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GENETIC VARIABILITY OF BIRD'S EYE CHILLI (*CAPSICUM FRUTESCENS* L.) IN HILL ZONES OF KARNATAKA, INDIA

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Keywords: Capsicum frutescens, Genetic variability, Diversity, Correlation

Abstract

Thirty-five accessions of bird's eye chilli (*Capsicum frutescens* L.) were evaluated for genetic variability, diversity and character association between various traits. Analysis of variance revealed high significant differences among all the accessions for all the characters studied. High to moderate estimates of genotypic coefficient of variation and phenotypic coefficient of variation were reported for most of the characters studied indicating the presence of wide variability among the accessions. Correlation studies indicated positive association of fruit yield per plant with weight of seeds per fruit, fresh weight of ten fruits and fruit length. Out of 19 characters studied, 16 showed direct positive effect on yield per plant. Accessions were grouped into six clusters with inter cluster D^2 values ranging between 172.33 and 1275.15. Higher ascorbic acid and capsaicin contents were recorded in Acc.133 and Acc.164, respectively. The most promising accessions for fruit yield were Acc.160 and Acc.158.

Introduction

Capsicum frutescens L. one of the most important species of the genus *Capsicum* is grown and consumed widely across north-east India, and also grown as homestead crop in the states of Kerala and Karnataka in India. It is a wild species of chilli and often used to denote any small sized, pointed chilli of high pungency. Unlike cultivated chilli i.e. *Capsicum annuum* is a short-lived perennial and bears fruits throughout the year. It is an erect, branched and semi-woody plant and reaches to a height of 1.5 to 2 m. The size and colour of the fruit varies greatly. It is utilized world-wide as a natural condiment in food as well as raw material for pharmaceutical industries. Traditionally it is used to ease arthritis and rheumatism and also as a cure for dyspepsia, flatulence and toothache (Chatterjee *et al.* 2012). Fruits are an excellent source of various antioxidant compounds like flavonoids, carotenoids and Vitamin-C. The sharp taste of Capsicum peppers is due to a mixture of seven related alkaloids of which, capsaicin is the most prevalent. Capsaicin (8-Methyl-N-vanillyl-trans-6-nonenamide) and di-hydro capsaicin (DHC) are major contributors to pungency. Capsanthin, the major carotenoid in ripe fruits, contributes up to 60% of the total carotenoids.

Genetic variability is the measure of the tendency of individual genotypes in a population to vary from one another. Improvement in any crop is invariably dependent on the extent of genetic variability encountered in the region of cultivated plants. To initiate any breeding work, it is necessary to assess the genetic variability present in the indigenous genotypes for yield and its components. In this context an attempt was made to collect, characterize and assess the magnitude of genetic variability in bird's eye chilli accessions.

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Materials and Methods

The field experiment was carried out at the farm field at College of Horticulture, Mudigereduring 2018-19. The experimental material for the study comprised of 35 bird's eye chilligenotypes collected from different regions of Karnataka *viz.,* Chickmagalur, Hassan, Udupi, Kodagu and Shivamogga districts. The experiment was laid out in open field with RCBD with three replications. Forty five days old healthy seedlings raised in the nursery were transplanted to main field at a spacing of 60 × 45 cm. The plants were maintained by following standard cultural practices. Observations on morphological, growth and yield parameters were recorded from five plants per plot selected randomly. Growth parameters *viz,* plant height, number of primary branches and plant spread were recorded at monthly intervals till harvest. Chlorophyll content (Spad units) on leaves were recorded once before the first harvest. Phenological characteristics were determined in the field by considering the number of days taken for first flowering, days taken for 50 per cent flowering, days taken for fruit set and fruit maturity. After harvest, the fruit parameters were recorded. Ascorbic acid and capsaicin content in fruit were estimated by volumetric and spectrophotometric method respectively. Data were subjected to statistical analysis and results have been presented and discussed at 5% probability level. Genotypic and phenotypic coefficient of variability, genotypic and phenotypic correlation studies and path analysis and genetic diversity analysis were estimated by using Windostat version 9.2.

