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Short Communication

GENETIC VARIABILITY FOR SOME AGRO-MORPHOLOGICAL TRAITS IN CHICKPEA GERMPLASM

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Germplasm collection, maintenance and its evaluation for economically important traits is a prerequisite for starting any breeding programme for the genetic improvement of the crop. Chickpea (*Cicer arietinum* L.) occupies unique position in Indian Agriculture by virtue of its high protein content apart from fixing atmospheric nitrogen. Although reports on evaluation of the germplasm of chickpea are quite frequent in literature, yet an attempt has been made in the present study to evaluate the germplasm of different ecogeographic sources and types (Desi and Kabuli) for genetic variability in some agromorphological traits.

Fifty nine genotypes of chickpea (*Desi* and *Kabuli*) from different ecogeographic regions were obtained from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad. These genotypes were grown in a randomized block design with 3 replications at experimental farms of Oilseed Research Station, Kangra of Himachal Pradesh Krishi Vishwa Vidyalaya (HPKVV), Palampur. Origin, type and other characteristics of 59 genotypes are listed in Table 1. Each plot had a single row of 2 m length with row to row and plant to plant spacing of 30 and 10 cm, respectively. Recommended cultural practices were followed to raise the crop. Observations were recorded on 10 randomly selected plants in each accession for 12 agromorphological selected traits, *viz.*, seed yield per plant, pods per plant, seeds per pod, 100-seed weight, specific gravity index, plant height, primary branches per plant, stem diameter, days to flowering, days to maturity and green and anthocyanin pigmentation on plant parts. Specific gravity index was expressed as per cent dipped seeds in the mercuric oxide solution of

Table 1 : Origin, type and seed colour of 59 genotypes of chickpea (*Cicer arietinum* L.)

Genotype	Origin	Type	Seed colour
C 235	India	Desi	Yellow
E 100	Greece	Desi	Yellow-brown
EC 103119-2	India	Desi	Yellow
EC 103400	USSR	Desi	Yellow-brown
EC 103418	Iraq	Desi	Yellow
EC 103422	Afganistan	Desi	Yellow
EC 103438	Iran	Desi	Yellow
EC 103457	Egypt	Kabuli	Salmon-white
EC 250142	Greece	Desi	Yellow-brown
EC 850-3127	Egypt	Kabuli	Salmon-white
F 61	India	Desi	Yellow
Giza	Egypt	Kabuli	Salmon-white
JG 37	India	Desi	Yellow
JG 897	India	Desi	Yellow
JM 466	Ethiopia	Kabuli	Salmon-white
JM 482	Pakistan	Kabuli	Salmon-white
JM 483	Netherland	Desi	Yellow-brown
K 468	India	Desi	Yellow-brown
K 1071	India	Desi	Yellow
Malkan A/2	Pakistan	Desi	Yellow
NEC 10	Jordan	Kabuli	Salmon-white
NEC 18	Jordan	Desi	Yellow-brown
NEC 30	Iraq	Kabuli	Salmon-white
NEC 34	Iraq	Kabuli	Salmon-white
NEC 108	Greece	Kabuli	Salmon-white
NEC 123	Morocco	Desi	Black
NEC 143	Sudan	Kabuli	Salmon-white
NEC 175	Peru	Kabuli	Salmon-white
NEC 197	Pakistan	Kabuli	Salmon-white
NEC 229	India	Desi	Brown
NEC 240	USSR	Desi	Yellow-brown
NEC 249	India	Desi	Yellow
NEC 318	Iran	Desi	Yellow-brown

(Table 1 continues)

NEC 426	Iran	Desi	Dark-brown
NEC 550	Iran	Desi	Yellow-brown
NEC 721	Iran	Desi	Yellow
NEC 989	Iran	Desi	Yellow-brown
NEC 1077	Iran	Desi	Yellow
NEC 1135	Iran	Desi	Brown
NEC 1639	Pakistan	Desi	Yellow
NEC 1646	Algeria	Kabuli	Salmon-white
NEC 2305	USA	Desi	Yellow-brown
NEC 2330	Pakistan	Desi	Yellow-brown
NEC 2368	Ethiopia	Desi	Brown
P 840	Morocco	Desi	Yellow-brown
P 992	Pakistan	Desi	Brown
P 993	Pakistan	Desi	Yellow
P 1081-1	Nigeria	Desi	Cream
P 1528-1	Morocco	Desi	Black
P 2019-1	Iran	Desi	Dark-brown
P 2591	Iran	Kabuli	Salmon-white
P 2994	Iran	Desi	Black
PRR 1	Mexico	Desi	Brown
V 4	Mexico	Desi	Brown
V 165	Mexico	Desi	Yellow-brown
WP 2654-A	Ethiopia	Desi	Brown
WR 315	India	Desi	Brown
12-071-05093	Iran	Desi	Black
12-071-10054	Iran	Desi	Black

specific gravity 1.35. Leaf colouration and anthocyanin pigmentation were scored after 3 and 4 months of sowing, on 1-9 scale representing 1 for high and 9 for the least expression of the respective trait. Data recorded on all above traits were subjected to statistical analysis following Panse and Sukhatme (1985). Different genetic parameters, *viz.*, mean, range, coefficient of variation, heritability and genetic advance were calculated following standard statistical procedures.

