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Genetic Variability and Correlation Studies for Seed Yield Characters in Chickpea (*Cicer arietinum* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Twenty-one chickpea genotypes were examined, and an experiment was carried out by using a Randomized Block Design with three replications at the Department of Genetics and Plant breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini Allahabad, U.P during the rabi season of 2021-2022. The analysis of variance revealed significant differences existed for most of the traits. Among all the genotypes IPC-05-62 recorded high seed yield per plant followed by IPC-6006, ICCY-10, IPC-05-24, GNG-1958, IPC04-52, KPG-59, IPC-06-77, GNG-1581, JG-24, IPC-97-29, IPC-2K-25, JGM-7 and ESCJ-627U. All these genotypes recorded high seed yield as compared to check UDAY. JG-24 was shown drought tolerant compared to among all genotypes. High Genotypic Coefficient of Variation and Phenotypic Coefficient of Variation was observed for seed vigour and drought tolerance score. High heritability coupled with

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high genetic advance as percent of mean was observed for plant height, number of primary branches, number of pods per plant, number of seeds per plant, harvest index, seed vigour and drought tolerance score. The correlation studies revealed that seed yield per plant was positively and significantly correlated with plant height, days to 50% flowering, number of primary branches, harvest index and seed index. The path analysis indicated that harvest index was observed as the maximum positive direct effect on seed yield per plant and thus, may be considered as useful traits for yield improvement of chickpea.

Keywords: Chickpea; variability; heritability; genetic advance; correlation.

1. INTRODUCTION

In India's agricultural sector, pulse crops rank first among food crops. Pulses give healthy protein to vegetarians, green, nutritious fodder and feed for animals, and help the earth fix atmospheric nitrogen. The chickpea (*Cicer arietinum* L.), a legume of the Fabaceae family, is a member of the Cicer genus in the Papilionaceae subfamily of the Leguminaceae. It first appeared in Southeast Turkey. Cicer is a Latinized version of the Greek word "Kiku," which signifies "power" or "strong." It is predominantly a self-pollinated annual grain legume crop. It has 2n = 2x = 16 chromosomes and is a diploid species. Chickpeas can be eaten fresh as a green vegetable or dried, fried, or cooked.

Chickpea was domesticated in association with other crops of wheat, barley, rye, peas, lentil, flax and vetch [1,2] and with sheep, goats, pigs and cattle [3] as part of the evolution of agriculture in the Fertile Crescent 12,000-10,000 years ago [4,5]. In this broad arc extending from western Iran through Iraq, Jordan and Israel to south-east Turkey, there developed a 'balanced package of domesticates meeting all of humanity's basic needs: carbohydrate, protein, oil, animal transport and traction, and vegetable and animal fibre for rope and clothing' [3].

Chickpea seeds typically contain 358 calories (approximately 29 minutes of jogging), 22 percent protein, 4.5 percent fat, 63 percent crude fibre, and 2.7 percent ash. It is useful in a variety of cropping systems due to its resistance to three types of soil moisture stress. Kabuli and Desi are the two main types of chickpea (*Cicer arietinum* L.). The Kabuli variety (named after its origin in the Afghan capital of Kabul before spreading to India) has enormous, ram-head-shaped, colourful seeds with a low percentage of fibre, whereas the Desi kind has small, coloured, angular seeds with a high percentage of fibre. Desi chickpeas have a smaller output, whereas Kabuli chickpeas have a higher protein content. Globulin is the most important.

Chickpeas are high in protein while being low in fat and sodium. They are high in complex carbs, vitamins (especially vitamins B), and minerals (notably potassium, phosphorus, calcium, magnesium, copper, iron, and zinc). They also include soluble and insoluble fibre. It is high in linoleic and oleic acids, which are important unsaturated fatty acids for nutrition. These fatty acids contribute in the prevention of coronary and cardiovascular diseases. It may also lower blood cholesterol levels due to its high quantities of soluble fibre and vegetable protein.

By fixing atmospheric nitrogen and enhancing soil structure, chickpeas preserve soil fertility and are crucial to rainfed agriculture. Improving the physical, chemical, and biological characteristics of soils is thought to produce an outstanding crop for environmental agricultural diversification and, as a result, variable agriculture [6]. Up to 141 kg (about 310.85 lb) of nitrogen can be fixed by a healthy chickpea crop per hectare.

