability, genetic variability, genetic advance, correlation, and path analysis

Introduction

Chickpea is an integral part of an Indian agriculture since time, because of only its intrinsic value in terms of higher protein content, carbohydrates, minerals, nitrogen fixing ability and and alternative crop for crop diversification. Chickpea occupies a prime position among the pulses in the country with maximum hectare production and its higher nutritive value. Chickpea is an autogamous diploid (2n=16) legume. It belongs to family Fabaceae sub-family Papilionoideae. The genus Cicer includes 43 species, nine of which are annual, 33 are perennial and one with unspecific life cycle. Chickpea is the second most important pulse crop after dry beans. Genetic improvement in chickpea started since domestication and lot of improvement has been achieved, but crop improvement is a never-ending endeavor. It is an important winter season food legume having extensive geographical distribution. The genus Cicer originated in South-eastern Turkey and migrated to other parts of the world. lt is well adapted to relatively cooler climates; the largest area of adaptation is in the Indian sub-continent.

Chickpea contributes the single largest share in India's export basket of pulses registering 70.92% share in total pulse export. India contributes major share of worlds chickpea area (137.18 lakh.ha), and production (146.46 lakh tons) and the productivity is (1038.4 kg/ha) (FAOSTAT 2019). In India chickpea is cultivated mostly in as a rainfed crop. India is the largest Chickpea growing nation in the world with an area of production about 96.9 lakh.ha, the production of the country is about 110.78 lakh tones with the productivity of about 1142 kg/ha. The area cultivated under chickpea in Uttar Pradesh is about 6.21 lakh ha, while the production of chickpea in U.P Is about 8.51 lakh tones, with the productivity about 1371 kg/ha (SOURCE: Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and farmers Welfare, GOI, 2019-20). Chickpea is the World's third most important winter season food legume is valued for its nutritive seeds with high protein content, (25.3-28.9%) after de-hulling. There are major types of chickpea e.g. Desi, Kabuli. Desi chickpea is consumed as whole seeds, de-hulled splits or flour while, Kabuli chickpea is generally consumed as whole grains whereas, gulabi types are roasted and consumed as parched grains. Chickpea has been recognized as a rich source of protein, vitamins and minerals in human diet and occupies a very important place in human nutrition in many developing countries. Increasing population growth has resulted in a

sharp decline in the per capita availability of pulses in the recent years. Population explosion during the latter part of 20thcentury and early 21st century has created short fall in food grain availability and related mal-nutritional problems amongst the economically weaker sections. Globally there has not been any change in area under cultivation during the past four decades. Information on the nature and degree of genetic variability present in morphological, phenological, quality and traits associated to stresses of chickpea is an essential prerequisite of plant breeding. Chickpeas a good source of carbohydrates and proteins, which together constitutes about 80% of the total dry seed mass. The starch content of chickpea cultivars have been reported to vary from 41 % to 50%. The crude protein content of chickpea where is from 12.4 to 31.5 percent. Chickpea contains about 6% fat which is important in vegetarian diets of resource for consumers chickpea contains nutritionally important minerals, notably calcium and iron, and the availability of iron is reported to be good. The protein quality is considered to be better than other pulses (Hirdyani, 2014). Chickpea crop meets 80 percentage of its nitrogen (N) requirement from symbiotic nitrogen fixation and can fix up to 140 kg N ha from air. The estimates of genotyping coefficient of variance (GCV) reflect the total amount of genetic variability present in the material. However the proportion of the genotyping variability which is transmitted from parents to the progeny is reflected by heritability. Broad sense heritability determines the efficiency with which genotypic variability in a breeding program. The genotypic variance and its components are influenced by the gene frequencies. The presence of genetic variability is of utmost importance for any breeding program and due to this reason the plant breeders have emphasized the evaluation of germplasm for the improvement of crop yield as well as for utilization in further breeding programs. Evaluation of plant genetic resources is a prerequisite for which the future breeding work is based (Reddy *et al*. 2012). In addition to genetic variation, heritability of economically important characters is essential for effective breeding programs and selection of specific traits. Heritability estimates the genetic advance in a population provides information about the expected gain in the following generations. Correlation coefficient studies helps in determination of interrelationship between various plant characters. The path coefficient is a standardized partial regression coefficient and as such it measures the direct influence of variable upon another and partitioning correlation coefficient into components of direct and indirect effects. Divergence analysis by means of Mahalanobis's D^2 statistics is a powerful tool in qualifying the degree of divergence between two populations. It gives better idea about the magnitude of divergence and is independent of size of sample and provides the basis for selection of parental lines for further reading program full stop the role of Genetic diversity and its significance have been recognized for selection of desirable parents in breeding programs to obtain transgressive segregation and high heterotic response.