Results and Discussion

A high range of variation was observed for all the character under study (Table 1). Maximum variation was recorded for the fruit yield per plant (Saravaiya *et al.* 2011, Dhaliwal *et al.*2014). Number of primary branches per plant, fruit width, stalk length, stalk width, fresh weight and dry weight of ten fruits, number of seeds per fruit, weight of seeds per fruit, fruit to seed ratio and fruit yield per plant was recorded high genotypic and phenotypic coefficient of variation (Kannan *et al.* 2016, Sran and Jindal 2019).

The values for heritability in broad sense ranged from 48.65% for plant spread to 98% for fruit width. The prediction of genetic progress would only be possible when heritability combines with genetic advance (Johnson *et al.* 1955). High heritability coupled with high genetic advance was reported for chlorophyll content, days to first flowering, days taken from flowering to fruit set, fruit length, fruit width, stalk length, stalk width, fresh weight and dry weight of ten fruits, number of seeds per fruit, weight of seeds per fruit, fruit to seed ratio, fruit yield per plant, ascorbic acid content and capsaicin content (Table 1).

The correlation coefficient analysis at both genotypic (Fig. 1) and phenotypic (Fig. 2) levels was carried out and the traits *viz.,* plant spread, weight of seeds per fruit, stalk length, plant height, fruit length, fresh and dry weight of ten fruits, number of seeds per fruit, stalk width, number of primary branches per plant and fruit width found to be having significant positive correlation with fruit yield per plant (g) indicating the suitability of these traits for considering as parameters for selection for fruit yield (Aklilu *et al*. 2016, Sran and Jindal 2019).

Results of the path analysis at both genotypic (Table 2) and phenotypic levels (Table 3) revealed that, out of 19 characters studied, 13 characters showed positive and direct effect on yield per plant and the characters like days taken for first flowering, ascorbic acidcontent and capsaicin content had direct negative effect on yield per plant. These results are in agrement with the findings of earlier researchers (Chattopadhyay *et al.* 2011, Ullah *et al.* 2011).

These 35 chilli accessions were grouped into 6 clusters based on similarity of D^2 values (Table 4). The maximum contribution towards divergence was made by fruit width followed by fruit yield per plant and stalk width and there was no contribution for genetic divergence from

plant spread at 120 DAT, days taken for 50 per cent flowering, fruit length and dry weight of fruits (Table 4). Cluster IV and cluster V showed maximum inter cluster distance followed by cluster IV and VI while the lowest inter cluster distance was noticed between cluster I and IV followed by cluster III and IV (Table 5).

Table 1. Estimates of mean, range, components of variance, heritability and genetic advance for different growth and yield parameters in bird's eye chilli (*Capsicum frutescens* L.) accessions.

Sl. No.	Traits	Mean ± SEm	Range		GCV (%)	PCV (%)	h^2 (%)	GAM (%)
			Min.	Max.				
1	Plant height (cm) at 120 DAT	66.64 ± 2.90	51.80	79.81	11.08	13.46	67.71	18.78
2	No. of primary branches per plant	4.75 ± 0.35	2.17	7.17	23.45	26.83	76.40	42.23
3	Plant spread (cm^2) at 120 DAT	38.39 ± 2.06	27.96	46.46	9.16	13.14	48.65	13.16
4	Chlorophyll content (SPAD)	45.18 ± 2.47	37.97	64.97	14.18	17.13	68.50	24.17
5	Days to first flowering	65.49 ± 2.31	40.00	90.33	14.65	15.90	84.87	27.80
6	Days to 50% flowering	83.66 ± 2.85	53.33	100.00	9.24	11.01	70.36	15.96
7	Days taken from flowering to fruit set	5.94 ± 0.26	4.00	7.77	16.23	18.02	81.14	30.12
8	Days taken for physiological maturity	32.55 ± 1.45	26.67	38.67	8.89	11.83	56.49	13.77
9	Fruit length (cm)	2.03 ± 0.17	1.18	2.92	22.61	26.98	70.23	39.03
10	Fruit width (cm)	0.68 ± 0.02	0.31	1.68	39.89	40.27	98.00	81.40
11	Stalk length (cm)	2.76 ± 0.17	1.51	4.29	26.12	28.27	85.38	49.72
12	Stalk width (cm)	0.09 ± 0.003	.06	0.18	29.96	30.47	90.59	60.63
13	Fresh weight of 10 fruits (g)	6.80 ± 0.53	3.10	15.67	45.44	47.44	91.75	89.67
14	Dry weight of 10 fruits (g)	1.24 ± 0.13	0.43	3.46	48.13	51.59	87.02	92.49
15	Number of seeds per fruit	20.08 ± 1.40	9.67	51.00	43.75	45.43	92.74	86.79
16	Weight of seeds per fruit (mg)	0.11 ± 0.005	0.02	0.24	41.45	42.11	96.89	84.05
17	Fruit to seed ratio	2.18 ± 0.21	0.99	4.33	27.38	32.18	72.39	48.00
18	Fruit yield per plant (g)	456.08 ± 31.45	244.42	1011.72	49.03	50.50	92.24	98.05
19	Ascorbic acid content (mg/100gm)	73.24 ± 1.39	61.36	120.17	16.67	17.00	94.13	33.67
20	Capsaicin content (%)	1.60 ± 0.04	0.88	2.16	18.11	18.57	95.09	36.38