Genetic variability is an important indicator for plant breeders since it provides both a source of variety and a starting point for yield growth. Crop improvement is dependent on the selection of yield-contributing traits, which is influenced greatly by heritable variation and the heritability of the relevant variable. To support an accurate assessment of parameters, an acceptable and extremely precise approach to evaluate genetic variability that is unaffected by environmental factors is required. The degree of genetic variety inherent in breeding material has a direct impact on the amount of progress made in crop development as a result of selection.

The environment in which the expression occurs is also influenced. As a result, it is critical to collect, assess, and record all possible genetic variability in genotypes in order to meet the growing demand for varietal development and increased production. Before embarking on any crop development initiative, breeders must be familiar with and experienced with variability.

Heritability and variability are important traits that can assist breeders at various phases of crop improvement.

1.1 The present Investigation has been Made with the Following Objectives

To determine the genetic variability for seed yield characters and drought tolerance of Chickpea, to study relationship between yield component characters and seed yield and to estimate direct and indirect effects of yield component characters on seed yield

2. MATERIALS AND METHODS

The present investigation entitled "Genetic variability for seed yield characters in chickpea (*Cicer arietinum* L.)" was made to understand the genetic variability, heritability, genetic advance & correlation in chickpea. The details of the materials used and the methods adopted in the investigation, which was carried out at Department of Genetics and Plant breeding, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini during the rabi season of 2021-2022.

21 Chickpea genotypes were grown using Randomized Block Design with three replications for each genotype. Data for fourteen quantitative variables were collected on five randomly selected plants from each genotype in each replication. On the basis of five competitive plants selected at random from each replication, specific data were collected for the following thirteen (14) quantitative traits : 1. Plant height (cm), 2. Days to 50% flowering, 3. Days to 50% pod initiation, 4. Days to maturity, 5. Number of primary branches, 6. Number of secondary branches, 7. Number of pods per plant, 8. Number of seeds per plant, 9. Biological yield per plant (g), 10. Harvest Index (%), 11. Seed index, 12. Seed yield per plant (g), 13. Seed Vigour,14. Drought Tolerance score was evaluated visually at maturity using a drought tolerance score (DTS) on a 1-9 scale [7] 1= free. very good pod setting; 2= highly tolerant. 91-95% pod setting; 3= tolerant, 81-90% pod setting; 4= moderately tolerant, 71-80% pod setting; 5= intermediate, 51-70% pod setting; 6= moderately susceptible, 31-50% pod setting; 7= susceptible, late flowering, lack of early plant vigor, 1-10% pod setting; and 9= plants dead, no pod setting .

The F-test was created to evaluate variance analysis for genetic differences. Using the method described by Panse and Sukhatme (1967), total variance was separated into variation caused by treatments and variation caused by replications. "Furthermore, measures of heritability (in the broad sense), genetic progress as a percentage of mean, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), correlation analysis and path coefficient analysis were done using the appropriate statistical approach. The software called "OP-STAT" was used to perform the analysis mentioned above" [8].

2.1 Experimental Material

Experimental material, for the present study consists of, 21 chickpea genotypes was received from Department of genetics and Plant Breeding, SHUATS, during Rabi-2021-22 and experiment will be carried out in Randomized block design with 3 replications was conducted at the Experimental Farm of the Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh during Rabi, 2021-2022.

3. RESULTS AND DISCUSSION

3.1 Analysis of Variance

The mean sum of squares values for 14 biometrical traits was presented in Table 1. The mean sum of squares due to the genotypes were significant for all the characters studied at both levels of significance 1% and 5%, suggesting the existence of high genetic variability among the genotypes for all the traits [9]. This means that a sample for genotype selection from the current gene pool for yield and its component traits exists.

On the basis of mean performance seed yield per plant ranged from 7 to 14.53 with the grand mean value of 11.92. The genotypes RSG-931 (7), UDAY (check) (9.663), IPC-10-134 (10) recorded the lowest seed yield per plant. The genotypes IPC-05-62 (14.533), JGM-7 (14.467), IPC-6006 (14.133) were recorded as the highest seed yield compared to the other genotypes.

