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HERITABILITY AND GENETIC ADVANCE FOR YIELD AND YIELD CONTRIBUTING TRAITS IN CHICKPEA

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ABSTRACT

The present experiment was carried out with twenty nine genotypes of chickpea in *rabi,* 2007-08 at Pulses Research centre, Mokama, Rajendra Agricultural University, Pusa, Samastipur to assess the nature and magnitude of genetic parameters and its utilization in designing a conceptual ideotype in chickpea. The estimates of genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), genetic advance as well as correlation coefficients were worked out in desi chickpea genotypes for ten pant type related traits. Internode distance had maximum Genotypic and Phenotypic coefficient of variation (GCV and PCV), followed by seed index, number of effectives pod per plant and seed yield per plant. The traits plant height, angle between primary branches and ground, angle between primary branches and secondary branches, number of pods per plant, effective pods per plant, harvest index and seed yield per plant exhibited high heritability coupled with high genetic advance indicating the scope for improvement and genetic gain through the selection of these traits. High significant positive genotypic correlation was observed for plant height, number of total branches, number of pods per plant, test weight, biological yield and harvest index with seed yield per plant.

Key words : *Chickpea, genetic variability, correlation coefficient, plant type.*

Chickpea (*Cicer arietinum* L.) is a self self-pollinated crop, with 2n = 16 chromosome and genome size of 732 Mb (Arumuganathan and Earle, 1991). Globally, it is grown in at least 33 countries including central and west Asia, south Europe, Ethiopia, North Africa, north and South America and Australia (Ladizinsky and Alder 1976; Singh and Ocampo 1997). India is the largest producer of chickpea in the world sharing about 67% of area and production covering about 7.63 million ha area with annual production of 6.33 million tones grain. The present yield level is 830 kg/ha (FAOSTAT, 2008**),** which is far below the potential yield (4000 kg/ha) of the crop. In spite of India being the largest chickpea producing country, a deficit exists in domestic production and demand, which is met through imports and yield, has been stagnating since past three decades. Chickpea is an indeterminate plant and continues to produce vegetative growth whenever soil moisture, temperature and other environmental factors are favourable. Due to its indeterminate growth habit it gives a poor response in terms of seed yield to high fertility and irrigation water, henceforth chickpea is predominantly cultivated under marginal conditions of rainfed environments characterized by moisture stress and low fertility (Gaur *et al.* 2008). A change in plant architecture therefore is needed to achieve a breakthrough in chickpea productivity and stability of production. One of the important reasons for this might be that present day cultivars do not possess adequate form and frame to support more yield components per unit area. Thus the present investigation was undertaken to know the genetic architecture of traits related to plant type.

MATERIALS AND METHODS

The experimental material consisted of twenty nine genotypes of chickpea grown in *rabi,* 2007-08 at Pulse Research Centre, Mokama, Rajendra Agricultural University, Pusa, Samastipur**.** The experiment was laid out in a randomized complete block design with three replications. The plot size was 4.8 m^2, with 1 row of 4.0 m length. Inter row spacing distance was kept 30 cm and plant to plant spacing was 30 x 10 cm. The recommended packages of practices were followed to raise a healthy crop. Data were recorded on ten quantitative traits viz; plant height (cm), number of total branches per plant, Internode distance (cm), number of pods per plant, number of effective pods per plant, number of seeds per pod, seed index (g), biological yield (g), harvest index (%) and seed yield per plant (g). The seed yield per plant was recorded on a plot basis and plant height, number of total branches per plant,

Table-1 : Analysis of variance for ten quantitative characters in twenty-nine chickpea genotypes.

Sl. No.	Characters	Mean sum of squares		
		Replications (df=2)	Treatments (df=28)	Error (df=56)
1.	Plant height (cm)	1.16	178.72**	46.91
2.	Number of branches per plant	1.47	14.76**	3.12
3.	Internode distance (cm)	1.61	12.38**	3.04
4.	Number of pods per plant	110.15	362.06**	35.82
5.	Number of effective pods per plant	58.68	218.39**	24.97
6.	Number of seeds per pod	0.37	4.35**	0.72
7.	Seed Index (g)	7.85	22.98**	10.06
8.	Biological yield (g)	720.31	3082.34**	389.80
9.	Harvest Index (%)	92.46	372.53**	37.26
10.	Seed yield per plant(g)	152.43	986.75**	66.52

*, ** = Significant at 5% and 1% levels of significance, respectively.

Table-2 : Estimation of variability and genetic parameters of different quantitative characters in chickpea.

Sl. No.	Characters	GCV	PCV	Heritability (%) (h^2bs)	Genetic advance	GA as % of mean
1.	Plant height (cm)	12.88	14.24	81.84	13.09	24.00
2.	Number of branches per plant	17.11	18.93	81.75	12.60	31.87
3.	Internode distance (cm)	54.12	61.38	42.89	2.25	75.12
4.	Number of pods per plant	26.37	28.91	83.25	20.96	49.57
5.	Number of effective pods per plant	27.87	30.68	84.69	19.85	52.83
6.	Number of seeds per pod	18.35	20.42	80.71	0.60	33.95
7.	Seed Index (g)	30.29	32.55	98.34	13.84	61.88
8.	Biological yield (g)	17.63	18.57	90.16	8.26	34.48
9.	Harvest Index (%)	19.21	22.17	75.00	20.51	34.28
10.	Seed yield per plant(g)	27.50	30.43	82.00	32.33	51.33