The accessions were grouped under different clusters may be because of the difference in characters contributing towards the diversity (Udachappa *et al.* 2017, Nahak *et al.* 2018). Maximum inter cluster distance indicates the wider genetic diversity among the accessions, which can be utilized in recombination breeding programs while the minimum inter cluster distance indicates that the accessions falling in such clusters are closely related and thus exploitation of heterosis is least because of close genetic base (Hasan *et al.* 2014, Rana *et al.* 2015). The characters are selected from the clusters based on the high cluster mean value for a character in breeding programmes (Nahak *et al.* 2018).

High to moderate estimates of GCV and PCV were reported for most of the characters studied indicating the presence of wide variability among the accessions. Correlation studies revealed that the characters having significant positive correlation with the fruit yield per plant can be considered as the basis for selection. The traits which has direct effect on yield are having true

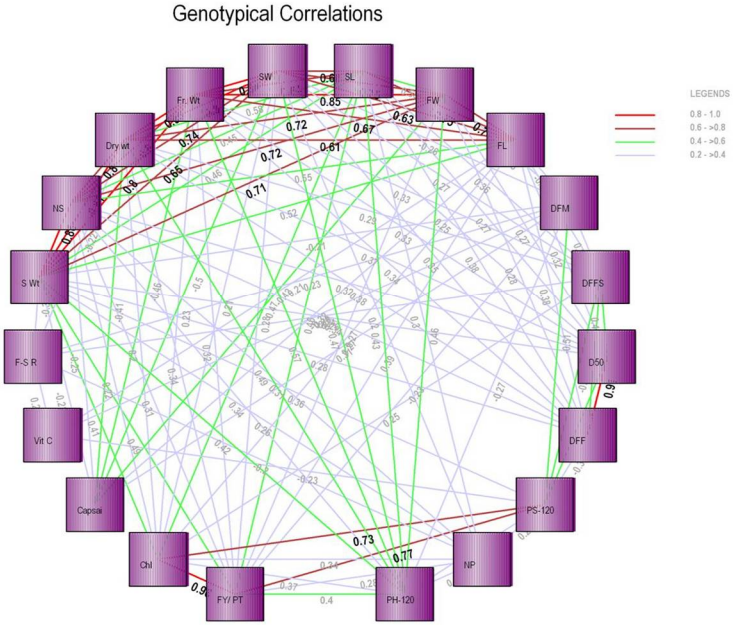

Fig. 1. Genotypic correlation coefficients among different characters in chilli.

