

## GENETIC DIVERGENCE AMONG CHICKPEA CULTIVARS

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### ABSTRACT

Genetic divergence among 23 cultivars of chickpea was estimated using  $D^2$  statistic for 7 yield traits. The cultivars were grouped into 6 clusters. Maximum genetic distance was recorded between clusters III and VI, followed by that between clusters IV and VI, suggesting wide diversity among these groups. Considering cluster means and the genetic distances, crosses between the cultivar of VI (ICCL 84225) with those of clusters III (ICCL 84217, ICCL 84219) and IV (ICCL 82108, ICCL 83214) are likely to recombine the genes for high yield.

**Key words:** Genetic divergence,  $D^2$  statistic, chickpea.

Multivariate analysis based on Mahalanobis'  $D^2$  statistic and quantification of the degree of divergence among biological population helps the plant breeder to recognise the importance of genetic diversity in selecting the genetically diverse parents for purposeful hybridization or heterosis breeding programme. Therefore, expecting relative genetic potential difference, an attempt was made in this study to group 23 cultivars of chickpea on the basis of their degree of total genetic divergence as measured by multivariate analysis.

### MATERIALS AND METHODS

Twenty three cultivars of chickpea (*Cicer arietinum* L.) collected from ICRISAT, Hyderabad, were evaluated in randomised complete block design with 3 replications. Each plot consisted of 4 rows, 5.5 m long, with inter- and intrarow spacings of 30 cm and 10 cm, respectively. Ten plants were selected at random from each plot to record observations on seven characters (Table 3). Plot means were subjected to analysis of variance and multivariate analysis by Mahalanobis'  $D^2$  statistic [1]. On the basis of magnitude of  $D^2$  values, the cultivars were grouped into different clusters following the Tocher's method [2].

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## RESULTS AND DISCUSSION

The significant treatment mean squares indicated potent variability, and based on  $D^2$  values for all possible 253 cultivar pairs, the 23 cultivars were grouped into six clusters. This shows the presence of a large amount of diversity among the cultivars for all the traits under study (Table 1). Cluster I was the largest with 14 cultivars, clusters II to V had 2 cultivars each, and cluster VI had a single cultivar. The intracluster distance ranged from 0.0 (cluster VI) to 6.7 (cluster V) as two cultivars including a local in cluster V were most heterogenous (Table 2). The maximum intercluster distance (14.0) was recorded between clusters III and VI, followed by the one between clusters IV and VI (12.8), suggesting wide diversity among these groups. On the other hand, the minimum distance between clusters I and VI (7.0) indicated their close relationship [3-7].

Table 1. Cluster composition in chickpea

Cluster number	Number of cultivars	Cultivars
I	14	Annigeri, ICCL 83227, 83135, 82115, 84215, 81215, 82230, 84224, 83149, 83319, 83132, 83302, 83328, ICC 13818
II	2	BDN 9-3, ICCL 83224
III	2	ICCL 84217, ICCL 84219
IV	2	ICCL 82108, ICCL 83214
V	2	ICCL 82236, Keonjhar Local
VI	1	ICCL 84225

Table 2. Intracluster (in bold) and intercluster distances ( $\sqrt{D^2}$ ) in chickpea

Clusters	I	II	III	IV	V	VI
I	<b>5.0</b>	7.8	11.6	10.5	9.9	7.0
II		<b>5.1</b>	8.5	9.7	9.5	12.1
III			<b>6.3</b>	8.3	9.5	14.0
IV				<b>6.4</b>	12.7	12.8
V					<b>6.7</b>	10.6
VI						<b>0.0</b>

A general study of all the intercluster distances showed that clusters I and II had smaller mean distance, indicating that they would be placed in the central region of the divergence diagram. The remaining clusters III to VI had high average distance, and would be placed at the periphery of the diagram, indicating genetically more diversity of traits. Similar results were also reported in blackgram [8].

Based on cluster means, the important cluster are: III for pods per plant, IV for seed yield, and VI for test weight (Table 3). Crosses involving parents from the most divergent clusters are expected to manifest maximum heterosis and also wide variability in genetic architecture [9]. The clusters comprising only one cultivar with specific traits could also be used in a hybridization programme for exploiting hybrid vigour. Thus, crosses between the cultivar of cluster VI (ICCL 84225) and those of clusters III (ICCL 84217, ICCL 84219) and IV (ICCL 82108, ICCL 83214) are expected to exhibit high heterosis and are also likely to produce new recombinants with desired traits.

Table 3. Cluster means of seven characters in chickpea

Character	Character means in different clusters					
	I	II	III	IV	V	VI
Days to 50% flowering	58	57	62	55	67	62
Days to maturity	99	100	100	98	99	100
Plant height (cm)	39.1	41.5	40.5	35.3	36.6	37.7
Branches per plant	4.1	4.2	4.6	4.4	4.0	4.4
Pods per plant	61.9	67.2	86.9	70.8	56.2	56.3
100-seed weight (g)	13.7	9.7	9.6	12.5	10.1	16.9
Seed yield per plant (g)	8.9	6.9	17.7	17.8	7.3	12.2

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