Materials and Methods

The present investigation was carried out in Chickpea (*Cicer arietinum* L.) comprising of 31 Chickpea genotypes. These genotypes were evaluated in Randomized Block Design with three replications during Rabi 2019-20 at Field experimentation centre of the Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P). Each plot consists of 3 rows consists of 10 plants with a spacing of 10 cm between the plants and 30cm between rows was maintained. Chemical fertilizers, at the rate of 20:40:25 NPK kg/ha were applied in the form of Urea, Di-ammonium phosphate (DAP) and Murate of potash (MOP) and other standard agronomical operation and plant protection measures were adapted to rise healthy and uniform crops. The observations were recorded on a plot basis for traits like Days to 50% Flowering, Days to 50% Pod Setting, Days to Maturity while data for Plant Height (cm), Number of Primary branches/plant, Number of Secondary branches/plant, Number of Seeds/plant, Number of Pods/plant, Number of Seeds/pod, 100 seed weight, Biological yield/plant, Harvest index and Seed yield/plant were taken from five randomly selected plants from the middle of each row of each entry in each replication. After attaining physiological maturity, the plots were harvested manually. Mean values of different traits were subjected to Analysis of Variance (Fisher, 1936). The character association was estimated from variance and covariance components as per Al Jibouri, *et al*. (1958), GCV and PCV by Burton (1952), Heritability (h2)(Broad sense) by Burton and Devane (1953) and Genetic gain (genetic advance as percent of the mean) by Johnson *et al*.(1955). While the direct and indirect effects of components traits up on seed yield were measured by path analysis as described by Dewey and Lu, (1959) [12].

Results and Discussion

Analysis of variance revealed that significant differences were existed for the genotypes studied and it is represented in Table.1. The results revealed that the PCV was higher than the GCV for all traits under study which indicated that the environmental factors influencing the traits studied (Table 2). The estimated GCV and PCV helped in getting a clear understanding of the variability present among various genotypes. The high GCV was recorded for Number of seeds per plant (198.03) (Table 2). Moderate GCV was observed for Number of pods per plant (24.95), Biological yield (22.24), Seed yield per plant (21.33), Harvest index (18.76), Number of primary branches (16.93), Number of seeds per pod (16.28), Number of secondary branches (16.23), 100 Seed weight (14.54). The low GCV was recorded for Plant height (9.13), Days to 50% flowering (3.27), Days to 50% pod setting (1.56), Days to maturity (0.61). The high PCV value was recorded for the Number of Seeds per plant (198.33) (Table 2). Moderate PCV was observed for Number of pods per plant (26.95), Biological yield (25.51), Seed yield per plant (24.12), 100 Seed weight (14.54), Harvest index (21.08), Number of primary branches (18.95), Number of seeds per pod (18.59), and Number of secondary branches (17.59). The PCV was low for the rest of the characters like Plant height (13.92), Days to 50% pod setting (5.01), Days to 50% flowering (4.52), Days to maturity (1.90). An estimate of heritability is a good index for predicting the transmission of characters from parents to their offspring (Falconer, 1981). The estimates of heritability (%) in the broad sense for 13 characters studied (Table 2), which ranged from 9.60 to 99.70%. High heritability (broad sense) (>60%) was recorded for character Number of seeds per plant (99.70%), No of Pods per plant (85.70), No of secondary branches (85.10), No of Primary

