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Genetic Parameters Study for Growth, Yield and Quality Traits in Bird's Eye Chilli (*Capsicum frutescens* L.)

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A B S T R A C T

Genetic parameters study for variability, correlation and path coefficients analysis of thirty six accessions of bird's eye chilli for fourteen growth and yield attributing traits revealed that the characters such as plant spread, total number of fruits per plant, fruit length, fruit width, weight of 100 dry fruits, number of seeds per fruit, weight of seeds per fruit, thousand seeds weight, yield, capsaicin and oleoresin contents showed high GCV and high heritability along with high genetic advance and these characters are controlled by additive gene. The study of path analysis indicated that direct selection of plant height, plant spread, days to first flowering, total number of fruits per plant, fruit length, weight of 100 dry fruits, fruit yield per plant, number of seeds per fruit and capsaicin content could be used as selection criteria for improvement. Association analysis revealed that selection criteria based on plant height, number of primary branches per plant, plant spread, total number of fruits per plant, fruit length, fruit width, dry weight of 100 fruits, fruit yield per plant (g) can provide better result for improvement of fruit yield and quality in bird's eye chilli.

Introduction

Capsicum frutescens L. is one among the five cultivated species of the genus and is closely related to *C. chinense* Jacq. Numerous local land races of *C. frutescens* are cultivated in tropical and subtropical regions of the world (Heiser and Smith, 1953). Bird's eye chili is called by many other synonyms like African pepper, chili pepper, goat's pod, Mexican chili, red pepper, Tabasco pepper, Zanibar pepper and Cayenne pepper whose small, very pungent fruits separate easily from calyx. The name bird's eye chilli is because birds love to pick the ripe chilli. The plant originated in South America and introduced to India towards 16th century. It is a wild form of chili and often used to denote any small sized, pointed chilli of high pungency. Bird's eye chili has been grown as a neglected crop in very few pockets of the world and in India. In India all kinds of bird's eye chilies are found scattered all over the north-eastern region from Sikkim to Arunachal to Assam to Myanmar (Baruah and Barua, 2004). In India it is grown as a homestead crop and 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). Among the north-eastern states of India, Mizoram is known for the presence of incredible diversity of bird's eye chilli with respect to fruit shape, size, color, pungency, plant type, physiological characteristics, reactions to diseases and pests, adaptability and distribution (Ozgur *et al.,* 2011). Huge diversity of the crop with respect to these characters is found in these areas and holds a huge scope and potential in these areas (Dutta *et al.,* 2015). Capsaicin (8-Methyl-N-vanillyl-trans-6-nonenamide) and di-hydro capsaicin (DHC) are major contributors to pungency and forms about one-third (69%) of the total capsaicin. The capsaicin content ranges from 0.26 to 1.21% w/w or 1,00,000-1,50,000 scoville heat units (SHU) (Bosland, 1993). Most bird's eye chilies are processed to extract the oleoresin for sale to the food and pharmaceutical industries due to its high pungency, color and medicinal properties. In medicine, the bird's eye chili was traditionally used to ease arthritis and rheumatism and also as a cure for dyspepsia, flatulence and toothache (Chatterjee *et al.,* 2012).

Genetic variability among the parents is a prerequisite to select better segregates for various economic characters. Knowledge of correlations is equally important in plant breeding for simultaneous and/or indirect improvement of characters that are difficult to quantify especially for those traits, which exhibit low heritability. Therefore, it is essential to make preliminary investigation of the characters of the lines to be used for the development of superior hybrids. In the light of the above, present investigation were undertaken to study the genetic variability, correlation among different quantitative and qualitative traits and path analysis in bird's eye chilli accessions to facilitate the selection of suitable superior accessions for yield and quality.

