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Evaluation of Bird's Eye Chilli Accessions (*Capsicum frutescens* L.) for Growth and Yield Traits

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Abstract An experiment was conducted during 2015-16 to identify potential accession for quantitative traits among thirty six accessions of chilli (*Capsicum frutescens* L.). Significant difference was observed among the accessions for all the characters under study. Among thirty six accessions, the Acc. 26 recorded maximum plant height (94.23 cm), number of primary branches per plant (8.05), more number of fruits per plant (1930.63), maximum fruit yield per plant (855.95 g) and per hectare (20.71 q/ha). Accession 17 was early flowering (52.14 days) and early maturing type (24.25 days). Accession 20 recorded maximum fruit length (3.42 cm), fruit width (1.49), fresh and dry weight of 100 fruits (231.51 g and 98.71 g respectively), maximum number of seeds per fruit (66.35), weight of seeds per fruit (0.40 mg) and seed test weight (4.53 g), whereas the maximum fruit to seed ratio was observed in the Acc.27.

Keywords *Capsicum frutescens*, Bird's eye chilli, Yield, Growth characters.

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 [1]. Bird's eye chilli is called by many other synonyms like African pepper, chilli pepper, goat's pod, Mexican chilli, red pepper, Tabasco pepper, Zanibar pepper and Cayenne pepper. The plant originated in South America and introduced to India towards 16th century. It is a wild form of chilli and often used to denote any small sized, pointed chilli of high pungency. Bird's eye chilli 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 chillies are found scattered all over the North-Eastern region from Sikkim to Arunachal to Assam to Myanmar [2]. 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 Among the north-eastern states of India, Mizoram is known for the presence of incredible diversity of bird's eye chilli [3].

Cpasaicin (8-Methyl-N-vanillyl-trans-6-nonenamide) is the main principle compound present in fruits responsible for its pungency folowed by dihydro capsaicin (DHC). The capsaicin content ranges from 0.26 to 1.21% w/w or 1,00,000–1,50,0000 scoville heat units (SHU). Apart from this, each 100 g edible protein of fruits contains water 86.0 g, protein 1.9 g, carbohydrates 9.2 g, iron 1.2 mg, calcium 14.4 mg, vitamin-A 700–21600 IU, vitamin-C 242.0 mg and energy value of 257.0 kJ [4].

As like other chillies it is also used as a spice,

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candiment and used for extraction of oleresin in food and pharmacuetical industries. Bird's eye chilli is most valued for its medicinal value. Traditionally used to treat arthritis, rheumatism, for dyspepsia and tooth ache. It helps in increasing appetite by stimulating the gut and is very effective in controlling flatulence [5]. Despite its wide usage, bird's eye chilli is yet to draw considerable attentions from the farming community.

The assessment of nature and magnitude of variability in the available germplasm is the prerequisite of any breeding program. The effectiveness of selection and development of improved varieties depends on the nature of variability expressed for yield and its contributing characters in the gene pool. High yield and yield contributing characters have been the major objective of chilli breeding program. The importance of genetically diverse genotypes with desirable combinations has also been realized by several workers [6, 7].

Despite its economic significance, improvements in commercially cultivated varieties of bird's eye chilli have occurred largely as a result of human selection within existing varieties and limited information is available in the scientific literature regarding variability for agronomic or horticultural traits within the gene pool and this species is much less variable than the other cultivated species in the genus. Therefore this study becomes most valuable for improvement of this crop. Keeping in view the above facts, the present investigation was undertaken to observe the performance of accessions of bird's eye chilli for quantitative traits and to screen the best performing accessions for utilization in further breeding program.

Materials and Methods

A field experiment was conducted at college of Horticulture, Mudigere during 2015-16. The experiment was designed to study the genetic variability and correlation studies in bird's eye chilli (*Capsicum frutescens* L.). Thirty six accessions collected from different geographical regions (Table 1). The experiment was laid out in randomized complete block design (RCBD) with two replications. The seeds were sown in protrays with suitable potting mixtures and 45 days old seedlings were transplanted to main field at a spacing of 70 cm × 100 cm. Manures and fertilizers were applied as per the recommendation. The other cultural practices like irrigation, weeding and plant protection operations were carried out as and when required. Each row consisted of 12 plants, of which five competitive plants were selected at random for recording the observations on plant height (cm), number of primary branches per plant, plant spread (cm^2) days to first flowering, days to 50% flowering, days taken for physiological maturity, number of fruits per plant, fruit yield per plant (g), fruit width (cm), fruit length (cm),

Table 1. List of bird's eye chilli accessions used in the experiment and their location.