branches (79.80), Harvest index (79.20), Seed yield per plant (78.20), No of seeds per pod (76.70), Biological yield (76.00). Moderate heritability (broad sense) (30-60%) was recorded for characters i.e. Days to 50% flowering (52.40), 100 seed weight (47.10), Plant height (43.00). Low heritability (broad sense) (<30%) was recorded for Days to maturity (10.40), Days to 50 % Pod setting (9.60). Genetic advance predicts the genetic gain under selection. Genetic advance as a percentage of mean is more reliable index for understanding the effectiveness of selection in improving the traits because its estimated value is derived by the involvement of heritability, phenotypic standard deviation and intensity of selection. Genetic advance as % of mean varied from 0.41 to 407.30 (Table 2). High genetic advance as % mean (>20%) was recorded for the No of seeds per plant (407.30) followed by No of pods per plant (47.58), Biological yield (39.95), Seed yield per plant (38.87), Harvest index (34.40), No of Primary branches (31.07), No of Secondary branches (30.84), No of seeds per pod (29.36), 100 seed eight (20.55). Moderate genetic advance as % mean (10-20%) was recorded for Plant height (12.34). Low genetic advance as % mean (<10%) was recorded for Days to 50% Flowering (4.88), Days to 50% pod setting (1.00) and Days to maturity (0.41). Number of seeds per plant (99.70 and 407.30), No of Pods per plant (85.70 and 47.58), No of secondary branches (85.10 and 30.84), No of Primary branches (79.80 and 31.17), Harvest index (79.20 and 34.40), Seed yield per plant (78.20 and 38.87), No of seeds per pod (76.70 and 29.36), Biological yield (76.00 and 39.35) showed high heritability coupled with high genetic advance as percent of mean. The Phenotypic and Genotypic correlation coefficients were computed among 13 characters (Table 3). This indicated an inherent association between various traits. In the present investigation, Phenotypic correlation coefficient for Seed yield per plant showed significant and positive association with No of secondary branches (0.531**), No of pods per plant (0.554**), No of seeds per plant (0.227*), 100 Seed weight (0.228*), Biological yield (0.521**), Harvest index (0.429**). While positive but non-significant association was recorded for Days to 50 percent pod setting (0.12), Days to maturity (0.16), Plant height (0.02), No of seeds per pod (0.06). While negative and significant association was recorded for No of Primary branches (-0.269**). While negative but non-significant association was recorded for Days to 50 percent Flowering (-0.20). Genotypic correlation coefficient for Seed yield per plant showed highly significant and positive association with Days to maturity (0.905**), No of secondary branches (0.615**), No of pods per plant (0.550**), Biological yield (0.531**), Harvest index (0.428**). While positive but non-significant association with 100 seed weight (0.15). While negative and significant association was recorded for Days to 50% Flowering (-0.281**), Days to 50% pod setting (-0.282**), No of Primary branches (-0.299**). While negative but non-significant association was recorded for Plant height (-0.13), No of seeds per pod (-0.03) Path coefficient analysis is a statistical technique to split the observed coefficient into direct and indirect effects of independent variables on the dependent variable. In the present study path coefficient analysis was carried out using Phenotypic and Genotypic correlation (Table 4) matrix of 13 characters. In the present investigation the results of path coefficient analysis indicated that, the traits having direct effects on Seed yield are understood to be strongly associated with it. The Phenotypic path coefficient analysis results showed that positive and direct effect on Seed yield was exhibited by Days to maturity (0.03), No of Primary branches (0.04), No of secondary branches (0.04), No of pods per plant (0.15), 100 Seed weight (0.03), Biological yield (0.94), Harvest index (0.90). The Phenotypic path coefficient analysis results showed that negative and direct effect on Days to 50% Flowering (-0.06), Days to 50% Pod setting (-0.03), Plant height (-0.06), No of seeds per pod (-0.01), No of seeds per plant (-0.11). The Genotypic path coefficient analysis results showed that positive and direct effect on Seed yield was exhibited by Days to 50% Pod setting (0.03), Days to maturity (0.04), No of Primary branches (0.20), No of secondary branches (0.00), Biological yield (1.14), Harvest index (0.99). The Genotypic path coefficient analysis results showed that negative and direct effect on Days to 50% Flowering (-0.22), Plant height (-0.19), No of pods per plant (-0.01), No of seeds per pod (-0.10), No of seeds per plant (-0.18), 100 Seed weight (-0.22). Thus, the yield was mainly affected by the direct and indirect effects through Days to maturity, No of Primary branches, No of secondary branches, Biological yield, Harvest index.

