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Genetic Divergence Studies for Yield Contributing Traits in Chilli Genotypes under Hill Zone of Karnataka

A. Mamatha, Devaraju, U. Premchand

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Abstract Studies on genetic diversity was conducted with forty chilli genotypes at the field of vegetable science block in college of Horticulture. Mudigere during *kharif* season. The observations were recorded for 13 quantitative characters viz., plant height at 60 DAT, plant height at 90 DAT, number of branches per plant at 60 DAT, number of branches per plant at 90 DAT, days to first flowering, days to 50% flowering, days to first fruit harvest, number of fruits per plant, fruit diameter, fruit weight, fruit yield per plant, fruit yield per plot and fruit yield per ha were taken into consideration. The forty genotypes were grouped into eight clusters. The cluster I constituted maximum number of genotypes (fifteen) followed by cluster II – 13 genotypes, cluster III – 6 genotypes, cluster VII – 2 genotypes. The other remaining cluster consists of single genotype each. The highest inter cluster distance was observed between cluster VI and VIII whereas, the distance between cluster II and IV was least. The cluster VI had recorded maximum intra-cluster distance followed by cluster II and cluster VII. Intercrossing among the genotypes belonging to cluster VIII, II and III had been suggested to develop high yielding varieties with desirable characters.

Keywords Chilli, *Capsicum annuum* L., Diversity, Variability, Genotypes.

Introduction

Chilli (*Capsicum annuum* L.) 2n=24 is an important vegetable as well as condiment crop, widely grown throughout India. Green fruit of chilli are one of the richest sources of anti-oxidant vitamins such as vitamin A, C and E. The capsaicin alkaloid is responsible for pungency and it has medicinal value also. In India, the major chilli growing states are Andhra Pradesh, Karnataka, Maharashtra, Orissa, Tamil Nadu, Madhya Pradesh and Rajasthan. Al though chilli is grown widely in India but the lack of improved genotypes is the main constraint to low yield.

Assessment of different desirable traits spread

A. Mamatha*, Devaraju
Department of Vegetable Science,
College of Horticulture, Mudigere 577132,
University of Agricultural and Horticultural Sciences,
Shivamogga, Karnataka, India
C/O Ajjappa K Beside Ramakrishna theater,
Mahadevi Road, Challakere 577522 (Tq),
Chitradurga (District), Karnataka, India

U. Premchand
Department of Plant Pathology,
College of Horticulture, Bagalkot 577103,
University of Horticultural Sciences,
Bagalkot, Karnataka, India
e-mail : mamathahorti@gmail.com
*Correspondence

Table 1. Forty germplasm lines used in the study. *DCC-Devihosur Chilli Collection.

Sl. No.	Name of germplasm	Sl. No.	Name of germplasm	Sl. No.	Name of germplasm	Sl. No.	Name of germplasm
1	DCC – 1	11	DCC – 27	21	DCC – 55	31	DCC – 127
2	DCC – 2	12	DCC – 33	22	DCC – 66	32	DCC – 134
3	DCC – 5	13	DCC – 36	23	DCC – 69	33	DCC – 135
4	DCC – 10	14	DCC – 39	24	DCC – 77	34	DCC – 157
5	DCC – 14	15	DCC – 42	25	DCC – 82	35	DCC – 164
6	DCC – 15	16	DCC – 43	26	DCC – 86	36	DCC – 167
7	DCC – 18	17	DCC – 44	27	DCC – 92	37	DCC – 168
8	DCC – 20	18	DCC – 50	28	DCC – 103	38	DCC – 172
9	DCC – 24	19	DCC – 52	29	DCC – 109	39	DCC – 185
10	DCC – 25	20	DCC – 53	30	DCC – 115	40	DCC – 186

over diverse genotypes is important to rapid advance in yield improvement of any crop. The importance of genetic diversity in the improvement of a crop has been studied in both self and cross pollinated crop. The plant breeders are always interested to know the genetic divergence among the varieties available due to reasons that crosses between genetically diverse parents are likely to produce high heterotic effect and crosses involving distantly related parents within the same species produce wide spectrum of variability. A logical way to start any breeding program is to collect precise information on the nature and degree of genetic divergence that would help the plant breeder in choosing the right type of parents for purposeful hybridization in heterosis breeding. Moreover, evaluation of genetic diversity is important to know the source of genes for a particular trait within the available germplasm. Hence, Mahalanobis D^2 statistic of multivariate analysis is recognized as a powerful tool in quantifying the degree of genetic divergence among the populations. The present study was undertaken to assess the genetic diversity in 40 chilli (*Capsicum annuum* L.) genotypes and to identify suitable donors for a successful breeding program in this crop.