Accssesions (Acc.)	Locations
Acc. 1	Kottigehara, Mudigere taluk
Acc. 2	ZAHRS Mudigere
Acc. 3	ZAHRS Mudigere
Acc. 4	ZAHRS Mudigere
Acc. 5	ZAHRS Mudigere
Acc. 6	Jannapura, Mudigere taluk
Acc. 7	Charmadi, Mudigere taluk
Acc. 8	Mudigere
Acc. 9	Chickamagalur
Acc. 10	Balehonnur, Chikkamagalur district
Acc. 11	Banakal, Mudigere taluk
Acc. 12	Balehonnur, Chikkamagalur district
Acc. 13	Mudigere
Acc. 14	Mudigere
Acc. 15	Banakal, Mudigere taluk
Acc. 16	ZAHRS Mudigere
Acc. 17	Mudigere
Acc. 18	Palguni, Mudigere taluk
Acc. 19	Gonibeedu, Mudigere taluk
Acc. 20	Palguni, Mudigere taluk
Acc. 21	Aldhur, Chikkamagalur
Acc. 22	Sakaleshapura, Hassan district
Acc. 23	ZAHRS Mudigere
Acc. 24	ZAHRS Mudigere
Acc. 25	Balehonnur, Chikkamagalur district
Acc. 26	Mudigere
Acc. 27	Brahmavara, Udupi district
Acc. 28	Namsai, Arunachal Pradesh
Acc. 29	ZAHRS Mudigere
Acc. 30	Brahmavara, Udupi district
Acc. 31	Sirsi, Uttara Kannada district
Acc. 32	Sirsi, Uttara Kannada district
Acc. 33	ZAHRS Mudigere
Acc. 34	Koppa, Chikkamagalur district
Acc. 35	Athani, Belgaun district
Acc. 36	Chickkamagalur

Table 2. Analysis of variance for growth and yield characters in bird's eye chilli (*Capsicum frutescens* L.). * & **Indicates significant @ 5% and 1% level respectively, DAT : Days After Transplanting.

Sl. No.	Sources of variation/characters Degrees of freedom	Replication 1	Treatments (Accession) 35	Error 35	SEm±	CD (5%)
1	Plant height (cm)	10.61	97.63**	11.29	2.34	6.82
2	Number of primary branches per plant at harvest	0.08	0.85**	0.27	0.36	1.05
3	Plant spread (cm^2)	676.81	102.97**	14.57	2.66	7.75
4	Days taken for first flowering	3.29	45.44**	4.73	1.15	4.41
5	Days taken for 50% flowering	6.41	42.93**	5.51	1.63	4.76
6	Days taken for flowering to fruit set	0.20	0.42**	0.01	0.08	0.24
7	Days taken for physiological maturity	8.83	23.71*	10.63	2.27	6.61
8	Total number of fruits per plant	21263.00	264500.32**	5251.77	40.59	116.53
9	Fruit length (cm)	0.0006	0.62**	0.08	0.20	0.59
10	Fruit width (cm)	0.002	0.08**	0.0007	0.01	0.07
11	Fruit yield per plant (g)	292.82	23048.31**	16.50	2.83	8.24
12	Fresh weight of 100 fruits (g)	59.22	3069.94**	111.33	7.35	21.42
13	Dry weight of 100 fruits (g)	41.89	650.36**	12.53	2.46	7.18
14	Number of seeds per fruit	0.42	238.16**	2.28	1.05	3.07
15	Weight of seeds per fruit (mg)	0.0001	0.009**	0.0002	0.01	0.03
16	Fruit to seed ratio	32.57	11.54**	2.90	1.18	3.45
17	Test weight (g)	0.04	0.91**	0.07	0.18	0.54
18	Yield (q/ha)	0.11	41.13**	0.16	0.28	0.82

fresh and dry weight of 100 fruits (g), number of seeds per fruit, weight of seeds per fruit (mg), seed test weight (g) and fruit yield (q/ha). Analysis of variance was carried out as per the procedure given by Panse and Sukhatme [8].

Results and Discussion

Significant differences were observed among the accessions for all the characters (Table 2) under study indicating the presence of wide genetic variability in the accessions and considerable scope for their improvement [9, 10].

