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Genetic Diversity Studies in Chilli (Byadagi Kaddi) Genotypes

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A B S T R A C T

To study the genetic divergence of chilli, 48 genotypes were evaluated in Randomized Block Design with two replications at the experimental field of College of Horticulture Bagalkot. The genetic material exhibited wide range of genetic divergence for all the 20 characters investigated. The cluster I constituted maximum number (20) of genotypes, cluster II had 5 genotypes cluster- III, IV and V with 7 genotypes, cluster VI and cluster VII had only one genotype each. Cluster-VI and cluster-V showed maximum inter cluster distance whereas the distance between clusters IV and II was least. Cluster-V had recorded maximum intra-cluster diversity.

Introduction

Chilli has diverse uses as spice, condiment and medicine, vegetable and ornamental plant. Byadagi chilli is one such variant, predominantly appears across Dharwad, Gadag and Haveri districts of Karnataka. Byadagi chilli known for its quality attributes like colour, flavour and mild pungency. Generally diverse plants of compatible taxa are expected to give high hybrid vigour (Harrington, 1940) and hence, it necessitates study of genetic divergence among the existing varieties and germplasm collection for identification of more ideal parents for hybridization programme. The information on genetic divergence of various traits particularly of those that contribute to yield and quality would be most useful in planning the breeding programme. The D^2 statistic developed by Mahalanobis (1936) provides a measure of magnitude of divergence between two groups under comparison. It considers the variation produced by any character and their consequent effect that it bears on other characters. Grouping of genotypes based on D^2 analysis will be useful in choosing suitable parental lines for heterosis breeding. Such

studies are also useful in selection of parents for hybridization to recover superior transgressive segregants and it can further result into release of improved open-pollinated varieties for commercial cultivation.

Materials and Methods

The present investigation was carried out during kharif 2017-18 at Havelli farm College of Horticulture Bagalkot. 48 genotypes (Byadagi kaddi) of chilli in a randomized block design with two replications. The nursery was raised during First week of July and the seedlings were transplanted at a spacing of 60 cm × 60 cm. The crop was raised as per the recommended package of practices. Observations were recorded from five randomly selected plants in each experimental plot for growth, yield and quality parameters. The parameters considered for the study were plant height (cm), number of primary branches, plant spread (cm) number of fruits plant, fruit diameter (cm), fruit length (cm), average dry fruit weight (g), fruit yield per plant (g),fruit yield per plot(kg),fruit yield per ha(t),ascorbic acid (mg/100g) and capsaicin (SHU). Analysis of variance was carried out as per the procedure given by Panse and Sukhatme (1964). Mahalanobis (1936) D^2 statistics was used for assessing the genetic divergence between populations comprising 48 chilli genotypes. Using all D^2 values, the genotypes were grouped into clusters using Tocher's method as described by Rao (1952). The intra- and inter-cluster distances were calculated by the formula given by Singh and Chaudhary (1979).

Results and Discussion

Analysis of variance revealed the significant differences among genotypes for all the traits studied indicating the presence of sufficient genetic variability to be exploited in a breeding programme (Table 1).

Genetic diversity of the genotypes

Based on the D^2 value, 48 genotypes have been grouped into 7 clusters. Cluster I was the largest group comprising of 20 genotypes followed by cluster II of 5 genotypes and cluster III IV and V of 7 genotypes. Cluster VI and VII had only one genotype (Table 2). Here no relationship between genetic diversity and geographic diversity. (Thul *et al.,* 2009) (Derly *et al.,* 2001). The selection and choice of parents mainly depend on contribution of characters towards genotypic divergence.

In the present study (Table 3), the capsaicin content (66.76%), had maximum contribution towards divergence followed by fruit yield per plot (10.02%), fruit diameter (9.75%) and number of fruits per plant (7.15%). All the three are very important traits for productivity as well as economic value of product. The intra cluster divergences ranged from 40.91 to 57.16 and inter cluster divergence ranged from 65.11 to 582.14 (Table 4). The highest inter cluster distance was observed between clusters V and VI (582.14) followed by clusters IV and V (581.15),clusters II and V (439.96) and cluster V and VII (384.14).