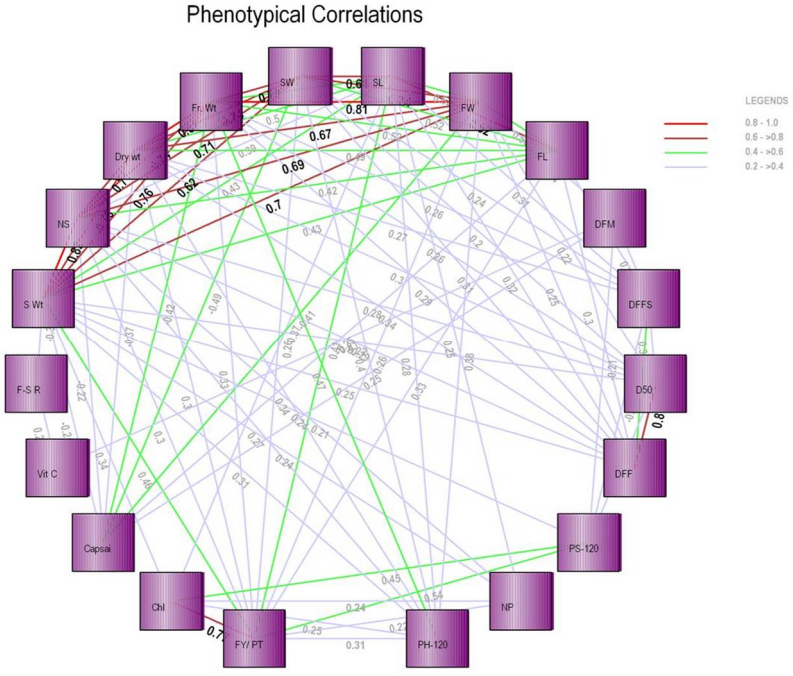

Fig. 2. Phenotypic correlation coefficients among different characters in chilli.

Table 2. Genotypic path coefficient analysis for growth, yield and quality parameters in thirty-five bird's eye chilli genotypes