Coefficient of variation: The findings (Table 3) demonstrated that the magnitude of PCV was greater than the corresponding GCV for all the traits showing that there was an influence of the environment. Among the 14 quantitative characters, high estimates of GCV and PCV

(>20%) were recorded for drought tolerance score (30.681, 32.498) and low estimates of GCV and PCV (0- 10%) were recorded for days to maturity (1.167, 2.232).

Table 1. List of genotypes studied in the experiment

S.No	GENOTYPES	S.No	GENOTYPES
1	IPC 2K-25	12	IPC-10-134
2	RSG 931	13	JG 24
3	GNG 1958	14	NBEG-47
4	GNG 1581	15	IPC 06-77
5	IPC-97-29	16	NBEG-3
6	JGM 7	17	CSG-8962
7	IPC-05-24	18	ICC 1205
8	IPC-6006	19	ICCY-10
9	IPC-04-52	20	KPG-59
10	ESCJ-627U	21	UDAY (check)
11	IPC-05-62		

Table 2. Analysis of variances for 14 quantitative traits among chickpea genotypes

Trait	Mean sum of squares		
	Replication	Treatment	Error
Degree of Freedom	**2**	**20**	**40**
Plant height (cm)	4.5960	105.819**	8.402
Days to 50% flowering	9.0630	50.563**	18.897
Days to 50% pod initiation	16.9680	23.711*	10.218
Days to maturity	9.190	12.367*	5.807
Number of primary branches	0.0010	1.492**	0.059
Number of secondary Branches	0.3610	0.877**	0.132
Number of pods per plant	2.7980	97.874**	7.271
Number of seeds per plant	5.5120	290.378**	15.301
Biological yield per plant (g)	2.370	35.399**	9.539
Harvest Index (%)	1.1880	165.359**	24.285
Seed Index	1.490	20.621**	7.339
Seed yield per plant	0.3550	10.747**	2.174
Seed Vigour	26.7780	1092.087**	65.211
Drought tolerance score	00	6.4**	0.25

** 5% Level of Significance , ** 1% Level of Significance*

Table 3. Genetic parameters for 14 quantitative characters in chickpea genotypes

Trait	GCV%	PCV%	h^2	Genetic advance	GA% of Mean
Days to fifty percent flowering	11.104	12.458	79.444	10.463	20.388
Days to fifty percent pod setting	4.032	6.734	35.839	4.007	4.972
Days to maturity	2.159	3.906	30.563	2.415	2.459
Plant height (cm)	1.167	2.232	27.353	1.593	1.258
Number of primary branches	18.597	19.704	89.08	1.344	36.157
Number of secondary branches	9.3	11.518	65.205	0.828	15.471
Number of pods per plant	18.153	20.221	80.596	10.163	33.572
Number of seeds per plant	19.111	20.644	85.699	18.261	36.446
Seed yield per plant (g)	11.077	16.078	47.468	4.167	15.722
Biological yield per plant (g)	15.096	18.59	65.944	11.471	25.254
Harvest Index (%)	8.703	14.188	37.627	2.659	10.998
Seed Index (g)	14.181	18.818	56.792	2.624	22.015
Seed Vigour	26.035	28.407	83.997	34.93	49.153
Drought tolerance score	30.681	32.498	89.13	2.785	59.669

GCV: Genotypic Coefficient of Variation, PCV: Phenotypic Coefficient of Variation, h^2: Heritability, GA% of Mean: Genetic Advance at percent of mean

