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Genetic Diversity in Bird Eye Chilli (*Capsicum frutescens* L.) Germplasm

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ABSTRACT

Thirty one genotypes of bird eye chilli were used to study the nature of genetic divergence for 12 economically important characters. Diversity studies was carried out using Mahalanobis D^2 **statistics method.** From the D^2 statistics the genotypes were grouped into seven clusters. Cluster IV included maximum seven genotypes. The highest dissimilarity was observed between cluster III and VII with inter cluster distance of 1162.62. Cluster IV and VI had the lowest dissimilarity (33.76).Intercrossing of genotypes A14, A16,A17,A19 of cluster III and genotypes A23, A31, A30, A21,A28 of cluster VII is expected to result in high heterosis.

Key Words: Bird eye chilli, Genetic diversity, Inter and intra-cluster distance.

INTRODUCTION

Bird eye chilli (*Capsicum frutescens* L.) is one of the important crops grown for its fruits in India. The Bird Eye pepper is a slow-growing short-term perennial or perennial sub-shrub. Flowers are in clusters of 2 or more, waxy greenish white, usually erect. Fruits elongate, usually upright, usually small and narrow, up to 5cm x 1cm, green to cream and yellow when immature, orange to red when mature, fruit wall smooth and extremely pungent. The pungent fruits are consumed in small quantity and considered as spice or condiment for seasoning and stimulating appetite as well as used in local medicine (Srinivas and Thomas, 2018). It is consumed widely across malnad regions of South Karnataka, Kerala, Tamil Nadu and in north-east India, particularly in the states of Mizoram and Manipur. The north-eastern hill (NEH) region, being one of the hot-spots of biodiversity in the Indian gene centre, is also known for its richness in ethnic diversity and traditional culture (Dutta *et al*, 2015). Information on genetic divergence of plant material is vital to a plant breeder for efficient choice of parents for hybridization. It is an established fact that genetically diverse parents are likely to contribute desirable segregants. More diverse the parents greater the chances of obtaining high heterotis F_1s and broad-spectrum variability in segregating generations (Murthy, 1965; Murthy and Arunachalam, 1966; Molla *et al,*1974). Parents identified on the basis of divergence analysis are expected to be more promising in hybridization for both self and cross pollinated crops.

The D^2 statistic is a tool to evaluate large number of germplasm lines for their genetic diversity and helps in identification of genetically divergent parents for their exploitation in hybridization programs as hybrids between lines of diverse origin display greater heterosis than those between closely related strains. Very little information is available on genetic divergence of bird eye chilli. Hence the present study was carried out to ascertain nature and magnitude of genetic diversity among 31 germ plasm lines using D^2 statistic.

MATERIALS AND METHODS

Thirty one bird eye chilligenotypes collected from different places of Uttara Kannada district formed the experimental material. The present experiment was conducted at the ICAR-KVK,Uttara Kannada farm. Experiment was laid out in a randomised complete block design with

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Table 1. Distribution of 31 genotypes in different cluster.

Cluster number	**Number of genotypes**	**Cluster members**
I	4	A4, A9, A11, A12
II	3	A6, A24, A26
III	4	A14, A16,A17,A19
IV	7	A1, A7, A10, A13, A15, A20, A22
V	4	A2, A3,A18,A25
VI	4	A5, A8,A27,A29
VII	5	A23, A31, A30, A21, A28

two replications. The 60 days old seedlings were planted in main field at 2.7m X 2.7 m spacing. Other package of practices of chilli were followed for raising good crop. The observations were recorded on five randomly selected plants of each genotype for 12 quantitative parameters, namely, length of first internode, plant height, plant spread, length of leaf blade, width of leaf blade, days to 50% flowering, fruit length, fruit diameter, fruit stalk length, fresh wt. of 100 fruits, dry wt. of 100 fruits and fruit yield per plant. Multivariate analysis using Mahalonobis D^2 statistics (Mahalanobis, 1936) was used for assessing the divergence and grouping of the genotypes was done according to Tochers method as described by Rao (1952). Statistical analysis of data was carried out using the BioStat statistical programme.

RESULTS AND DISCUSSION

On the basis of computation of D^2 values, 31 bird eye chilli genotypes were classified into 7 clusters with an assumption that those within a cluster had smaller differences in D^2 values among themselves than those of other clusters. Depending on their genetic divergence, cluster IV was the largest cluster with seven genotypes, indicating that less variation existed among the genotypes for these quantitative traits, followed by cluster I, III, V and VI (each with 4 genotypes). Cluster II and VII had 3 and 5 genotypes, respectively. Distribution of genotypes in different cluster is shown in Table 1. Intra-cluster distances were smaller than inter-cluster distances, indicating presence of wider genetic diversity among genotypes included in these clusters (Table 2). Occurrence of such diversity contributes to heterosis and is therefore useful in identifying transgressive segregation. Similar findings were reported by Srinivas *et al* (2015).