The accessions differed significantly for plant height. The plant height ranged from 62.58 cm to 94.23 cm with a mean of 75.75 cm. Accession 26 was found tallest (94.23 cm) as compared to other accessions, Variations in plant height could be attributed to the genetic makeup of the accession. Number of primary branches per plant was also maximum in Acc. 26 (8.05). This might be due to the increased plant height in the Acc.26 that intern increased vegetative growth, which might have facilitated accumulation of more photosynthates leading to production of more number of primary branches per plant [11—14]. Significantly higher plant spread (68.01 cm^2) was observed in Acc. 28. This might be due to more number of primary branches and increased vegetative growth, which might have given the plants an adequate opportunity for photosynthesis [15].

The Acc. 17 has recorded less number of days for first flowering (52.14 days) and 50% flowering (72.14 days), whereas Acc. 25 was late flowering type (95.31 days). This might be due to the genetic make-up of the respective accession. Accession 17 was early to mature (24.25 days) and Acc. 25 (44.75 days) was late maturing type. This can be justified by their earliness and delayed flowering habits [11, 13, 15, 16].

Number of fruits per plant was maximum in Acc. 26 (1930.63). Higher number of fruits per plant in Acc. 26 can be justified by its higher assimilatory surface area due to the maximum plant height and more number of primary branches which intern altered the canopy structure and might have results in the stimu-

Table 3. Performance of bird's eye chilli (*Capsicum frutescens* L.) accessions for growth characters.

Accessions	Plant height (cm)			Number of primary branches per plant	Plant spread (cm^2)		
Acc. 1	49.50	58.43	72.94	6.30	28.80	30.68	38.20
Acc. 2	49.24	59.15	73.55	6.00	38.10	42.96	49.11
Acc. 3	46.17	56.43	68.34	5.40	20.39	24.22	40.42
Acc. 4	44.60	55.58	74.35	5.70	21.81	28.93	39.95
Acc. 5	46.81	57.97	72.06	6.90	23.21	33.71	44.59
Acc. 6	40.41	50.69	73.83	5.60	19.33	28.65	46.29
Acc. 7	41.54	44.54	67.97	5.10	18.10	27.05	34.74
Acc. 8	43.18	49.97	74.06	6.00	21.80	29.97	39.33
Acc. 9	40.95	44.88	70.57	5.70	20.26	35.46	35.81
Acc. 10	46.74	55.75	73.76	6.30	26.08	36.20	40.22
Acc. 11	44.92	54.03	79.03	5.50	30.33	39.22	49.86
Acc. 12	46.93	58.16	70.05	6.00	30.03	38.39	49.67
Acc. 13	35.48	48.20	70.37	5.90	28.46	38.92	48.69
Acc. 14	37.31	49.65	74.17	5.80	24.10	30.25	48.57
Acc. 15	44.05	55.35	71.10	7.00	32.03	38.49	48.96
Acc. 16	47.90	59.57	75.73	6.70	32.91	38.51	49.63
Acc. 17	45.26	60.51	85.05	6.10	32.03	40.89	61.88
Acc. 18	46.75	56.90	80.03	7.00	24.80	36.42	45.14
Acc. 19	41.84	52.10	74.23	6.10	22.35	36.24	46.26
Acc. 20	44.41	53.41	81.74	6.20	26.25	28.69	37.62
Acc. 21	46.28	55.07	70.15	5.90	28.20	32.48	46.70
Acc. 22	48.45	52.09	82.73	5.80	21.55	34.87	44.55
Acc. 23	44.70	53.74	69.04	5.60	23.78	31.09	44.60
Acc. 24	49.27	55.97	68.35	5.80	29.66	36.01	46.20
Acc. 25	47.05	57.40	82.77	5.50	25.65	28.60	45.03
Acc. 26	55.78	65.60	94.23	8.05	38.25	49.70	59.10
Acc. 27	47.39	57.06	78.41	6.60	34.30	47.25	54.73
Acc. 28	51.62	60.50	91.73	7.75	44.50	57.01	68.01
Acc. 29	41.04	46.83	77.72	6.50	21.75	40.70	43.60
Acc. 30	47.21	55.89	77.94	6.50	28.70	40.17	56.17
Acc. 31	38.67	46.27	70.14	5.60	28.70	32.86	51.09
Acc. 32	27.63	35.23	62.58	5.60	24.63	26.17	38.62
Acc. 33	28.04	40.28	67.97	5.30	20.95	28.42	40.62
Acc. 34	39.18	54.03	66.14	5.40	28.80	34.10	49.26
Acc. 35	38.55	49.78	85.23	5.90	37.45	31.11	42.86
Acc. 36	43.96	54.13	99.11	5.90	22.93	36.69	43.12
SEm±	4.25	4.36	2.34	0.36	1.79	2.59	2.66
CD at 5%	12.30	12.71	6.82	1.05	5.22	7.56	7.75

lation of more number of fruits per plant [11, 17, 18]. Fruit length (3.42 cm) and width (1.49) were maximum in Acc.20. These differences may be attributed to their genetic makeup [16].