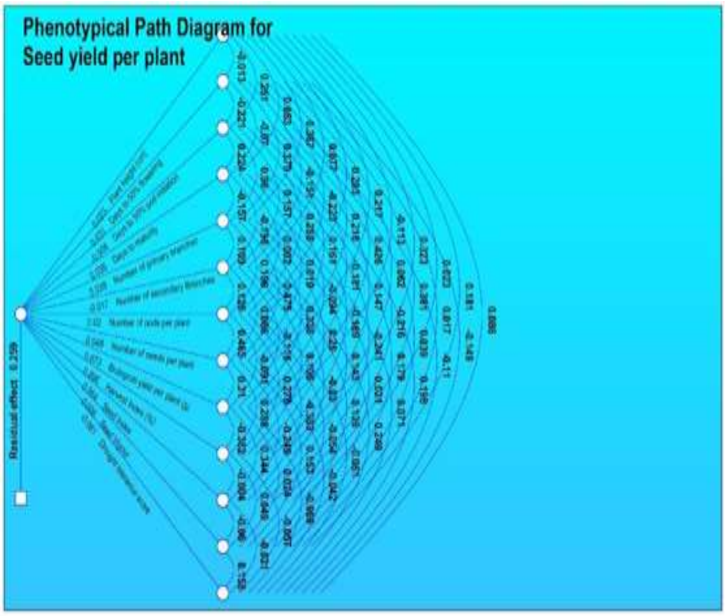

Fig. 1. Phenotypical path diagram

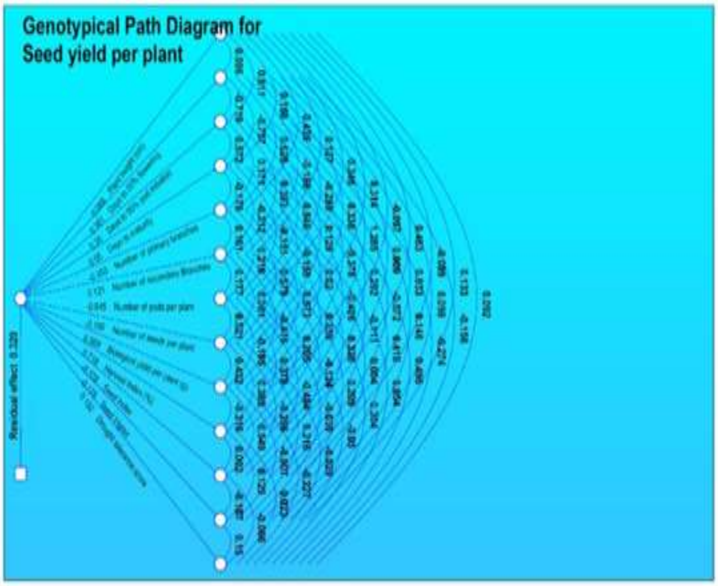

Fig. 2. Genotypical path diagram

Similar findings were also reported high GCV by Lokere et al. [10] for seed yield, pod per plants and [11] for harvest index.

Heritability: The estimates of heritability ranged from 89.13 % to 27.353 % (Table 3). High heritability (>60%) was recorded for drought tolerance score (89.13%), number of primary branches (89.08%), number of seeds per plant (85.699%), seed vigour (83.997%), number of pods per plant (80.596%), plant height (79.444%), harvest index (65.944%) and number of secondary branches (65.205%). Moderate heritability (30-60%) was recorded for seed yield per plant (56.792 %), biological yield per plant (47.468%), seed index (37.627) and days to 50% flowering (35.839). Low heritability (<30%) was recorded for days to 50% pod initiation (30.563) and days to maturity (27.353). "The high heritability values of the considered traits in the present study indicated that these were less influenced by the environment and thus help in effective selection of the traits based on the phenotypic expression by adopting simple selection method and suggested the scope of genetic improvement" [8].

3.2 Genetic Advance as Percent of Mean

The estimates of genetic progress expressed as a percentage of the mean (Table 3) ranged from 59.669 to 1.258. Drought tolerance score (59.669) followed by seed vigour (49.154), number seeds per plant (36.446), number of primary branches (36.157), number of pods per plant (33.572), harvest index (25.254) and seed yield per plant (22.015) showed high genetic advance as a percent of mean (>20%). Plant height (20.383), biological yield per plant (15.722) and number of secondary branches (15.471) all showed moderate genetic advancement (10–20%). seed index (10.998), days to 50% flowering (4.972), days to 50% pod initiation (2.459) and days to maturity (1.258) showed low genetic advance as a percent of mean (0–10%) was noted.

3.3 Genotypic Correlation Coefficient

In the present investigation (Table 4) seed yield per plant showed positive and significant correlation with plant height (0.381*), days to 50% flowering (0.937**), number of primary branches (0.780**), number of pods per plant (0.333*), number of seeds per plant (0.753**), biological yield per plant (0.611**), harvest index (0.604**) and seed index (0.394*) which indicated the strong association of these traits with the yield. The correlation showed positive nonsignificant association with days to 50% pod initiation (0.0198) and seed vigour (0.1430). The correlation showed negative and significant for days to maturity (-0.349*). The correlation showed negative and non-significant for the number of secondary branches (-0.1036) and drought tolerance score (-0.1603). Therefore, top priority should be given to these characters while making selection for yield improvement [12].