Materials and Methods

A field experiment was conducted at college of Horticulture, Mudigere during the period from August 2015 to March 2016. The experiment was designed to study the genetic variability and correlation studies in bird's eye chilli (*Capsicum frutescens* L.). The experiment was laid out in Randomized Complete Block Design (RCBD) with two replications. The experiment consisted of thirty six accessions collected from different locations. The seeds were sown in portrays with suitable potting mixtures and 45 days old seedlings were transplanted to a main field at a spacing of 1m x 1m. FYM and fertilizers were applied as per the recommendations. The other cultural practices like irrigation, weeding and plant protection operation were carried out as and when required. The statistical analysis was done according to the methods of Ostle (1966) for the analysis of variance, Burton and Devane (1953) for genetic coefficients of variation, Robinson (1966) for heritability in broad sense and Johnson *et al.,* (1955) for genetic advance.

Results and Discussion

The analysis of variance was conducted to test significance different among accessions studied. The mean sums of squares due to various sources for different characters are presented in table 1. The genotypic and phenotypic variability, genotypic and phenotypic coefficient of variation, heritability, genetic advance and genetic advance as percent over mean for each of the characters are presented in table 2.

Table.1 Estimates of mean, range and genetic parameters for growth parameters in bird's eye chilli accessions

Sl. No.	Characters	Mean ± S.Em	Range %	GV	PV	GCV (%)	PCV (%)	h^2 (bs) (%)	GA	GAM (%)
1	Plant height (cm)	75.75 ± 2.34	62.58-94.23	43.17	54.46	8.75	9.83	79	12.50	16.06
2	Number of primary branches per plant at harvest	6.08 ± 0.36	8.05-5.10	0.29	0.56	8.86	12.32	51	0.79	13.12
3	Plant spread (cm^2)	46.37 ± 2.66	34.74-68.01	44.19	58.77	14.27	16.46	75	11.87	25.49

Table.2 Estimates of mean, range and genetic parameters for yield and quality parameters in bird's eye chilli accessions

Sl. No.	Characters	Mean ± S.Em	Range %	GV	PV	GCV (%)	PCV (%)	h^2 (bs) (%)	GA	GAM (%)
1	Days to first flowering	62.03±1.15	52.14-72.75	20.35	25.09	7.27	8.07	81	8.37	13.49
2	Days to 50% flowering	81.91±1.63	72.14-95.30	18.70	24.22	5.27	6.00	77	7.83	9.55
3	Days taken from flowering to fruit set	7.68±0.08	6.39-8.95	0.20	0.21	5.80	6.07	93	0.89	11.66
4	Days taken for physiological maturity	32.07±1.08	24.25-44.75	6.53	17.17	8.00	12.97	38	3.25	10
5	Number of fruits per plant	726.77±40.59	375.10-1960.56	129624.27	134876.04	49.94	50.94	50	150.00	20.63
6	Fruit length (cm)	1.92±0.20	1.37-3.42	0.26	0.35	26.74	30.71	75	0.93	47.98
6	Fruit width (cm)	551.54±0.01	0.08-1.49	0.03	0.04	39.89	40.27	98	0.40	81.40
7	Fruit yield per plant (g)	551.54±2.83	319.76-855.97	11515.90	11532.40	19.45	19.47	97	196.21	35.57
8	Fresh weight of 100 fruits (g)	41.48 ±7.35	16.83-231.50	1479.30	1590.63	92.71	96.14	53	40	96.43
9	Dry weight of 100 fruits (g)	25.14 ± 2.46	8.07-98.71	318.91	331.44	71.01	72.39	73	22.48	89.41
10	Number of seeds per fruit	19.66 ± 1.05	10.79-66.35	117.93	120.22	55.22	55.75	80	18	91.55
11	Weight of seeds per fruit (mg)	0.08 ± 0.01	0.02-0.40	0.004	0.004	83.16	85.17	95	0.07	87.50
12	Fruit to seed ratio	6.31 ± 1.18	2.06-11.10	4.32	7.22	32.44	42.58	59	3.31	52.48
13	Test weight (g)	1.95 ± 0.18	0.83-4.53	0.42	0.49	33.13	35.84	85	1.23	63.08
14	Yield (q/ha)	6.08 ± 0.28	1.48-20.71	20.48	20.64	74.40	74.69	96	3.28	53.94
15	Pedicel length (cm)	2.15 ± 0.21	1.49-3.32	0.13	0.22	16.76	21.89	58	0.57	26.46
16	Vitamin-C content (mg/100gm)	93.29 ± 1.74	53.03-159.05	725.53	731.82	28.87	28.99	44	54.24	58.11
17	Capsaicin content (%)	0.94 ± 0.03	0.65-1.86	0.04	0.04	21.92	22.59	94	0.41	43.87
18	Oleoresin content (%)	0.04 ± 0.12	0.65-11.36	7.61	7.65	68.29	68.43	95	3.67	91.75
19	Capsanthin content (Color units)	366.14 ± 1.06	251.75-436.05	239.95	2241.14	4.29	13.11	10	10.44	2.89