The genotypes of cluster-I has maximum plant height at 60 days (62.23 cm) plant number of primary branches (4.80), number of secondary branches (6.09) and plant spread (E-W) at 60 and 90 days (42.15 cm and 42.48 cm respectively). Cluster-III has maximum fruit length (14.36 cm). Cluster-IV had highest mean value for number of fruits per plant (46.34 g), dry fruit yield per plant(46.91g),dry fruit yield per plot (1.31 kg) and dry fruit yield per plot (12.98 q/ha). Cluster-V had maximum ascorbic acid (163 mg/100 g), similarly cluster VI has maximum plant height at 90 days and 120 days (74.85 cm and 86.75 cm), Plant spread (N-S) at 60 90 and 120 days (58.15 cm 58.90 cm and 65.40 cm, respectively) and capsaicin (10230.50SHU).

Table.1 Analysis of variance for various characters in Chilli (mean sum of squares)

Sl. No.	Character /Source	Mean sum of squares	
		Genotype d.f=47	Error d.f=47
1	Plant height 60 days	52.02*	29.93
2	Plant height 90 days	65.41**	32.08
3	Plant height 120 days	93.08**	25.84
4	Number of primary branches	0.50*	0.290
5	Number of secondary branches	0.289*	0.17
6	Plant Spread @ 60 days E-W	48.36*	29.68
7	Plant Spread @ 60 days N-S	51.57**	24.01
8	Plant Spread @ 90 days E-W	54.73**	28.90
9	Plant Spread @ 90 days N-S	47.52**	27.72
10	Plant Spread @ 120 days E-W	49.34**	27.48
11	Plant Spread @ 120 days N-S	59.12**	29.19
12	Fruit length(cm)	2.72*	0.691
13	Fruit diameter(mm)	0.92**	0.108
14	Number of fruits per plant	31.70**	4.91
15	Average dry fruit weight(g)	0.04**	0.015
16	Dry fruit yield per plant (g)	135.61**	31.61
17	Fruit yield per plot(kg)	0.10*	0.0089
18	Dry fruit yield per plot (q/ha)	10.43**	2.43
19	Ascorbic acid (mg/100g)	714.90**	4.70
20	Capsaicin (SHU)	3666527.16**	1456295.44

d.f = Degrees of freedom

Table.3 Relative percent contribution of different characters in the total divergence in chilli

Sl. No.	Source	Times ranked 1st	Contribution %
1	Plant height 60 days	1	0.09%
2	Plant height 90 days	11	0.98%
3	Plant height 120 days	2	0.18%
4	No of primary branches	1	0.09%
5	NO of secondary branches	7	0.62%
6	Plant Spread @ 60 days E-W	2	0.18%
7	Plant Spread @ 60 days N-S	3	0.27%
8	Plant Spread @ 90 days E-W	9	0.8%
9	Plant Spread @ 90 days N-S	3	0.27%
10	Plant Spread @ 120 days E-W	9	0.8%
11	Plant Spread @ 120 days N-S	1	0.9%
12	Fruit length(cm)	12	1.06%
13	Fruit diameter(mm)	110	9.75%
14	Number of fruits per plant	81	7.18%
15	Average dry fruit weight(g)	10	0.89%
16	Dry fruit yield per plant (g)	2	0.18%
17	Fruit yield per plot(kg)	113	10.02%
18	Dry fruit yield per plot(q/ha)	3	0.27%
19	Ascorbic acid (mg/100g)	8	0.71%
20	Capsaicin (SHU)	753	66.76%
	Total	**1141**	**102.89**