Similar findings were also reported earlier for pods for plant for seed yield were carried out at genotypic level by Babbar et al. [13].

3.4 Phenotypic Correlation Coefficient

In the current investigation (Table 4) seed yield per plant showed positive significant association with days to 50% flowering (0.429**), number of primary branches (0.524**), number of seeds per plant (0.5288**), biological yield per plant (0.398*), Harvest index (0.656**) and seed index (0.284*). Positive and nonsignificant association with plant height (0.2158), days to 50 % pod initiation (0.0031), number of pods per plant (0.1955) and seed vigour (0.0602). Negative and non-significant is shown for days to maturity (-0.2127), number of secondary branches (-0.0208) and drought tolerance score (-0.1619). Therefore, top priority should be given to these characters while making selection for yield improvement. Correlation between grain yield and attributing traits [12].

Similar findings were also reported earlier for pods for plant for seed yield were carried out at genotypic level by Babbar et al. [13].

3.5 Phenotypic Path coefficient analysis

In the present investigation (Table 5) positive direct effect was shown by days to 50% flowering (0.0313), days to maturity (0.0355), number of primary branches (0.0380), number of pods per plant (0.0203), number of seeds per plant (0.0458), biological yield per plant (1.6732), harvest index (0.8956), seed index (0.0638), seed vigour (0.0064) and seed yield per plant (1.0000). Negative direct effect was shown by plant height (-0.0232), days to 50% pod initiation (-0.0080), number of secondary branches (-0.0168), drought tolerance score (-0.0606) [14].

Similar findings for biological yield were earlier reported by Thakur et al. [15].

3.6 Genotypic Path Coefficient Analysis

In the present investigation (Table 5) positive direct effect was shown by days to 50% flowering (0.3611), days to 50% pod initiation (0.3500), days to maturity (0.0504), number of secondary branches (0.1213), biological yield per plant (0.5681), harvest index (0.7190), drought tolerance score (0.1924) and seed yield per plant (1.0000). Negative direct effect was shown by plant height (-0.0693), number of primary branches (-0.3527), number of pods per plant (-0.0448), number of seeds per plant (-0.1564), seed index (-0.3378), seed vigour (-0.1756) [14].

Similar finding for biological yield were earlier reported by Thakur et al. [15].

Table 4. Correlation coefficient analysis

Traits		PH	DF50	DP50	DM	NPB	NSB	NPP	NSP	BY	H.I	SI	SV	DTS	SYP
PH	P	1.0000	0.0065	0.611**	0.1580	0.435**	0.1270	0.346*	0.314*	-0.0973	0.463**	-0.0888	0.1327	0.0921	0.381*
	G	1.0000	0.0065	0.611**	0.1580	0.435**	0.1270	0.346*	0.314*	-0.0973	0.463**	-0.0888	0.1327	0.0921	0.381*
DF50	P		1.0000	-0.719**	-0.757**	0.626**	-0.1857	-0.289*	0.338*	1.2850	0.0090	0.933**	0.0982	-0.1565	0.937**
	G		1.0000	-0.719**	-0.757**	0.626**	-0.1857	-0.289*	0.338*	1.2850	0.0090	0.933**	0.0982	-0.1565	0.937**
DP50	P			1.0000	0.572**	0.1710	0.393*	0.546**	0.1293	-0.378*	0.292*	-0.572**	0.1461	-0.274*	0.0198
	G			1.0000	0.572**	0.1710	0.393*	0.546**	0.1293	-0.378*	0.292*	-0.572**	0.1461	-0.274*	0.0198
DM	P				1.0000	-0.1775	-0.312*	-0.1510	-0.1550	0.0199	-0.406**	-0.1112	0.418**	0.496**	-0.349*
	G				1.0000	-0.1775	-0.312*	-0.1510	-0.1550	0.0199	-0.406**	-0.1112	0.418**	0.496**	-0.349*
NPB	P					1.0000	0.1609	0.2182	0.579**	0.573**	0.360*	0.338*	0.0039	0.0543	0.780**
	G					1.0000	0.1609	0.2182	0.579**	0.573**	0.360*	0.338*	0.0039	0.0543	0.780**
NSB	P						1.0000	0.1771	0.0813	-0.416**	0.2047	-0.1236	0.2093	0.304*	-0.1036
	G						1.0000	0.1771	0.0813	-0.416**	0.2047	-0.1236	0.2093	0.304*	-0.1036
NPP	P							1.0000	0.521**	-0.1054	0.378*	-0.484**	-0.0387	-0.0503	0.333*
	G							1.0000	0.521**	-0.1054	0.378*	-0.484**	-0.0387	-0.0503	0.333*
NSP	P								1.0000	0.433**	0.385*	-0.286*	0.2157	-0.0286	0.753**
	G								1.0000	0.433**	0.385*	-0.286*	0.2157	-0.0286	0.753**
BY	P									1.0000	-0.316*	0.549**	-0.0068	-0.2274	0.611**
	G									1.0000	-0.316*	0.549**	-0.0068	-0.2274	0.611**
H.I.	P										1.0000	0.0023	0.1290	0.0234	0.604**
	G										1.0000	0.0023	0.1290	0.0234	0.604**
SI	P											1.0000	-0.1865	-0.0661	0.394*
	G											1.0000	-0.1865	-0.0661	0.394*
SV	P												1.0000	0.1500	0.1430
	G												1.0000	0.1500	0.1430
DTS	P													1.0000	-0.1603
	G													1.0000	-0.1603
SYP	P														1.0000
	G														1.0000