Analysis of variance (Table 2) indicated presence of sufficient genetic variability for all the traits in 59 genotypes of chickpea. Seed yield per plant

ranged from 4.33 (JM 466) to 29.67 g per plant (NEC 550) with an average yield of 13.15 g per plant. Pods per plant ranged from 42.07 (12 - 071 - 10054) to 154 (P 2019-1) with an average of 90.74. Germplasm population had 1.73 seeds per pod with a range of 1 (MEC 249) to 2.60 (JM 466). Genotype, P 2994 exhibited minimum 100-seed weight (10.70 g), whereas maximum seed weight (33.53 g) was exhibited by NEC 34. Similarly, specific gravity index ranged from 6.33 (NEC 34) to 95.67 (C 235) with an average of 64.77. Plant height at maturity ranged from 68.33 to 104.20 cm with a mean height of 83.26cm. Germplasm had 7.61 average primary branches per plant which ranged from 3.27 (JM 466) to 10.60 (NEC 550). Stem diameter ranged from 0.56 (NEC 10) to 0.97 cm (NEC 123) with a mean of 0.72 cm. A narrow range was observed for days to first flowering and maturity, i.e. 107 to 137 and 192 to 201, respectively. Genotypes C-235 and JM466 were observed to be early maturing and early flowering type, respectively. Intensity of green leaf colour and anthocyanin ranged from scale 1 to 9 with an average score of 4.43 and 6.03, respectively. Eleven (EC 103418, EC 103422, EC 850 - 3137, F 61, NEC 18, NEC 123, NEC 229, NEC 989, NEC 2305, P1528-1 and P2994) and six (NEC 229, NEC 721, NEC 1135, P 992, P1528-1 and V4) genotypes out of 59 studied, had highest intensity of green and anthocyanin pigmentation (score, = 1). For seed yield per plant, 100-seed weight and specific gravity index, 3 genotypes, *viz.*, NEC 550, NEC 108 and NEC 197 were most notable.

Table 2 : Estimates of genetic parameters of variability for structural, phenological, physiological, yield and yield components in chickpea

Traits	Mean ± SE	Range	Coefficient of variability			Herit-ability (%)	Genetic advance (per cent over mean
			Pheno-typic	Geno-typic	Eviron-mental		
Seed yield/plant (g)	13.15±.85	4.33–29.67	42.55	41.00	11.38	92.85	81.44
Pods/plant	90.74±9.19	42.07–154.00	35.64	31.02	17.54	75.77	55.62
Seeds/pod	1.73±0.10	1–2.60	20.65	18.49	9.19	80.17	34.43
100-seed weight (g)	16.49±0.43	10.70–33.53	34.12	33.82	4.51	98.25	68.95
Specific gravity index	64.77±1.66	6.33–95.67	41.01	40.77	4.43	98.84	83.51
Plant height (cm)	83.26±1.52	68.33–104.20	9.68	9.08	3.17	89.13	17.67
Primary branches	7.61±0.4	3.27–10.60	29.62	27.97	9.92	89.23	54.37
Stem diameter (cm)	0.72±0.00	0.56–0.97	13.38	11.98	5.95	80.21	25.19
Days to first flowering	126±1.14	107–137	5.15	4.91	1.56	90.82	9.64
Days to maturity	197.82±0.56	192–201	0.92	0.77	0.49	71.28	1.35
Intensity of leaf colour (Grade)	4.43±0.00	1–9	61.72	61.72	0.00	100.00	126.90
Intensity of purple pigmentation (Grade)	5.03±0.00	1–9	53.45	53.45	0.00	100.00	110.08

Seed yield per plant had high coefficient of variation both at phenotypic and genotypic levels, which are more than 3 times the coefficient of variability at environment levels. However, highest coefficient of variability was exhibited by intensity of green and anthocyanin pigmentation with no influence of environment. Specific gravity index, pods per plant, primary branches per plant and 100-seed weight also exhibited high coefficient of variability both at phenotypic and genotypic levels. However, pods per plant appeared to be highly influenced by environment. Therefore, selection based on pods per plant may not be quite profitable as compared to the one based on specific gravity index, 100-seed weight and seed yield per plant itself. In general, high heritability estimates were recorded for all yield and yield components as also reported by Chandra *et al.* (1971), Ramanujam and Gupta (1974) and Asawa *et al.* (1977). All structural, phenological and physiological traits also recorded high heritability. Sandhu and Singh (1970) and Gupta *et al.* (1972) had also reported high heritability for plant height and primary branches per plant. Among yield and its components, high heritability was associated with high genetic advance (GA as % of mean) for specific gravity index, seed yield per plant and 100-seed weight. Thus, these traits can be used to select high yielding genotypes. Among structural, phenological and physiological traits, intensity of green pigmentation, intensity of anthocyanin pigmentation and primary branches per plant also had high heritability alongwith high genetic advance, which supplements their choice as characterization traits. Genetic advance was low inspite of high heritability for pods per plant, plant height, stem diameter, days to flowering and days to maturity which can be ascribed to low genetic variability for these traits.

Therefore, the present study revealed sufficient genetic variability for specific gravity index, pods per plant, 100- seed weight, primary branches per plant, seed yield per plant, and intensity of green and anthocyanin pigmentation which can be exploited for improvement of this crop as also characterization traits during selection. Specific gravity index, 100-seed weight and seed yield per plant seem to be most reliable selection parameters. NEC 550, NEC 108 and NEC 197 are elite lines for yield and its components, and can be used in breeding programmes.

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