Note:
DAT- Days After Transplanting; GV- Genotypic Variance; PV- Phenotypic Variance
h^2- Broad sense heritability; PCV- Phenotypic Co-efficient of Variation; GCV- Genotypic Co-efficient of Variation
GA-Genetic Advance
GAM- Genetic Advance as Per cent Mean

A high range of variation was observed for all the characters. It was maximum in case of total number of fruits per plant (375.10 to 1960.56 g per plant) and weight of seeds per fruit (0.02 to 0.40mg). Fruit yield per plant (g) also had high range of variation (319.76 to 855.97g per plant). The characters showing wide range of variation provide an ample scope for selecting desired types. The difference between the genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were found to be narrow for plant height, plant spread, day to first flowering, days to fifty per cent flowering, days taken from flowering, days taken from flowering to fruit set, total number of fruits per plant, fruit width, dry weight of 100 fruits, weight of seeds per fruit, test weight and capsaicin content. The results suggest that these traits are least affected by environment and selection for these traits on phenotypic would be rewarding. Numbers of primary branches per plant, days taken for physiological maturity, fruit to seed ratio, pedicel length and capsaicin content for these the estimates of PCV were greater than GCV. This indicates that the variation for these traits is not only by genotypes but also due to environment. For the rest of the characters estimates of GCV and PCV were equal. Selection based on phenotypes may miss lead as their expression depends more on genetical factors. Similar observations were reported in chilli by Sha *et al.,* (1986) and Shirsat (1994).

In the present study, most of the characters exhibited high estimates of heritability except days taken for physiological maturity, number of fruits per plant, fresh weight of 100 fruits, fruit to seed ratio, pedicel length, vitamin-C and capsanthin contents. The high estimates of heritability for plant height (79%), plant spread (75%), days to first flowering (81%), days to 50 per cent flowering (77%), days taken flowering to fruit set (93%), fruit length (75%), fruit width (98%), fruit yield per plant (97%), dry weight of 100 fruits (73%), number of seeds per fruit (80%), weight of seeds per fruit (95%), test weight (85%), yield (96%), capsaicin content (94%) and oleoresin content (95%) suggest that selection will be effective for these characters. These results are in conformity with those of report Sahoo *et al.,* (1989) and Amarchandra *et al*., (1990).

High heritability along with high genetic advance is an important factor for predicting the resultant effect for selecting the best individuals. In the present study, high heritability was accompanied with high values of genetic advance for plant spread, fruit length, fruit width, fruit yield per plant, dry weight of 100 fruits, number of seeds per fruit, weight of seeds per fruit, test weight, yield, capsaicin and oleoresin contents indicating predominance of additive gene component. Thus, there is ample scope for improving these characters based on direct selection. High heritability with moderate genetic advance noticed for plant height, days to first flowering and days taken from flowering to fruit set implied equal importance of additive and non-additive gene action. These results are in agreement with the earlier findings of Rani *et al.,* (1996). It was evident from the study that considerable degree of variability exists among the accessions for yield and its component characters. The most promising accessions for fruit yield were Acc.26 followed by Acc.28. Accession17 was found to be of early flowering type. Higher vitamin-C and oleoresin contents were recorded in Acc.30. Accession15 registered maximum capsaicin content and Acc.27 recorded maximum capsanthin content.

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