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19
X1	**-0.1594**	-0.0398	-0.0325	0.0128	0.0048	-0.0129	0.0434	-0.0318	-0.0729	-0.0689	-0.0748	-0.0908	-0.0774	-0.0541	-0.0670	-0.0064	-0.0087	0.0223	-0.0587
X2	0.0990	**0.3962**	0.0859	-0.0759	-0.0481	-0.0677	-0.0410	0.0275	-0.0099	0.1207	0.0806	0.0533	0.0707	0.1229	0.1047	-0.0812	-0.0004	0.0637	0.1361
X3	0.1339	0.1423	**0.6565**	-0.2191	-0.2922	-0.3254	-0.3346	0.1257	0.0874	0.0869	-0.0036	0.0251	-0.0010	0.1270	0.2339	0.0697	-0.1485	0.0246	0.4798
X4	-0.0329	-0.0784	-0.1366	**0.4091**	0.3722	0.2086	0.0713	0.1546	0.1160	0.1546	0.1431	0.1381	0.1570	0.1390	0.1145	0.0066	-0.0648	-0.0358	0.0160
X5	-0.0028	-0.0111	-0.0409	0.0836	**0.0919**	0.0438	0.0096	0.0296	0.0251	0.0253	0.0232	0.0307	0.0340	0.0298	0.0239	-0.0125	-0.0141	-0.0024	-0.0099
X6	-0.0013	0.0027	0.0078	-0.0080	-0.0075	**0.0157**	-0.0057	-0.0036	-0.0026	-0.0056	-0.0042	-0.0051	-0.0046	-0.0011	-0.0021	-0.0038	-0.0017	0.0021	-0.0039
X7	0.0335	0.0127	0.0627	-0.0214	-0.0128	-0.0448	**-0.1230**	0.0289	0.0400	0.0239	0.0316	0.0179	0.0142	0.0165	0.0254	-0.0278	-0.0345	-0.0381	0.0177
X8	-0.0044	-0.0015	-0.0042	-0.0083	-0.0071	-0.0050	0.0052	**-0.0220**	-0.0153	-0.0166	-0.0137	-0.0148	-0.0134	-0.0120	-0.0114	0.0005	-0.0046	0.0071	-0.0058
X9	-0.2343	0.0128	-0.0682	-0.1451	-0.1400	-0.0849	0.1663	-0.3571	**-0.5118**	-0.2840	-0.3857	-0.4341	-0.1698	-0.3689	-0.3656	0.0449	-0.0932	0.2131	-0.0754
X10	-0.1118	-0.0788	-0.0342	-0.097	-0.0711	-0.0924	0.0502	-0.1948	-0.1436	**-0.2587**	-0.1769	-0.1660	-0.1500	-0.1165	-0.1203	-0.0124	-0.0088	0.0420	-0.1216
X11	0.0466	0.0202	-0.0006	0.0347	0.0250	0.0268	-0.0255	0.0621	0.0748	0.0679	**0.0993**	0.0833	0.0798	0.0735	-0.0641	-0.0029	0.0087	-0.0495	0.0213
X12	0.8212	0.1938	0.0551	0.4863	0.4813	0.4684	-0.2096	0.9710	1.2219	0.9246	1.2091	**1.4407**	1.3846	1.1499	1.1538	-0.2659	0.1144	0.6566	0.3247
X13	-0.2869	-0.1055	0.0009	-0.2268	-0.2187	-0.1723	0.0683	-0.3598	-0.4270	-0.3428	-0.4752	-0.5680	**-0.5910**	-0.4727	-0.4787	0.1308	-0.0697	0.2438	-0.1208
X14	-0.4075	-0.3721	-0.2320	-0.4076	-0.3893	-0.0865	0.1614	-0.6552	-0.8646	-0.5403	-0.8883	-0.9574	-0.9595	**-1.1996**	-1.0351	0.0584	-0.1502	0.2940	-0.2667
X15	0.3836	0.2413	0.3253	0.2554	0.2370	0.1199	-0.1888	0.4719	0.6521	0.4244	0.5895	0.7311	0.7395	0.7878	**0.9129**	-0.3184	-0.0069	-0.2049	0.3751
X16	0.0199	-0.1011	0.0524	0.0080	-0.0672	0.1203	0.1118	-0.0111	-0.0433	0.0236	-0.0143	-0.0911	-0.1092	-0.0240	-0.1722	**0.4937**	0.1089	0.0306	0.0737
X17	0.0167	-0.0003	-0.0688	-0.0481	-0.0466	0.0325	0.0853	0.0634	0.0553	0.0103	0.0266	0.0241	0.0358	0.0380	-0.0023	0.0670	**0.3039**	0.0417	-0.0077
X18	0.0191	-0.0219	-0.0051	0.011	0.0036	0.0181	-0.0423	0.0439	0.0568	0.0221	0.0679	0.0621	0.0562	0.0334	0.0306	-0.0084	-0.0187	**-0.1363**	-0.0081
X19	0.0716	0.0668	0.1421	0.0076	-0.0209	0.0485	-0.0280	0.0517	0.0286	0.0914	0.0417	0.0438	0.0397	0.0432	0.0799	0.0290	-0.0050	0.0116	**0.1944**
rValue	**0.4039**	**0.2783**	**0.7657**	**0.0513**	**-0.1055**	**0.1793**	**-0.2257**	**0.3949**	**0.2670**	**0.4589**	**0.2760**	**0.3229**	**0.3358**	**0.3122**	**0.4892**	**0.1608**	**-0.0939**	**-0.1272**	**0.9603**

Residual effect = 0.2411, r = correlation coefficient of component traits with fruit yield per plant.

X_1- Plant height (cm) at 120 DAT, X_2- Number of primary branches, X_3- Plant spread(cm^2) at 120 DAT, X_4-Days to first flowering, X_5- Days 50 per cent flowering, X_6- Days taken for flowering to fruit, X_7- Days from flowering to fruit maturity, X_8- Fruit length (cm), X_9- Fruit width (cm), X_{10}- Stalk length (cm), X_{11}- Stalk width (mm), X_{12}- Fresh weight of 10 fruits (g), X_{13}- Dry weight of 10 fruits (g), X_{14}- Number of seeds per fruit, X_{15}- Weight of seeds per fruit (mg), X_{16}- Fruit to seed ratio, X_{17}- Ascorbic acid content, X_{18}- Capsaicin content, X_{19}- Chlorophyll content, X_{20}- Yield per plant (g).

Table 3. Phenotypic path coefficient analysis for growth, yield and quality parameters in thirty-five bird's eye chilli accessions.