Fruit yield per plant (855.97 g) was maximum in Acc. 26. It is clearly evident that there is a direct relationship between plant growth and yield. Acc. 26 recorded more number of primary branches, increased plant height, production of more number of fruits per plant and maximum fruit length. All these together might have contributed to fruit yield per plant [11, 12, 14, 18].

Accession 20 (66.35) has recorded maximum number of seeds per fruit, fresh and dry weight of 100 fruits (231.50 g and 98.70 g respectively). This may be due to the maximum fruit length, fruit width in Acc.

Table 4. Performance of bird's eye chilli (*Capsicum frutescens* L.) accessions for yield characters.

Accessions	DTFF	DT 50% F	DTPM	NFPP	FL	FW	DW 100 F	FYPP	NSPF	TSW	FSR	FY
Acc. 1	67.60	81.88	30.15	498.75	1.46	0.46	16.23	550.27	18.76	2.44	2.44	3.61
Acc. 2	62.13	82.23	30.25	559.10	1.37	0.48	16.18	525.25	11.95	1.70	7.37	3.40
Acc. 3	68.25	83.25	31.70	570.30	2.58	0.61	36.38	560.13	25.54	1.26	4.91	5.45
Acc. 4	65.75	80.75	30.00	433.08	1.82	0.40	16.21	506.20	12.32	2.25	5.65	2.68
Acc. 5	58.12	78.12	31.73	437.75	1.85	0.53	21.39	502.38	15.24	1.22	6.02	3.35
Acc. 6	58.40	76.40	33.06	435.75	1.60	0.33	16.84	493.97	14.08	1.85	4.83	2.18
Acc. 7	66.73	83.73	30.09	375.10	1.67	0.43	8.07	319.76	13.94	1.83	2.79	1.48
Acc. 8	64.47	84.47	30.25	409.43	1.60	0.37	14.06	491.90	14.05	1.68	4.68	3.10
Acc. 9	64.79	82.29	33.24	549.38	1.50	0.41	14.15	465.93	12.00	0.83	5.65	2.08
Acc. 10	66.55	86.55	32.76	617.66	1.40	0.41	13.93	459.43	12.28	2.26	8.94	4.02
Acc. 11	63.26	82.26	31.60	647.35	1.49	0.08	14.22	497.64	11.12	1.38	8.06	4.70
Acc. 12	62.00	82.13	32.20	887.91	1.44	0.40	15.09	499.73	11.74	1.85	8.33	3.30
Acc. 13	63.25	83.73	34.15	949.88	1.96	0.53	14.85	450.27	11.04	1.26	5.19	2.63
Acc. 14	62.87	83.05	30.23	888.93	1.61	0.42	15.43	589.95	13.40	1.57	5.12	3.55
Acc. 15	61.18	81.43	32.03	680.41	1.57	0.45	18.01	508.31	10.63	1.75	5.08	2.68
Acc. 16	60.45	80.73	30.23	421.58	2.28	0.52	24.67	554.68	13.22	1.83	7.96	5.35
Acc. 17	52.14	72.14	24.25	556.90	2.59	0.51	55.59	560.76	27.34	2.42	8.72	5.93
Acc. 18	60.23	80.23	30.00	876.53	2.53	0.60	31.38	799.11	34.60	2.70	4.76	15.98
Acc. 19	62.24	82.24	30.83	701.49	2.49	0.67	64.24	559.26	36.14	1.88	5.47	12.07
Acc. 20	60.11	83.11	37.88	535.88	3.42	1.49	98.71	751.26	66.35	4.53	10.96	10.16
Acc. 21	64.81	84.81	31.10	893.36	2.04	0.58	15.91	460.26	21.76	1.81	7.20	4.32
Acc. 22	55.31	76.81	35.00	1725.24	2.72	0.53	26.79	648.41	27.40	1.32	8.40	6.10
Acc. 23	58.05	78.55	31.25	676.12	1.92	0.60	46.14	496.81	14.86	1.71	9.83	8.45
Acc. 24	56.91	77.41	32.00	807.23	2.24	0.42	17.33	562.93	14.49	1.61	7.9	3.73
Acc. 25	72.75	95.31	44.75	974.88	1.48	0.43	18.18	611.26	13.76	1.66	8.90	4.48
Acc. 26	58.13	75.25	29.03	1960.56	2.97	0.56	44.22	855.97	33.24	3.74	6.57	20.71
Acc. 27	58.28	82.03	32.60	680.00	2.25	0.62	38.79	597.61	23.09	2.06	11.10	13.64
Acc. 28	54.16	73.38	28.25	1737.73	1.88	0.56	33.23	808.59	25.58	1.59	4.57	17.25
Acc. 29	65.35	85.85	30.00	399.35	1.55	0.43	16.14	598.24	16.76	1.88	3.42	2.38
Acc. 30	66.74	87.74	32.70	711.23	2.14	0.54	28.85	530.26	24.04	1.79	7.97	6.45
Acc. 31	68.57	90.10	31.14	511.24	2.29	0.49	17.46	527.73	23.48	1.82	3.01	4.57
Acc. 32	59.13	82.13	40.90	652.83	1.54	0.51	17.19	519.94	28.78	2.11	4.51	5.01
Acc. 33	56.44	77.44	31.14	692.88	1.64	0.38	14.61	498.31	14.10	1.89	5.18	6.33
Acc. 34	64.18	84.18	31.13	433.47	1.46	0.41	13.99	503.41	10.79	2.16	9.76	6.20
Acc. 35	68.78	88.78	34.82	613.40	1.55	0.38	15.75	502.63	11.31	2.64	4.01	5.32
Acc. 36	55.07	78.57	32.23	660.98	1.54	0.62	15.22	487.11	18.82	2.23	2.06	6.43
SEm±	1.15	1.63	2.27	40.59	0.21	0.02	2.46	2.83	1.05	0.18	1.18	0.28
CD @ 5%	4.41	4.76	6.61	116.53	0.59	0.06	7.18	8.24	3.07	0.54	3.45	0.82