Table 1: Analysis of variance for 13 biometrical traits of Chickpea.

S. No	Character	Mean Sum of Squares		
		Replication (d. f=02)	Treatment (d. f=30)	Error (d. f=60)
1.	Days to50% Flowering	54.75	31.12**	7.23
2.	Days to 50% Pod Setting	90.33	34.01**	25.76
3.	Days to Maturity	29.72	10.21**	7.58
4.	Plant Height	131.91	180.90**	55.39
5.	No of Primary Branches	0.12	0.31**	0.02
6.	No of Secondary Branches	1.03	3.79**	0.20
7.	No of Pods Per Plant	303.16	1154.94**	60.87
8.	No of Seeds Per Pod	0.04	0.21**	0.02
9.	No of Seeds Per Plant	2.00	392.40**	0.40
10.	Biological Yield	190.68	402.37**	38.29
11.	100 Seed Weight	2.59	38.72**	10.55
12.	Harvest Index	68.70	185.58**	14.92
13.	Seed Yield Per Plant	23.60	55.90**	4.74

*, **Indicates significant at 5% and 1% level of significance respectively.

Table 2: Genetic parameters for 13 biometrical traits of Chickpea.

S. No	Character	GCV	PCV	Heritability (%)	Genetic Advance	Genetic Advance as % Mean
1.	Days to50% Flowering	3.27	4.52	52.40	4.21	4.88
2.	Days to 50% Pod Setting	1.56	5.01	9.60	1.06	1.00
3.	Days to Maturity	0.61	1.90	10.40	0.62	0.41
4.	Plant Height	9.13	13.92	43.00	8.74	12.34
5.	No of Primary Branches	16.93	18.95	79.80	0.57	31.17
6.	No of Secondary Branches	16.23	17.59	85.10	2.08	30.84
7.	No of Pods Per Plant	24.95	26.95	85.70	36.42	47.58
8.	No of Seeds Per Pod	16.28	18.59	76.70	0.46	29.36
9.	No of Seeds Per Plant	198.03	198.33	99.70	23.51	407.30
10.	Biological Yield	22.24	25.51	76.00	19.79	39.95
11.	100 Seed Weight	14.54	21.19	47.10	4.33	20.55
12.	Harvest Index	18.76	21.08	79.20	13.83	34.40
13.	Seed Yield Per Plant	21.33	24.12	78.20	7.53	38.87

Table 3: Phenotypic and Genotypic Correlation Coefficient for yield contributing traits of Chickpea