Materials and Methods

Table 2. Cluster composition based on D^2 statistics in chilli genotypes.

Clusters	Number of genotypes	Genotypes included in the cluster*
I	15	DCC-3, DCC-5, DCC-17, DCC-21, DCC-9, DCC-6, DCC-24, DCC-8, DCC-15, DCC-16, DCC-19, DCC-28, DCC-30, DCC-20, DCC-2.
II	13	DCC-34, DCC-36, DCC-33, DCC-32, DCC-35, DCC-38, DCC-27, DCC-18, DCC-29, DCC-12, DCC-7, DCC-13, DCC-10.
III	6	DCC-37, DCC-40, DCC-39, DCC-4, DCC-23, DCC-25.
IV	1	DCC-11
V	1	DCC-26
VI	1	DCC-31
VII	2	DCC-1, DCC-22
VIII	1	DCC-14

Table 3. Per cent contribution from different characters to the total divergence in chilli genotypes.

Characters	Number of times ranked first	Contribution to total divergence %
Plant height (cm) at 60 DAT	0	0.00
Plant height (cm) at 90 DAT	0	0.00
Number of branches per plant 60 DAT	0	0.00
Number of branches per plant 90 DAT	0	0.00
Days to first flowering	1	0.31
Days to 50 per cent flowering	25	3.21
Days to first fruit harvest	84	10.77
Number of fruits per plant	96	12.31
Fruit diameter (cm)	222	28.46
Fruit weight (g)	315	40.38
Fruit yield per plant (g)	16	2.05
Fruit yield per plot (kg)	9	1.15
Fruit yield (t/ha)	12	1.54

Table 4. Intra and inter cluster D^2 and D values in chilli genotypes.

Clusters	I	II	III	IV	V	VI	VII	VIII
I	45.55	116.95	124.12	108.13	178.00	315.23	382.32	155.94
II		83.13	107.80	97.24	99.60	135.92	189.12	312.50
III			77.85	210.63	158.89	141.06	364.81	371.01
IV				0.00	102.68	294.16	152.85	179.28
V					0.00	172.07	148.55	278.21
VI						0.00	219.66	700.43
VII							61.97	553.03
VIII								0.00

The present investigation was carried out at the vegetable science block in the Department of Horticulture, College of Horticulture, Mudigere, University of Agricultural and Horticultural Sciences. Shivamogga during the *kharif* 2013-14.

For this experiment, forty chilli germplasm lines were taken which is reported in Table 1. Experiment was laid out in randomized block design with two replications. 45 days oil seedlings were transplanted in 60 × 45 cm spacing and all the recommended agronomic package of practices were followed. In each genotype, 5 plants were randomly selected for recording the observations. The observations were recorded for Thirteen quantitative characters viz., plant height at 60 DAT, plant height at 90 DAT, number of branches per plant at 60 DAT, number of branches per plant at 90 DAT, days to first flowering, days to 50% flowering, days to first fruit harvest, number of fruits per plant, fruit diameter, fruit weight, fruit yield per plant, fruit yield per plot and fruit yield per ha were taken into consideration for statistical analysis using Mahalanobis D^2 statistics. Grouping of genotypes into various clusters was carried out by using Tocher's method and inter and intra cluster distance was calculated.

Results and Discussion

Analysis of variance revealed that the presence of significant variability among chilli genotypes for all the characters studied. Based on the relative magnitude of D^2 estimates, the 40 genotypes could be grouped into eight clusters (Table 2).

It is confirmed that the genotypes grouped together are less divergent than the ones, which are placed in different clusters. Among them, cluster 1 was the largest and had as many as 15 genotypes followed by the cluster II had 13 genotypes, cluster III consists of 6 genotypes, cluster VII had 2 genotypes and cluster IV, V, VI and VIII comprising of solitary genotypes each (Table 2). The pattern of clustering revealed that prevalence of certain extent of diversity in the materials maintained. Manju and Sreelathakumary [1]. Senapati et al. [2], Amarul Junior et al. [3], also niticed maximum diversity in the genotypes studied.

