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GENETIC DIVERGENCE, HERITABILITY AND GENETIC ADVANCE IN CHILLI (*CAPSICUM ANNUUM* L.)

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ABSTRACT

Genetic divergence, heritability and genetic advance for 10 characters in 32 genotypes of chilli (*Capsicum annuum* L.) were studied. Based on D^2 values, the genotypes were clustered in 11 gene constellations. Grouping of genotypes in different clusters was not related to their geographical origin. Considerable amount of genotypic and phenotypic coefficients of variation was observed for leaf area index, fruits/plant, fruit weight, and total yield, indicating existence of greater diversity for these characters. High heritability coupled with high genetic advance as percentage of mean and genetic coefficients of variation was observed in respect of leaf area index, fruits/plant, fruit weight, seeds/fruit, plant height and fruit length, indicating that these characters are under control of additive gene or nonenvironmental effects and could be dependable for yield improvement in chillies.

Key words: Genetic divergence, heritability, genetic advance, *Capsicum annuum*.

For an efficient breeding programme, selection of genetically divergent parents and superior genotypes is important which ensures the exploitation of heterosis and development of transgressive segregants. Very little work has been done to estimate the amount of genetic diversity in chilli (*Capsicum annuum* L.). Hence an effort was made to assess the existing genetic diversity, coefficient of variability, heritability and genetic advance in a set of 32 genotypes.

MATERIALS AND METHODS

Thirty two genotypes of chilli collected from different parts of India were studied during 1987-88. The crop was grown in randomized block design with three replications. Observations were recorded on plant height, number of primary branches, leaf area index,

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days to flowering, fruits/plant, fruit length, fruit girth, fruit weight, seeds/fruit and total yield/plant. Five randomly tagged plants in each treatment were used for recording observations. The genetic divergence was estimated using Mahalanobis' D^2 statistic and the populations were grouped into clusters by following the Tocher's Method [1]. Coefficient of variation was estimated as per Burton and De Vane [2]. Heritability in broad sense and genetic advance were calculated as per [3].

RESULTS AND DISCUSSION

The 32 genotypes were grouped into 11 clusters based on the D^2 values (Table 1). Cluster I was the largest, comprising 12 genotypes, followed by cluster II, which has 5 genotypes. Cluster III comprised of 4 genotypes, cluster IV had 3 and cluster V included two genotypes only. Clusters VI, VII, VIII, IX, X and XI had single genotype each, as these could not be clubbed with any other genotype.

The intracluster D^2 values ranged from 0.0 (cluster VI to XI) to 36.7 (cluster III) (Table 2). The intercluster D^2 value was maximum (159.1) between clusters X and XI. The minimum distance was between clusters II and V (36.9), indicating close relationship among the genotypes included.

The comparison of cluster means for the different characters (Table 3) indicated considerable differences between clusters for all the characters. Cluster X had the maximum number of fruits per plant (333.0) and total yield per plant (128.2 g). Cluster VIII had early-

Table 1. Distribution of 32 genotypes of chilli in different clusters

Cluster No.	No. of genotypes	Genotypes	Origin/source*
I	12	LIC-13, TPT Local-1, CA-555, CA-1824, CA-561, CA-196, Solan Yellow, LCA-1077, X-235, CA-165, ICA-1079, NP 46-A	Andhra Pradesh (5); Bihar (1); Kerala (1); Himachal Pradesh (1); Tamil Nadu (4)
II	5	CA-577, CA-1386, Jwala Pant C-1, Flame Fountain	Delhi (1); Tamil Nadu (2); Uttar Pradesh (2)
III	4	CA-960, LCA-180, Kiran-200, Suryamukhi	Andhra Pradesh (2); Tamil Nadu (1); West Bengal (1)
IV	3	CA-1449, TPT Local-2, CA-427	Tamil Nadu (2); Andhra Pradesh (1)
V	2	G-4, Pant C-2	Uttar Pradesh (1); Andhra Pradesh (1)
VI	1	CA-558	Tamil Nadu (1)
VII	1	G-5	Andhra Pradesh (1)
VIII	1	Waxy Globe	Kerala (1)
IX	1	Elephant Trunk	Uttar Pradesh (1)
X	1	CA-330	Kerala (1)
XI	1	Veerawada	Andhra Pradesh (1)

*Figures in parentheses indicate the number of genotypes from different states.

Table 2. Intra- and intercluster average divergence (D^2) values of 11 clusters from 32 genotypes of chilli

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
I	32.9	40.8	51.5	48.9	50.4	40.5	60.2	56.3	79.7	87.2	103.4
II		29.3	48.4	61.8	36.9	40.8	68.9	71.9	92.6	64.2	122.7
III			36.7	75.2	55.9	49.2	83.3	54.7	100.9	80.4	128.6
IV				25.2	63.9	58.5	46.7	75.5	49.9	112.7	82.9
V					31.7	56.8	77.2	77.5	98.1	73.7	128.0
VI						0.0	55.2	71.9	86.1	67.8	106.8
VII							0.0	93.2	62.4	104.2	63.3
VIII								0.0	95.0	114.9	131.9
IX									0.0	144.6	73.7
X										0.0	159.1
XI											0.0

flowering genotypes with lowest yields. Fruits per plant, leaf area index, fruit weight, and total yield were reported to be the chief contributors towards genetic divergence [4, 5].