Character		Days to 50% flowering	Days to 50% pod setting	Days to maturity	Plant height	No of primary branches per plant	No of secondary branches per plant	No of pods per plant	No of seeds per pod	No of seeds per plant	100 seed weight	Biological yield per plant	Harvest index	Seed yield per plant
Days to 50% flowering	P	1.00	0.20	0.2689 **	-0.2848 **	0.08	-0.02	0.05	0.02	-0.08	-0.2536 *	-0.2068 *	0.02	-0.20
	G	1.00	1.39	-0.505**	-0.517**	0.03	-0.01	0.15	0.06	-0.11	-0.439**	-0.265*	0.00	-0.281**
Days to 50% pod setting	P		1.00	-0.14	-0.2388 *	-0.2286 *	0.12	0.3600 ***	0.16	0.09	0.02	0.10	0.03	0.12
	G		1.00	1.39	-0.505**	-0.517**	0.03	-0.01	0.15	0.06	-0.11	-0.439**	-0.265*	0.00
Days to maturity	P			1.00	0.2141 *	0.11	0.04	0.14	0.08	0.10	-0.14	-0.04	0.20	0.16
	G			1.00	0.05	-0.424**	-0.03	0.663**	0.789**	0.290**	-0.01	-0.05	0.962**	0.905**
Plant height	P				1.00	0.3518 ***	0.01	-0.13	-0.12	-0.14	0.20	-0.01	0.04	0.02
	G				1.00	0.430**	-0.18	-0.318**	-0.06	-0.228*	0.223*	-0.12	0.00	-0.13
No of primary branches per plant	P					1.00	-0.18	-0.5091 ***	0.13	-0.3338 **	0.17	-0.4169 ***	0.15	-0.269**
	G					1.00	-0.286**	-0.583**	0.236*	-0.376**	0.349**	-0.554**	0.270**	-0.299**
No of secondary branches per plant	P						1.00	0.5490 ***	-0.13	0.19	-0.05	0.4346 ***	0.03	0.531**
	G						1.00	0.622**	-0.11	0.207*	-0.14	0.465**	0.09	0.615**
No of pods per plant	P							1.00	0.00	0.5641 ***	-0.2299 *	0.5282 ***	-0.03	0.554**
	G							1.00	-0.05	0.602**	-0.542**	0.559**	-0.05	0.550**
No of seeds per pod	P								1.00	0.2765 **	-0.16	-0.3134 **	0.4369 ***	0.06
	G								1.00	0.312**	-0.323**	-0.468**	0.522**	-0.03
No of seeds per plant	P									1.00	-0.2987 **	0.3696 ***	-0.10	0.227*
	G									1.00	-0.439**	0.412**	-0.11	0.244*
100 seed weight	P										1.00	0.09	0.13	0.228*
	G										1.00	0.09	0.07	0.15
Biological yield per plant	P											1.00	-0.5212 ***	0.521**
	G											1.00	-0.525**	0.531**
Harvest index	P												1.00	0.429**
	G												1.00	0.428**
Seed yield per plant	P													1.00
	G													1.00

P-Phenotype, G–Genotype

Table 4: Phenotypic and Genotypic path coefficient for yield contributing traits of Chickpea