***1%LevelofSignificance, *5% Level of Significance*

Table 5. Path coefficient analysis

Traits		PH	DF50	DP50	DM	NPB	NSB	NPP	NSP	BY	HI	SI	SV	DTS	SYP
PH	P	-0.0232	0.0003	-0.0058	-0.0012	-0.0085	-0.0018	-0.0066	-0.0050	0.0026	-0.0075	-0.0005	-0.0042	-0.0020	0.2158
	G	-0.0693	-0.0004	-0.0424	-0.0109	-0.0302	-0.0088	-0.0240	-0.0218	0.0067	-0.0321	0.0062	-0.0092	-0.0064	0.381*
DF50	P	-0.0004	0.0313	-0.0069	-0.0022	0.0119	-0.0047	-0.0070	0.0068	0.0133	0.0019	0.0119	0.0005	-0.0047	0.429**
	G	0.0023	0.3611	-0.2595	-0.2732	0.2260	-0.0671	-0.1044	0.1220	0.4640	0.0033	0.3367	0.0355	-0.0565	0.937**
DP50	P	-0.0020	0.0018	-0.0080	-0.0018	-0.0005	-0.0013	-0.0023	-0.0013	0.0015	-0.0012	0.0017	-0.0003	0.0009	0.0031
	G	0.2139	-0.2515	0.3500	0.2002	0.0599	0.1374	0.1910	0.0452	-0.1322	0.1022	-0.2003	0.0511	-0.0957	0.0198
DM	P	0.0019	-0.0025	0.0079	0.0355	-0.0056	-0.0070	0.0001	0.0007	-0.0033	-0.0060	-0.0085	0.0064	0.0070	-0.2127
	G	0.0080	-0.0381	0.0288	0.0504	-0.0089	-0.0157	-0.0076	-0.0078	0.0010	-0.0205	-0.0056	0.0211	0.0250	-0.349*
NPB	P	0.0139	0.0144	0.0023	-0.0060	0.0380	0.0042	0.0074	0.0180	0.0128	0.0099	0.0054	0.0008	0.0027	0.524**
	G	-0.1535	-0.2207	-0.0603	0.0626	-0.3527	-0.0568	-0.0770	-0.2042	-0.2021	-0.1268	-0.1194	-0.0014	-0.0191	0.780**
NSB	P	-0.0013	0.0025	-0.0026	0.0033	-0.0018	-0.0168	-0.0021	-0.0014	0.0020	-0.0018	0.0005	-0.0023	-0.0042	-0.0208
	G	0.0154	-0.0225	0.0476	-0.0378	0.0195	0.1213	0.0215	0.0099	-0.0504	0.0248	-0.0150	0.0254	0.0368	-0.1036
NPP	P	0.0058	-0.0045	0.0059	0.0000	0.0040	0.0026	0.0203	0.0095	-0.0019	0.0056	-0.0078	-0.0011	-0.0012	0.1955
	G	-0.0155	0.0130	-0.0244	0.0068	-0.0098	-0.0079	-0.0448	-0.0233	0.0047	-0.0169	0.0216	0.0017	0.0023	0.333*
NSP	P	0.0099	0.0100	0.0074	0.0009	0.0218	0.0039	0.0213	0.0458	0.0142	0.0132	-0.0114	0.0070	-0.0019	0.528**
	G	-0.0491	-0.0528	-0.0202	0.0242	-0.0906	-0.0127	-0.0815	-0.1564	-0.0676	-0.0603	0.0447	-0.0337	0.0045	0.753**
BY	P	-0.0759	0.2866	-0.1216	-0.0634	0.2274	-0.0783	-0.0613	0.2089	0.6732	-0.2575	0.2315	0.0162	-0.0468	0.398*
	G	-0.1136	1.5009	-0.4413	0.0232	0.6693	-0.4855	-0.1231	0.5052	0.5681	-0.3692	0.6408	-0.0079	-0.2657	0.611**
H.I.	P	0.2897	0.0553	0.1315	-0.1516	0.2326	0.0947	0.2467	0.2583	-0.3426	0.8956	-0.0032	0.0442	-0.0508	0.656**
	G	0.5179	0.0101	0.3265	-0.4539	0.4018	0.2288	0.4226	0.4308	-0.3533	0.7190	0.0025	0.1443	0.0261	0.604**