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19
X1	**0.0702**	0.0132	0.0073	-0.0065	-0.0044	0.0011	-0.0056	0.0070	0.0265	0.0199	0.0278	0.0328	0.0241	0.0189	0.0220	0.0079	0.0035	-0.0085	0.0172
X2	0.0029	**0.0156**	0.0025	-0.0023	-0.0012	-0.0023	-0.0009	0.0003	-0.0002	0.0040	0.0029	0.0018	0.0022	0.0037	0.0037	-0.0021	0.0002	0.0021	0.0037
X3	0.0232	0.0357	**0.2238**	-0.0385	-0.0677	-0.0573	-0.0477	0.0351	0.0199	0.0274	0.0010	0.0061	-0.0025	0.0223	0.0464	0.0050	-0.0309	0.0056	0.1018
X4	0.0127	0.0199	0.0235	**-0.1369**	-0.1094	-0.0581	-0.0077	-0.0407	-0.0348	-0.0441	-0.0423	-0.0391	-0.0459	-0.0397	-0.0342	-0.0045	0.0208	0.0104	-0.0113
X5	-0.0043	-0.0053	-0.0208	0.0549	**0.0687**	0.0246	0.0031	0.0132	0.0148	0.0133	0.0140	0.0177	0.0208	0.0191	0.0149	-0.0069	-0.0096	-0.0010	-0.0037
X6	0.0011	-0.0106	-0.0183	0.0304	0.0256	**0.0716**	0.0181	0.0174	0.0108	0.0222	0.0172	0.0185	0.0190	0.0069	0.0077	0.0141	0.0066	-0.0064	0.0133
X7	-0.0006	-0.0004	-0.0015	0.0004	0.0003	0.0018	**0.0070**	-0.0009	-0.0017	-0.0010	-0.0012	-0.0005	-0.0008	-0.0008	-0.0011	0.0010	0.0015	0.0018	-0.0005
X8	0.0130	0.0028	0.0203	0.0385	0.0249	0.0314	-0.0157	**0.1294**	0.0750	0.0798	0.0678	0.0678	0.0628	0.0545	0.0551	0.0046	0.0228	-0.0325	0.0227
X9	-0.0509	0.0016	-0.0120	-0.0343	-0.0290	-0.0203	0.0328	-0.0781	**0.1347**	-0.0695	-0.0999	-0.1092	-0.0905	-0.0930	-0.0945	0.0097	-0.0236	0.0546	-0.0169
X10	0.0210	0.0188	0.0091	0.0238	0.0144	0.0230	-0.0100	0.0456	0.0382	**0.0739**	0.0450	0.0426	0.0367	0.0286	0.0315	0.0038	0.0029	-0.0108	0.0274
X11	-0.0475	-0.0221	-0.0005	-0.0370	-0.0243	-0.0287	0.0208	-0.0628	-0.0888	-0.0728	**0.1197**	-0.0942	-0.0882	-0.0845	-0.0743	0.0001	-0.0094	0.0581	-0.0199
X12	0.0047	0.0011	0.0003	0.0028	0.0026	0.0026	-0.0007	0.0052	0.0081	0.0057	0.0078	**0.0100**	0.0087	0.0073	0.0075	-0.0013	0.0007	-0.0042	0.0019
X13	0.0019	0.0008	-0.0001	0.0018	0.0017	0.0015	-0.0006	0.0027	0.0037	0.0027	0.0041	0.0048	**0.0055**	0.0039	0.0042	-0.0010	0.0006	-0.0020	0.0010
X14	-0.0214	-0.0190	-0.0079	-0.0231	-0.0221	-0.0077	0.0086	-0.0335	-0.0549	-0.0307	-0.0561	-0.0586	-0.0566	**0.0795**	-0.0649	0.0042	-0.0087	0.0177	-0.0146
X15	0.1231	0.0942	0.0812	0.0980	0.0850	0.0421	-0.0628	0.1671	0.2751	0.1668	0.2432	0.2963	0.2978	0.3202	**0.3920**	-0.1235	-0.0019	-0.0838	0.1318
X16	0.0191	-0.0225	0.0038	0.0055	-0.0169	0.0335	0.0238	0.0061	-0.0122	0.0086	0.0001	-0.0213	-0.0301	-0.0090	-0.0533	**0.1694**	0.0342	0.0093	0.0269
X17	-0.0034	-0.0008	0.0095	0.0105	0.0097	-0.0064	-0.0147	-0.0121	-0.0121	-0.0027	-0.0054	-0.0050	-0.0075	-0.0075	0.0003	-0.0139	**-0.0690**	-0.0088	0.0011
X18	0.0183	-0.0200	-0.0038	0.0115	0.0022	0.0135	-0.0383	0.0380	0.0613	0.0220	0.0734	0.0641	0.0561	0.0336	0.0324	-0.0083	-0.0192	**-0.1513**	-0.0079
X19	0.1221	0.1185	0.2267	0.0410	-0.0269	0.0929	-0.0336	0.0876	0.0626	0.1845	0.0830	0.0949	0.0871	0.0919	0.1676	0.0791	-0.0080	0.0259	**0.4984**
r Value	**0.3050**	**0.2214**	**0.5430**	**0.0407**	**-0.0668**	**0.1586**	**-0.1242**	**0.3266**	**0.2566**	**0.4101**	**0.2625**	**0.3296**	**0.2986**	**0.2970**	**0.4629**	**0.1376**	**-0.0866**	**-0.1239**	**0.7724**