Characters		Days to 50% flowering	Days to 50% pod setting	Days to maturity	Plant height (cm)	No of primary branches per plant	No of secondary branches per plant	No of pods per plant	No of seeds per pod	No of seeds per plant	100 seed weight (g)	Biological yield per plant (g)	Harvest index (%)	Seed yield per plant (g)
Days to 50% flowering	P	-0.06	-0.01	-0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	-0.20
	G	-0.22	-0.30	0.11	0.11	-0.01	0.00	-0.03	-0.01	0.02	0.10	0.06	0.00	-0.281**
Days to 50% pod setting	P	-0.01	-0.03	0.00	0.01	0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.12
	G	0.04	0.03	0.09	0.00	-0.01	0.02	0.02	-0.01	0.01	-0.04	0.00	-0.01	-0.282**
Days to maturity	P	0.01	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.16
	G	-0.02	0.10	0.04	0.00	-0.02	0.00	0.02	0.03	0.01	0.00	0.00	0.03	0.905**
Plant height (cm)	P	0.02	0.01	-0.01	-0.06	-0.02	0.00	0.01	0.01	0.01	-0.01	0.00	0.00	0.02
	G	0.10	0.02	-0.01	-0.19	-0.08	0.04	0.06	0.01	0.04	-0.04	0.02	0.00	-0.13
No of primary branches per plant	P	0.00	-0.01	0.00	0.01	0.04	-0.01	-0.02	0.01	-0.01	0.01	-0.02	0.01	-0.269**
	G	0.01	-0.06	-0.09	0.09	0.20	-0.06	-0.12	0.05	-0.08	0.07	-0.11	0.06	-0.299**
No of secondary branches per plant	P	0.00	0.01	0.00	0.00	-0.01	0.04	0.02	-0.01	0.01	0.00	0.02	0.00	0.531**
	G	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.615**
No of pods per plant	P	0.01	0.05	0.02	-0.02	-0.08	0.08	0.15	0.00	0.09	-0.03	0.08	0.00	0.554**
	G	0.00	-0.01	-0.01	0.00	0.01	-0.01	-0.01	0.00	-0.01	0.01	-0.01	0.00	0.550**
No of seeds per pod	P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	-0.01	0.06
	G	-0.01	0.02	-0.08	0.01	-0.02	0.01	0.00	-0.10	-0.03	0.03	0.05	-0.05	-0.03
No of seeds per plant	P	0.01	-0.01	-0.01	0.02	0.04	-0.02	-0.06	-0.03	-0.11	0.03	-0.04	0.01	0.227*
	G	0.02	-0.05	-0.05	0.04	0.07	-0.04	-0.11	-0.06	-0.18	0.08	-0.07	0.02	0.244*
100 seed weight (g)	P	-0.01	0.00	0.00	0.01	0.00	0.00	-0.01	0.00	-0.01	0.03	0.00	0.00	0.228*
	G	0.09	0.28	0.00	-0.05	-0.08	0.03	0.12	0.07	0.09	-0.22	-0.02	-0.02	0.15
Biological yield per plant (g)	P	-0.19	0.09	-0.04	-0.01	-0.39	0.41	0.49	-0.29	0.35	0.09	0.94	-0.49	0.521**
	G	-0.30	-0.13	-0.05	-0.14	-0.63	0.53	0.64	-0.53	0.47	0.10	1.14	-0.60	0.531**
Harvest index (%)	P	0.02	0.02	0.18	0.04	0.14	0.03	-0.03	0.39	-0.09	0.11	-0.47	0.90	0.429**
	G	0.00	-0.19	0.95	0.00	0.27	0.09	-0.05	0.51	-0.11	0.07	-0.52	0.99	0.428**
Seed yield per plant (g)	P	-0.20	0.12	0.16	0.02	-0.269**	0.531**	0.554**	0.06	0.227*	0.228*	0.521**	0.429**	1.00
	G	-0.281**	-0.282**	0.905**	-0.13	-0.299**	0.615**	0.550**	-0.03	0.244*	0.15	0.531**	0.428**	1.00
Partial R^2	P	0.01	0.00	0.00	0.00	-0.01	0.02	0.08	0.00	-0.02	0.01	0.49	0.39	
	G	0.06	-0.01	0.03	0.03	-0.06	0.00	-0.01	0.00	-0.04	-0.03	0.60	0.42	

