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Genetic divergence in chickpea germplasm

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Abstract : Genetic divergence measured by Mahalanobis' D^2 statistics was carried out with 126 chickpea genotypes available in the germplasm pool. The varieties were grouped into seven clusters. Maximum divergence was observed in the clusters IV and VII and the minimum between the IV and V. The intercluster divergence varied from 0 to 2.99. The maximum intercluster distance was in cluster I with 108 genotypes. The cluster III included kabuli types quite diverse from the desi types and this was again confirmed in the cononical root squre analysis. *(Key words : Genetic divergence - D^2 cluster - Cannonical).*

India is a premier chickpea growing country covering 70 per cent world area and production. The crop is regarded for rich source of protein (28 per cent), minerals (Ca, P) among the pulse crops and essential amino acids free from anti nutritional factors. The major chickpea growing states are U.P., M.P., Maharastra, Rajasthan, Punjab, Haryana, Andrapradesh, West Bengal, Karnataka and Tamilnadu. Considerable variability exists in this crop traditionally representing diverse agro climatic conditions and also due to forces of natural and human selection. Precise information on the nature and the degree of genetic variability in the principal area of cultivation would help in understanding the evolutionary mechanism involved in the intraspecific divergence and choice of desirable parts for evolving superior varieties. The present investigation was aimed at assessing the genetic divergence among 126 varieties of chickpea using Mahalanobis' D^2 statistics analysis among the set of characters related to fitness and productivity.

Materials and Methods

One hundred and twenty six genotypes of chickpea were selected for measuring genetic divergence based on the quantitative traits. These lines were grown in a randomized block design with two replications and the individual plot size was four rows of 4 m length with plants spaced 10 cm apart. The inter row distance was 30 cm. Five plants were selected at random from two central rows of each plot for recording observation on plant height, days to 50 per cent flowering, number of primary branches, number of secondary branches, days to maturity, seed yield per plant and 100 seed weight. The analysis of genetic divergence using Mahalanobis 'D^2 statistic was carried out as described by Rao (1982). On the basis of magnitude of the D^2 value, the varieties were grouped into number of clusters as suggested by Toacher (1952).

Results and Discussion

Analysis of variance revealed highly significant differences among genotypes for most of the characters studied indicating the existence of genetic variability among the genotypes. The significance of statistic (^) shows that the difference between the means in respect of the pooled effect of all the characters between different populations were significant. Hence, further analysis to estimate D^2 value was done and on the basis of relative magnitude of D^2 value all the 126 genotypes were grouped in to seven clusters such that the varieties within the cluster had smaller D^2 value among themselves than those of two different characters (Table 1). Maximum intercluster divergence was observed between genotypes of cluster IV and VII and the minimum between the genotypes of cluster IV and V. The intracluster divergence varied from 0 to 2.99, the maximum being cluster I which comprised 108 genotypes.

Tabel 1. Average intra - and inter - cluster distance (D^2) values.

Cluster Number	I	II	III	IV	V	VI	VII
I	2.99	3.92	4.14	4.02	3.92	4.30	4.03
II		0.00	5.93	4.97	5.21	1.13	4.86
III			3.16	5.99	5.75	6.41	4.33
IV				0.00	1.04	4.75	6.59
V					0.00	5.19	6.27
VI						0.00	5.78
VII							0.00

Composition of clusters : Cluster I. PLS 5334-1(14), PLS.5173 (19), PLS.5521-2 (24), PLS 5098-1(4) RC.5304-2 (34), 4951-1(44), 11502(49), GCP-107(29), PLS.5037-2(9), CO.3(54), PLS 5219-2(21), ICMRN-2(36), 81228(41), CO.1(66), ICC 1018(69), RC-14-2(26), 800550(51), PLS 5225-2(31), PLS 5320-2(11), TNAU 8902(56), 12884(39), CO.2(59), 14606(71), BG.1003(70), 87214-1(60), ICC.15592(73) 15713(72), 86446 (46), ICC16102(77), 86239(67), ICC42(55), PLS.5334-2(13), 10136(48), PLS.5728-2(8), 2430-1(50), ICC.9714(100), ICC4958(90), PLS 5305-1(23), ICC 16048(75), 89339(38), COG88-30(63), ICC640(68), 89339(43), 87209-1(58), ICC15158(95), PLS.5588-1(18), 89213(40), PLS.5307-2(53), COG85-2(62), PLS.5425(28), ICC14597(85), 89337(37), 86416(45), PLS.5487-2(15), RC.102-2(33), ICC5353(110), 2430-2(52), PLS.5451-2(25), BG-391(125), 87227-1(57), ICCV 88109-1(61), 89305(42), RC.5-2(5), RC.12-2(20), PLS.5460(30), COG.29(120), ICC 12242(105), COG.30-1(115), ICC 38(88), ICC 88109-1(64), PLS.5560-2(10), ICC.16003(74), ICC 117653(80), BG-1043(118), ICC 15085(86), ICC 2016(83), ICC 11324(103), 89234(47), ICC 15629(96), RC. 110-2(35), ICC 10331(93). ICC9906(92), COG.88-13(65), BG.1071(113), PLS.5139-2(22), ICC.2812(97), ICC.134268(94), ICC.13268(94), ICC.4758(89), ICC 12237(104), RC 16-2(27), ICC 4278(98), RC.3-2(17), PLS.5225-1(32), PLS.5399-2(3), ICC12484(108), RC.7-2(12), ICC3302(84), ICC 6427(99), Phuk G-5(119), ICC 4951(16), ICC 15652(101), C.235(123), ICC.16349(79), Cluster II. PLS. 5433-2(6), Cluster III. Kodaikanal double. (11), JG.11(117), ICC 1247(107), L.550(122), ICCV-2(114), ICCV-10(124), ICC 3276(109), ICC 506(106), ICC 9697(91), 8397(111), FG.712(126), 7196(116), BDN-9-3(121), Cluster IV PLS.5241-2(7) Cluster V BG.256(2) Cluster VI ICHRN-1(1), Cluster VII.ICC 16340(78).