The selection and choice of parents mainly depend upon contribution of characters towards divergence. In the present study (Table 3) the highest contribution of character was observed under fruit weight (40.38%), followed by fruit diameter (28.46%), number of fruits per plant (12.31%), days to first harvest (10.77%), days to 50% flowering (3.21%), fruit yield per plant (2.05%), fruit yield/ha (1.54%), fruit yield per plot (1.15%) and days to first flowering (0.31%). Farhad et al. [4]. Smitha and Basavaraja [5], Vani et al. [6], also reported relative contribution of some characters towards divergence in chilli.

The crosses among divergent parents are likely to yield desirable recombinants. A breeding program may be initiated between the selected genotypes belonging to different clusters considering their cluster means (Tables 4 and 5). The mean value for all the characters were calculated which indicates the cluster VIII had highest mean value for days to first flowering (50.90), days to 50% flowering (69.20), days to first harvest (64.40) and fruit yield per plot (1.52) and least mean value for number of branches at 90 DAT

Table 5. The mean values of thirteen characters for 8 clusters in chilli genotypes. 1. Plant height (cm) at 60 DAT, 2. Plant height (cm) at 90 DAT, 3. Number of branches per plant 60 DAT, 4. Number of branches per plant 90 DAT, 5. Days to first flowering, 6. Days to 50% flowering, 7. Days to first fruit harvest, 8. Number of fruits per plant, 9. Fruit diameter (cm), 10. Fruit weight (g), 11. Fruit yield per plant (g), 12. Fruit yield per plot (kg), 13. Yield/ha (tonnes).

Clusters	1	2	3	4	5	6	7	8	9	10	11	12	13
I	24.58	46.52	2.85	7.71	41.80	61.08	56.18	159.39	2.73	2.48	78.20	1.28	17.15
II	26.35	50.09	3.28	8.48	39.65	59.77	55.10	194.56	3.24	3.40	127.69	1.19	27.59
III	26.48	53.08	3.27	8.67	38.18	58.85	54.45	187.15	3.52	2.40	105.65	1.31	22.83
IV	26.10	48.00	2.90	8.50	46.70	63.10	57.40	115.70	2.96	3.89	90.04	1.49	19.45
V	24.80	48.40	3.50	9.00	45.90	65.70	60.90	143.80	4.28	3.32	94.65	1.00	20.45
VI	27.10	53.50	3.40	9.20	37.10	57.20	51.20	207.60	4.23	3.63	136.31	1.37	29.45
VII	26.65	45.95	3.10	7.01	42.50	62.80	57.90	169.85	3.85	5.23	105.23	1.44	22.73
VIII	27.11	46.10	3.40	7.00	50.90	69.20	64.40	168.70	2.54	2.18	73.99	1.52	15.98

(7.00), fruit diameter (2.54), fruit weight (2.18) and fruit yield per plant (73.99), cluster VI had highest mean value for plant height at 60 DAT (27.10), plant height at 90 DAT (53.50), number of branches at 90 DAT (9.20), number of fruits per plant (207.60), fruit yield per plant (136.31) and fruit tield/ha (29.45). Similarly cluster V recorded highest mean value for number of branches at 60 DAT (3.50) and fruit diameter (4.28). This indicated that genotypes coming under the cluster VIII, VI and V may be utilized in breeding program. A comparison of cluster means for different characters indicated cosiderable differences between clusters for all the characters. Similar results were also reported by Vani et al. [6], Yating et al. [7].

The intra cluster distance ranged from 0.00 (Cluster IV, V, VI, VIII) to 77.82 (Cluster III). The genotypes were in the cluster III were more divergent than cluster IV, V, VI and VIII, the tendency of genotypes from diverse geographic regions group together in one cluster might be due to similarity in requirements and selection approaches under domestic utilization. These results are in agreement with the earlier reports of Manju and Sreelathakumary [1], Smitha and Basavaraja [5]. The inter cluster distance (Table 4) ranged from 97.24 to 700.43 between cluster II and IV and VIII. In general, among the 8 cluster inter cluster distance was highest between VI and VIII which has been reflected in the fruit related characters (Table 4). The present study clearly indicates that the geographical isolation of genotypes resulted in reproductive isolation leading to genetic divergence. Interestingly the diversity observed among the clusters was mainly due to important productive and economic traits. Therefore, the genetic material used in this study will be useful hybridization to generate rare desirable recombinants in chillies to enhance the productivity.

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