P-Phenotype, G -Genotype

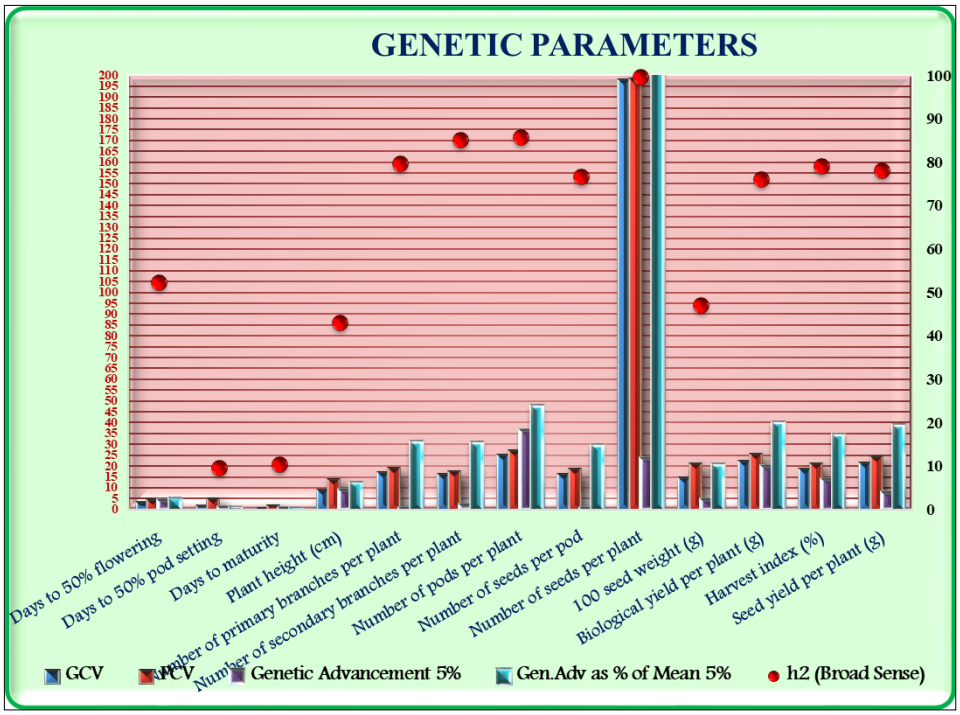

Fig 1: Bar chat representation to relationship among the GCV, PCV, Heritability, Genetic advance, Genetic advance Mean

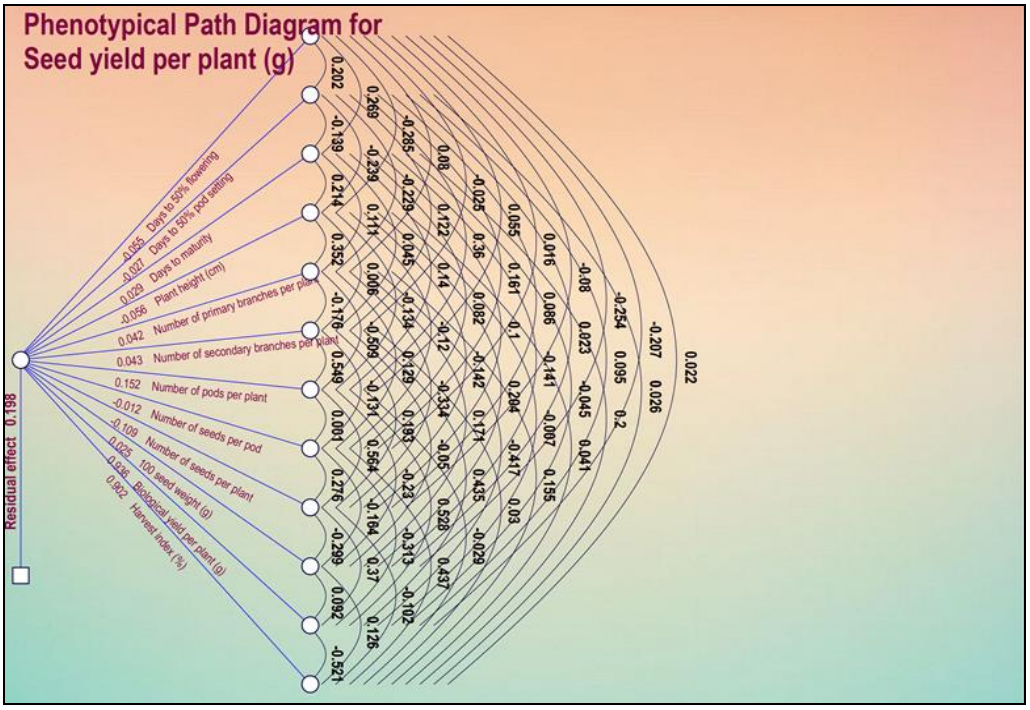

Fig 2: Phenotypic path for yield contributing traits of Chickpea.

Conclusion

It is concluded from experimental results that significant variation can be exploited further for improvement of the chickpea. High GCV, PCV, heritability and genetic advance for implies selection will be effective in this studied population. Here observed that Phule-4-5 genotype showed high seed yield per plant (30.200), JG-36 genotype showed high biological yield (75.633), Harvest index (Pusa-209 - 53.253), number of pods per plant (JG-36 - 117.933). Considerable amount of variability was observed in the studied genotypes. The Seed yield per plant exhibited a significant positive phenotypic correlation with Days to 50% Pod setting, Days to maturity, Plant Height, No of secondary branches per plant, No of pods per plant, No of seeds per pod, 100 Seed weight, Biological yield per plant, and Harvest Index paves the way of indirect selection of the traits for seed improvement. No of pods per plant showed high direct effect on seed yield, hence should be given utmost importance during selection.

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