SI	P	0.0014	0.0243	-0.0138	-0.0154	0.0091	-0.0019	-0.0244	-0.0159	0.0219	-0.0002	0.0638	-0.0038	-0.0013	0.284*
	G	0.0300	-0.3151	0.1934	0.0376	-0.1143	0.0418	0.1634	0.0965	-0.1853	-0.0008	-0.3378	0.0630	0.0223	0.394*
SV	P	0.0012	0.0001	0.0002	0.0011	0.0001	0.0009	-0.0003	0.0010	0.0002	0.0003	-0.0004	0.0064	0.0010	0.0602
	G	-0.0233	-0.0172	-0.0257	-0.0734	-0.0007	-0.0368	0.0068	-0.0379	0.0012	-0.0227	0.0328	-0.1756	-0.0263	0.1430
DTS	P	-0.0052	0.0090	0.0067	-0.0120	-0.0043	-0.0151	0.0037	0.0025	0.0042	0.0034	0.0013	-0.0096	-0.0606	-0.1619
	G	0.0177	-0.0301	-0.0526	0.0954	0.0104	0.0585	-0.0097	-0.0055	-0.0438	0.0045	-0.0127	0.0289	0.1924	-0.1603
SYP	P	0.2158	0.429**	0.0031	-0.2127	0.524**	-0.0208	0.1955	0.528**	0.398*	0.656**	0.284*	0.0602	-0.1619	1.0000
	G	0.381*	0.937**	0.0198	-0.349*	0.780**	-0.1036	0.333*	0.753**	0.611**	0.604**	0.394*	0.1430	-0.1603	1.0000

***1%LevelofSignificance , *5% Level of Significance*

4. CONCLUSION

The study concluded that IPC-05-62 was shown to be superior in seed yield over UDAY (check) among 21 genotypes of chickpea based on mean performance, followed by JGM-7 (14.477). JG-24 outperformed UDAY(Check) in terms of drought tolerance, followed by IPC-05-24. GNG 1581 documented the early days through maturity, which may be suitable for diverse cropping systems. GCV and PCV estimates were high for seed vigour and drought tolerance score. For seed vigour, genetic factors demonstrated that heritability and genetic progress as percent mean values are high. The examination of correlation coefficients revealed that seed yield per plant had a positive and significant relationship with plant height and days to 50% flowering, number of primary branches, seed index and harvest index at both genotypic and phenotypic levels. Path coefficient analysis revealed that character's days to 50% flowering, number of primary branches, number of seeds per plant, biological yield, seed index and harvest index have positive direct effect on seed yield per plant at genotypic and phenotypic levels. As a result, while selecting for seed yield per plant, these characteristics should be given top priority.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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