Statistical distance (D^2 Value) indicates the index of genetic diversity among the clusters. It would, therefore, be logical to effect crosses between genotypes belonging to clusters separated by the estimates of statistical distances. The study revealed some interesting features of sub-specific differentiation in the cultivated species of chickpeas.

The unique divergence of Kabuli and desi types in chickpea represent different germplasm pools (Bahl, 1979). Kabuli types possess genetic qualities as more number of primary branches, higher 100 seed weight and upright compact habit. On the contrary desi types can contribute characters like more number of seeds/pods, pods/plant and drought resistance which are lacking in Kabuli types. Therefore genes from Kabuli can be transferred to desi and vice versa by hybridization and selection for several combinations of characters.

The pattern of distribution of clustering revealed considerable genetic diversity within the material. In this study "Kabuli" types grouped into cluster I and III. The genotypes in cluster III were shorter in duration and had higher 100 seed weight (BG 1071, ICCV 2, V 550) than the genotypes in cluster I viz., ICC 4578, ICC 9697, ICC 10331, BG 1002 and PLS 5425. The notable genotypes Kodaikanal double, JG 11, ICC 12476, L 550 etc. were grouped into cluster III which had more number of pods per plant and also considerable yield traits. Genotype PLS 241 assigned into cluster IV and observed for highest 100 seed weight among the genotypes. Cluster V included the genotype of poor yielders. The cluster VI was totally contrast to the cluster V, had the highest numbers of primary branches and also high yielding genotypes. The genotype ICC 16340 is included in cluster VII, had short duration nature with considerable yield components traits.

The sum of all cannonical roots = 677.85; l 1=255.50; l 2=134.62; l 3 128.12. Contribution of Z_1 = 37.69%. Z_2 = 19.85% Z_3 = 18.90% Connonical vectors are given in Table (2). Since 5754 per cent of the variation is explained by first two cannonical roots, a two dimensional representation of the relative positions of the varieties is considered adequate.

Tabel 2. Cannonical vectors

Characters	Cannonical vectors		
	Z_1	Z_2	Z_3
Maturity days	0.149	0.418	0.416
Plant height	-0.045	-0.267	-0.028
Primary branches	0.376	0.062	0.194
Secondary branches	-0.184	-0.390	-0.024
Plant vigour	0.421	-0.428	-0.140
No. of pods	-0.355	-0.374	-0.324
100 seed weight	0.701	-0.149	-0.215
Seed yield per plant	0.058	0.501	-0.784

The study shows genetic variation among 126 varieties consisting 119 Desi Varieties including one double seeded genotype and few kabuli types. An apparent feature emerges from the analysis that most of kabuli genotype formed separate constellations in cluster III with exception of some desi genotypes. The cluster III genotypes posses the outstanding character of high number primary and secondary branches, 100 seed weight and yielding potential. It has been found that genotypes within cluster (III) are genetically divergent. These genotypes could be well utilized for evolving varietal improvement programme. Other clusters are also having divergent characters. In cluster VI. ICHRN-1 genotype possessed the higher number of branching habit, cluster VII, ICC 16340 genotype having highest number of pods/ plant among the entries, cluster V possessing genotype BG 256 for the highest 100 seed weight and cluster II genotype PLS 5433-2 for plant vigor. So, the divergent characters may be well utilized in hybridization programme for widening genetic base and also for selection. Cluster I varieties are having moderate yield component characters for all the genotypes.

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Effect of organics and irrigation levels on soil physical properties and yield of crops under sorghum-soybean cropping system

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Abstract : Field experiment was conducted to study the effect of addition of organic manures on physical properties, yield of Sorghum and the residual effect on the succeeding Soybean with different tillage treatments for residue management at TNAU under Sorghum-Soybean cropping sequence. The results revealed that the addition of organic manures to the first crop of Sorghum improved the soil physical properties such as bulk density, hydraulic conductivity, capillary and non capillary porosity besides yield enhancement. The residual effect of organics on Soybean yield was also noticed. However, the level of irrigation had no effect on the physical properties studied. *(Key Words : Sorghum - Soybean cropping system, organic manures, Bulk density, Hydraulic conductivity and Porosity)*

Crop yields are mainly controlled by physical, chemical and biological properties of the soil. Besides chemical and biological properties, the soil physical environment, especially bulk density, hydraulic conductivity and pore size distribution of the soil play a major role in providing good soil health. Further, physical properties are directly influenced by the application of organics. Addition of organics helps to have higher water retension by soils. The present study was made with the objective of studying the interactive effect of organics and irrigation levels on soil physical properties and to study the residual effect of organics on the residual crop of soybean under sorghum-soybean cropping sequence.

Materials and Method

A field experiment under sorghum-soybean cropping sequence was conducted at TNAU Farm,