Residual effect = 0.5010, r = correlation coefficient of component traits with fruit yield per plant.
X_1- Plant height (cm) at 120 DAT, X_2- Number of primary branches, X_3- Plant spread(cm^2) at 120 DAT, X_4-Days to first flowering, X_5- Days 50 per cent flowering, X_6- Days taken for flowering to fruit, X_7- Days from flowering to fruit maturity, X_8- Fruit length (cm), X_9- Fruit width (cm), X_{10}- Stalk length (cm), X_{11}- Stalk width (mm), X_{12}- Fresh weight of 10 fruits (g), X_{13}- Dry weight of 10 fruits (g), X_{14}- Number of seeds per fruit, X_{15}- Weight of seeds per fruit(mg), X_{16}- Fruit to seed ratio, X_{17}- Ascorbic acid content, X_{18}- Capsaicin content, X_{19}- Chlorophyll content, X_{20}- Yield per plant (g).

Table 4. Classification of bird's eye chilli (*Capsicum frutescens* L.) accessionsinto clusters based on D^2 value.

Cluster	Number of genotypes	Genotypes included in the cluster
I	27	Acc. 164, Acc. 198, Acc. 191, Acc.31, Acc.109, Acc.121, Acc.156, Acc.193, Acc.189, Acc.142, Acc.42, Acc.5, Acc.185, Acc.150, Acc.23, Acc.22, Acc.236, Acc.136, Acc.17, Acc.14, Acc.188, Acc.162, Acc.135, Acc.201, Acc.231, Acc.8 and Acc.154.
II	4	Acc.15, Acc.16, Acc.120 and Acc.133.
III	1	Acc.160
IV	1	Acc.18
V	1	Acc.117
VI	1	Acc.158

Table 5. Average intra and inter cluster distance values of bird's eye chilli (*Capsicum frutescens* L.) accessions for yield and related traits.

Clusters	I	II	III	IV	V	VI
I	**77.12**	286.17	243.88	172.33	862.71	682.58
II		**105.38**	228.49	552.40	320.98	395.05
III			**0.00**	334.09	552.14	225.53
IV				**0.00**	1275.15	965.05
V					**0.00**	384.93
VI						**0.00**

Diagonal values are intra cluster distances and off diagonal values are inter-cluster distances.

Plate 1. Different stages of fruit development in bird's eye chilli. (a) Flowering stage, (b) Fruit setting stage, (c) Matured fruits, (d) Ripe fruits.

relationship with yield. Hence, selection of these traits would be much rewarding for the improvement of fruit yield. Higher ascorbic acid and capsaicin contents were recorded in Acc.133 and Acc.164, respectively and utilized in hybridization breeding program to transfer of quality traits to adopted variety in hill Zone of Karnataka. The most promising accessions for fruit yield are Acc.160 followed by Acc.158. Acc.18 was found to be of early flowering type and those accessions could be evaluated in multi-location trails and stable accession may be proposed for farm trials and variety release in Hill zone of Karnataka, India.

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