Intra-cluster distances varies from 6.00 to 45.40, with cluster II showing the maximum distance. Maximum inter cluster distance (Table 2) was observed between cluster III and cluster

Table 2. Inter-cluster and intra-cluster distances among 14 clusters in bird eye chilli based on D^2 analysis.

Cluster	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**
I	40.38	351.81	113.06	598.10	99.79	702.17	782.01
II		45.40	650.61	81.10	133.32	114.00	144.33
III			14.57	996.11	323.90	1151.79	1162.62
IV				12.38	293.37	33.76	71.21
V					9.11	335.31	429.85
VI						6.00	92.37
VII							6.40

VII (1162.62). Genotypes of clusters with maximum inter cluster distance are expected to be genetically more divergent. Selection of parents for hybridization should be done from two clusters having higher inter cluster distance, to aim higher variability. Thus, the cross between the genotypes A6, A24, A26 from cluster III and genotypes A23, A31, A30, A21,A28 from cluster VII can be used in bird eye chilli breeding to achieve maximum heterosis. Dhillon *et al* (2017) also reported about selection of parental lines falling in clusters with highest inter cluster distances for developing better hybrids.

Differences in cluster-means (Table 3) existed for almost all characters. Highest mean value for plant height (106.50 cm), plant spread (91.00), length of leaf blade (11 cm), fruit stalk length (3.20 cm) and dry wt. of 100 fruits (10.75 g) was observed in cluster IV. Cluster VI recorded maximum length of first internode (10.15 cm), width of leaf blade (8.30 cm), fresh wt. of 100 fruits (25 g) and fruit yield per plant (413 g) while cluster VII showed highest mean value for days to 50% flowering (112), fruit length (2.85 cm) and fruit diameter (2.65 cm).

Cluster III recorded lowest mean values for length of first internode (6.89cm), plant height (61.13cm), plant spread (51.13 cm), length of leaf blade (6.48cm), width of leaf blade (4.19cm), days to 50% flowering (72.50), fruit length (0.93 cm), fruit diameter (0.83 cm), fruit stalk length (2.05 cm), fresh weight of 100 fruits (9.76 gm), dry weight of 100 fruits (4.19 g) and fruit yield per plant (176.76 g). Based on the cluster mean cross between genotypes of cluster IV, VI, VII with genotypes of cluster IIIshould result in production of highly transgressive segregants for yield contributing characters. Also, this stands to increase variability and scope for selection of superior lines. This result was in confirmation with results of Vaishnavi *et al* (2017) in bird eye chilli.

CONCLUSION

It was concluded that highest inter cluster distance between clusters namely III (A14, A16,A17,A19) and A23, A31, A30, A21,A28 of cluster VII indicated the presence of large diversity among genotypes. Hence genotypes of cluster III and VII may be used as parents in hybridization for obtaining useful segregants.

Table 3. Cluster mean value of 12 different characters of bird eye chilli genotypes.

Cluster	Characters											
	LFI	PH	PS	LLB	WLB	DF	FL	FD	FSL	FW	DW	FYP
1	6.42	75.90	65.04	7.76	5.35	78.85	1.18	0.99	2.44	13.50	5.21	252.32
2	7.90	94.65	77.30	9.07	6.53	85.85	1.76	1.94	2.87	19.91	7.76	365.99
3	4.89	61.13	51.13	6.48	4.19	72.50	0.93	0.83	2.05	9.76	4.19	176.76
4	8.80	106.50	91.00	11.00	7.15	93.00	2.30	2.14	3.20	22.65	10.75	408.00
5	7.25	85.00	71.00	8.00	6.40	86.00	1.50	1.38	2.60	17.50	5.90	330.00
6	10.15	101.00	81.00	10.15	8.30	91.00	2.20	2.24	3.10	25.00	10.70	413.00
7	7.85	94.00	84.00	10.04	6.90	112.00	2.85	2.65	3.05	21.00	7.95	380.00

LFI - Length of first internode (cm)
PH - Plant height (cm)
PS - Plant spread (cm)
LLB - Length of leaf blade (cm)
WLB - Width of leaf blade (cm)
DF - Days to 50% flowering
FL - Fruit length (cm)
FD - Fruit diameter (cm)
FSL - Fruit stalk length (cm)
FW - Fresh wt. of 100 fruits (g)
DW - Dry wt. of 100 fruits (g)
FYP - Fruit yield per plant (g)

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