Table.2 Clustering pattern of 48 genotypes of chilli based on D^2 values

Cluster number	Number of genotypes	Genotypes included
I	20	BK-37, BK-41,BK-22, BK-31, BK-23, BK-40,BK-19,BK-25, BK-32,BK-42, BK-33, BK-38, BK-43, BK-47, BK-39, BK-29,BK-2, BK-45,BK-14, BK- 24
II	5	BK-3, BK -12, BK -11, BK- 18,BK-46
III	7	BK- 7, BK- 48, BK-34, BK-5, BK- 20, BK-30,BK- 44
IV	7	BK-36, BK-9,BK-16, BK-15, BK-28, BK-26,BK- 27
V	7	BK- 6, BK-13,BK-1, BK-8,BK-35, BK- 10, BK- 21
VI	1	BK-17
VII	1	BK-14

Table.4 Average intra cluster and inter cluster D^2 values of 7 clusters for 20 characters of chilli

Clusters	I	II	III	IV	V	VI	VII
I	**40.91**	74.09	97.38	80.47	360.99	88.27	79.71
II		**46.38**	158.50	117.94	439.96	65.11	139.49
III			**52.67**	207.24	171.73	211.67	116.87
IV				**56.80**	581.15	88.27	100.50
V					**57.16**	582.14	384.14
VI						**0.00**	150.90
VII							**0.00**

Table.5 The mean values of 20 characters for 7 clusters formed by48 genotypes in chilli

Clusters	Plant height(cm)			Plant spread(cm) (E-W)			Plant spread(cm) (N-S)		
	60 Days	90 Days	120 Days	60 Days	90 Days	120 Days	60 Days	90 Days	120 Days
I	62.23	69.41	71.15	42.15	42.48	49.21	47.94	48.84	49.37
II	59.16	64.52	69.34	38.87	38.97	51.13	45.58	48.22	48.70
III	60.49	69.04	75.16	39.06	41.04	52.14	49.46	52.00	55.05
IV	58.22	70.89	73.04	38.37	39.10	46.01	43.79	46.64	48.23
V	58.06	67.99	68.71	38.46	39.00	49.21	49.17	49.53	50.64
VI	59.60	74.85	86.75	39.70	42.05	49.75	58.15	58.90	65.40
VII	47.75	62.15	66.38	37.65	41.75	60.45	52.20	55.80	59.70

Contd……

Clusters	Primary branches	Secondary branches	Fruit length(cm)	Fruit diameter (mm)	Number of fruits per plant	Average dry fruit weight(g)
I	4.80	6.09	13.81	5.03	41.94	0.92
II	4.01	5.75	13.17	4.47	40.14	0.71
III	4.71	5.80	14.36	5.31	43.30	0.80
IV	4.23	6.04	13.87	5.04	46.34	1.01
V	4.32	5.79	12.49	5.09	43.39	0.87
VI	3.70	5.60	13.15	4.65	44.50	0.58
VII	4.20	5.55	13.75	7.05	39.60	1.02

Contd……

Clusters	Fruit yield per plant (g)	Fruit yield per plot (kg)	Fruit yield per ha(q)	Capsaicin (SHU)	Ascorbic acid (mg/100g)
I	38.61	1.07	10.67	6576.04	119.04
II	28.52	0.79	7.87	6899.84	117.84
III	34.75	0.97	9.62	6807.31	138.60
IV	46.91	1.31	12.98	6646.11	106.27
V	37.66	1.04	10.39	7118.72	163.00
VI	25.65	0.71	7.10	10230.50	108.49
VII	40.42	1.13	11.15	7449.75	118.20

Cluster VII had maximum plant spread (E-W) at 120 days (60.45 cm), fruit diameter (7.05 mm), fruit yield per plant (46.91) and average dry fruit weight (1.02g) (Table 5).

In general the clusters VI and VII had BK-14 and BK-17 which were clustered separately, these are may be utilized as source of parent material in future breeding programme. The present study clearly indicates that the geographical isolation leading to divergence. Intresingly 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 to hybridization to generate rare desirable recombinants in chillies to enhance the productivity.

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