These results indicate that no firm relationship between genetic divergence and geographical distances is detected (Table 1) [5]. Further, 11 entries from Andhra Pradesh did not group into a single cluster but were distributed over seven separate clusters.

The genetic components for different characters (Table 4) indicate a wide range of variation for all the characters except primary branches/plant and fruit girth. The maximum range of variation was recorded for fruits/plant, and the minimum for primary branches/plant. The phenotypic and genotypic variations were high for plant height, fruits/plant, seeds/fruit, and total yield [6, 7]. High phenotypic and genotypic coefficients of variation (PCV, GCV) were recorded for fruits/plant, leaf area index, fruit weight, and yield/plant. This indicates the higher magnitude of variability present in the germplasm and selection may therefore be effective for the improvement of these characters [6, 7]. Low PCV and GCV were recorded by primary branches/plant and days to flowering [7].

High heritability estimates in broad sense were recorded for plant height, leaf area index, days to flowering, fruits/plant, fruit length, fruit girth, fruit weight and seeds/fruit [7, 8], while moderate heritability estimates were recorded for primary branches/plant and total yield/plant [9]. High heritability coupled with high genetic advance were observed for plant height, leaf area index, indicating the influence of additive gene action and, consequently, a possibility of improving these traits through selection [7, 10].

Table 3. Cluster means for different characters in chilli

Cluster	Plant height (cm)	No. of primary branches per plant	Leaf area index	Days to 50% flowering	Fruits per plant	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	Seeds per fruit	Total yield per plant (g)
I	72.4	5.4	1.1	83.2	123.9	5.5	2.9	0.6	46.5	72.4
II	77.5	5.6	1.7	82.3	196.8	6.2	2.6	0.5	40.0	95.5
III	67.8	5.8	0.9	85.8	122.8	4.5	2.8	36.8	36.8	53.2
IV	68.4	5.3	0.9	79.7	152.9	6.3	2.9	66.1	66.1	96.4
V	90.7	5.6	1.3	77.8	202.7	4.7	2.8	55.8	55.8	103.5
VI	94.8	5.9	2.5	81.0	126.8	5.9	2.8	51.9	51.9	75.20
VII	97.3	4.9	1.8	87.5	113.6	4.2	5.3	67.9	67.9	108.7
VIII	16.7	5.0	0.1	80.5	14.9	1.8	3.1	33.4	33.4	4.1
IX	66.4	5.3	0.5	83.5	25.7	8.7	3.9	53.5	53.5	38.8
X	108.4	6.3	3.6	84.0	333.0	5.6	2.8	39.9	39.9	128.2
XI	120.9	6.0	1.1	96.5	70.3	2.5	4.3	91.2	91.2	103.2
SD	26.4	0.4	0.93	4.8	84.9	1.8	0.8	0.4	16.2	34.4
$\bar{X}$	80.1	5.5	1.4	83.8	134.6	5.1	3.3	0.8	52.9	79.9
CV %	32.9	7.4	66.8	5.7	63.2	35.4	24.2	53.9	30.6	43.0

The high heritability estimates for primary branches/plant, days to flowering, and fruit girth was not coupled with high genetic advance, thus, the expression of these characters can be modified through hybridization, followed by selection.

Table 4. Variability and genetic parameters for different characters of chilli

Character	Range	Mean±SE	Genotypic variance	Phenotypic variance	GCV (%)	PCV (%)	Heritability (%)	GA (% of mean)
Plant height (cm)	16.7–108.4	76.6±2.3	375.9	381.0	25.3	25.5	98.7	51.2
Primary branches/plant	4.4–6.8	5.5±0.2	0.3	0.3	9.9	10.6	87.3	18.9
Leaf area index	0.1–3.6	1.3±0.1	0.5	0.5	56.3	56.5	99.3	115.5
Days to 50% flowering	73.5–96.5	83.4±0.7	27.5	28.1	6.3	6.4	98.0	12.9
Fruits/plant	14.9–333.0	140.9±13.1	3961.2	4132.9	44.7	45.6	95.9	90.1
Fruit length (cm)	1.8–8.7	5.4±0.2	1.9	1.9	25.6	25.9	97.9	52.2
Fruit girth (cm)	2.2–5.3	3.0±0.1	0.4	0.4	19.6	20.1	94.7	39.3
Fruit weight (g)	0.2–1.0	0.6±0.02	0.1	0.1	42.2	42.4	99.4	86.8
Seeds/fruit	27.1–91.2	48.5±1.3	187.8	189.5	28.2	28.4	99.1	57.9
Total yield/plant (g)	4.1–128.0	78.6±16.3	671.6	935.9	33.0	38.9	71.8	57.6

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