20 [11, 12, 14, 15]. The maximum fruit yield per hectare (20.71 q) was recorded in the Acc. 26 whereas, Acc. 7 has recorded minimum fruit yield per hectare (1.48 q) (Table 3). As Acc. 26 recorded better vegetative growth in terms of more number of primary branches per plant, increased plant height, more number of fruits per plant, more fruit yield per plant due to better photosynthetic efficiency and translocation of photosynthates from source to sink might have increased the fruit yield per hectare [11, 15, 19].

Conclusion

It was evident from the study that considerable degree of variability exists among the accessions for growth and yield characters (Table 4). The characters showing wide range of variation provide ample scope for selecting superior types and the selected genotypes can be used in further crossing program for introgression of their desired genes and to obtain heterotic hybrids. The most promising accessions for

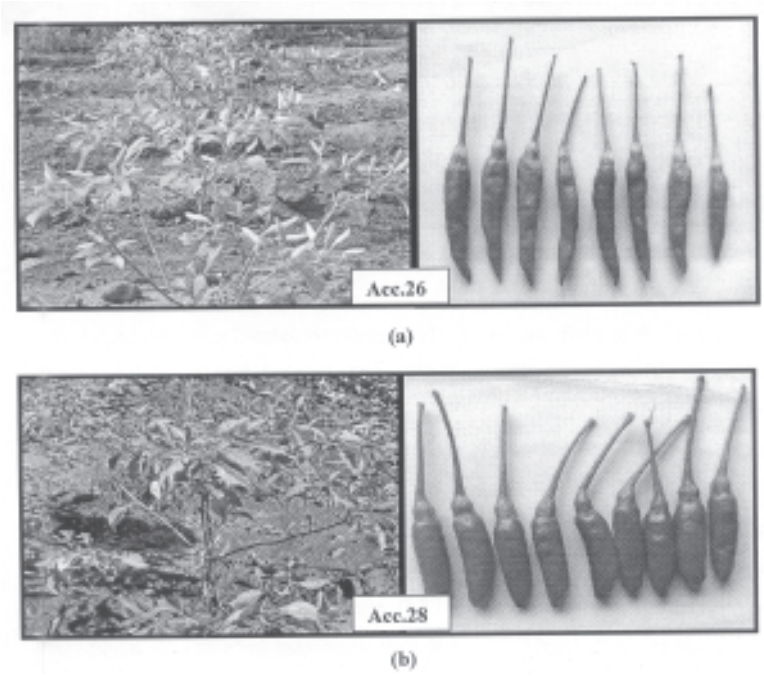

Fig. 1. (a and b) High yielding bird's eye chilli accessions.

fruit yield were Acc.26 and Acc.28 (Fig. 1). Accession 17 was found to be of early flowering type. Accession 20 was found to be the bold fruited type.

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