internode distance length (cm), number of pods per plant, number of effective pods per plant, number of seeds per pod, 100 seed weight (g), biological yield and harvest index were recorded from a random sample of five plants in each plot. The data were subjected to statistical analysis (Panse and Sukhatme, 1978). The Genotypic and Phenotypic variances were calculated (Burton and Devane 1953) and genotypic and phenotypic coefficients of variation were calculated according to the formula given by Falconer (1981). Heritability in the broad sense and genetic advance were calculated according to the formula given by Singh and Chaudhary (1985). The genotypic and phenotypic correlation coefficients were calculated as per the method of Al-Jibouri *et al*. (1958).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among the genotypes for all the ten characters study (Table-1). This is turn indicated that there was significant amount of genetic variability present in the material, which could be utilized in further breeding programme. The GCV, PCV, heritability (broad sense) and expected genetic advance for ten plant type related characters are presented in Table-2. All the characters under study exhibited narrow differences between GCV and PCV values indicating the greater role of genetic factors on the expression of these traits than the environmental factors. The estimates of PCV and GCV were higher for internodes distance (54.12 and 61.38) followed by seed index (30.29 and 32.55), number of effective pods per plant (27.87 and 30.68), seed yield per plant (27.50 and 30.43) and number of pods per plant (26.37 and 28.91). None of the traits was found low genotypic and phenotypic coefficient variation. The medium genotypic and phenotypic coefficients of variation were observed for plant height, number of total branches per plant, number of seeds per pod, biological yield per plant (g)

Table-3 : Genotypic correlation coefficients between yield and its component characters in chickpea genotypes.

S. N.	Characters	Plant height (cm)	Number of branches per plant	Internode distance (cm)	Number of pods per plant	Number of effective pods per plant	Number of seeds per pod	Seed Index (g)	Biological yield (g)	Harvest Index (%)	Seed yield per plant(g)
1.	Plant height (cm)	1.000	0.352	0.474*	0.445*	0.422*	-0.108	0.520**	0.472*	0.399*	0.460*
2.	Number of branches per plant		1.000	0.105	0.288	0.265	-0.341	0.376*	0.290	0.495**	0.552**
3.	Internode distance (cm)			1.000	0.232	0.209	0.192	0.252	0.414**	-0.690	-0.106
4.	Number of pods per plant				1.000	0.364*	0.282	0.310	0.523**	0.470*	0.559**
5.	Number of effective pods per plant					1.000	0.239	0.425*	0.320	0.151	0.529**
6.	Number of seeds per pod						1.000	-0.203	0.121	-0.353	-0.340
7.	Seed Index (g)							1.000	0.630**	0.501**	0.702**
8.	Biological yield (g)								1.000	0.109	0.488**
9.	Harvest Index (%)									1.000	0.945**

*, ** Significant at 5% and 1% levels of significance, respectively.

and harvest index (%). Similar results were reported by Bahl and Jain (1977) and Jeena *et al.* (2005).

High heritability is a good index of the transmission of characters from the parents to their off-springs. In the present study, nine characters showed high heritability (>60%) indicating less influence of environment over genotypic effect. While the other one traits namely internodes distance showed moderate heritability values. The highest heritability was found seed index followed by biological yield per plant, number of effective pods per plant, number of pods per plant and seed yield per plant. Genetic advance as percent of mean ranged from 24.00 for plant height to 75.12 for internodes distance. The present study for high heritability for these characters was conformed to those observed by Chandra (1968), Joshi (1972), Indu (1985) in different chickpea trials.

Heritability estimates give information on the magnitude of inheritance of quantitative traits but provides an indication of the amount of genetic progress that would results from selecting the best individuals. A suitable selection procedure can be followed only when heritability (broad sense) estimates are high accomplished by high genetic advance values. High genetic advance was recorded by seed yield per plant. High heritability coupled with high

genetic advance was recorded for seed yield per plant, number of pods per plant, harvest index and number of effective pods per plant indicating that these characters were governed largely through the additive gene effect as reported by Parshuram *et al.* (2003), Chavan (1994), Joshi (1972) and Chandra (1968). Asawa *et al. (*1977) also observed high genetic coefficient of variation in chickpea, which was in conformity with the present study.

The association between yield and its components and among components themselves is presented in Table-3. Yield is the results of the expression and association of several attributing traits, which contribute additively or help in some conditions in modifying the expression of other traits directly or indirectly. It is therefore desirable for plant breeder to know the extent of relationship between yield and its various components, which will inevitably facilitate selection of desirable characteristics. Genotypic correlation analysis revealed that seed yield per plant exhibited significant and positive association with plant height, number of total branches per plant, number of pods per plant, number of effective pods per plant, 100-seed weight (g), biological yield and harvest index and while it showed insignificant and negative association with internodes distance length and number of seeds per pod (Table-3). Similar findings were reported by Bahl and Jain (1977), Sadhu and Mandal (1989), Raval and Dobariya (2003), Muhammad *et al.* (2003) and telebi *et al*. (2007). The negative association between seed yield per plant and internodes distance may be because of the fact that as internode distance increases it reduces the number of pods per plant. Therefore, a conceptual ideal plant type should have higher biological yield, 100-seed weight, more number of total branches, number of pods per plant and taller in plant height.

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