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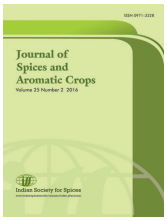

Genetic analysis of paprika genotypes for dry fruit yield in chilli

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Abstract

Ten genotypes of paprika were evaluated for mean performance, variability parameters and association of characters towards dry fruit yield. Based on mean performance, genotype C-6 ('U.S.609') was the best for all characters except number of seed fruit^{-1}, ascorbic acid, oleoresin content, capsaicin and capsanthin content. High estimates of genotypic coefficients of variation for numbers of primary branches, dry fruit yield plant^{-1}, fresh ripe fruit yield plant^{-1} and fruit length indicated that the major part of variability was due to genetic makeup for these traits. Fruit length, fresh ripe fruit yield plant^{-1} and dry fruit yield plant^{-1} had higher genetic advance coupled with high heritability indicates the additive gene action. Among the characters analyzed for association it could be concluded that number of fruit plant^{-1}, fruit length, plant height, days from anthesis to harvest and number of primary branches plant^{-1} would be appropriate selection parameters for improvement of fresh fruit yield.

Keywords: *Capsicum annuum* var. *longum*, selection, variability parameters

Fruit of the spice paprika (*Capsicum annuum* var. *longum* L.), are used as a vegetable, and when fully ripe, are dried, milled and used as a spice and colouring agent in the food and cosmetic industries, respectively (Shiva *et al*. 2015). In India, there is little cultivation of paprika and only a few varieties with reduced pungency, fleshly large fruit and with excellent color. For any crop improvement programme information on the range of variability present in quantitative traits is important as the success of phenotypic selection depends upon the range of genetic variability present in the population. India is in the beginning stage of paprika breeding and no commercial cultivation of paprika. A breeding program has to be initiated to evaluate existing varieties or genotypes. An evaluation was conducted with paprika genotypes (Table 1) to (i) study the extent of variability available for yield and its component traits in paprika genotypes, and (ii) understand the direction and magnitude of association among yield components in paprika at College Orchard, Department of Horticulture, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal during 2010. The

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Table 1. Details of material used

Genotype	Genotypes designation	Source
Arka Abir	C-1	ICAR-Indian Institute of Horticultural Research, Bengaluru, India
Bydagi Dabbi	C-2	University of Agricultural Sciences, Dharwad, India
Bydagi Kaddi	C-3	University of Agricultural Sciences, Dharwad, India
AVNPC-131	C-4	Gujarat Agricultural University, India
Hekla	C-5	East West Seed Indonesia, Aurangabad, India
U.S 609	C-6	Indo American Hybrid Seeds, Bangalore, India
Hakone	C-7	East West Seed Indonesia, Aurangabad, India
ACS-01	C-8	Gujarat Agricultural University, India
ACS-04	C-9	Gujarat Agricultural University, India
KTPL-19	C-10	ICAR-Indian Agricultural Research Institute, Regional Station, Katrain, India

experiment was arranged in a Completely Randomized Block Design replicated three times. After uniform leveling, a spacing of 50 cm × 30 cm was used. Plot size was 4 × 3 m^2. Thirty-five day-old seedlings were transplanted on ridges. Recommended cultural practices were followed as per TNAU Crop Production Guide (2005). Observations were recorded from randomly selected plants in each replication. The data were analyzed by the methods outlined by Panse & Sukhatme (1967), genotypic and phenotypic coefficient of variation (Burton 1952), heritability (Lush 1949) and genetic advance (Johnson *et al*. 1955). Correlation and path coefficients were computed using formulae of Johnson *et al*. (1955) and Dewey & Lu (1959).

Fruit yield is the ultimate and most important trait. Significant differences occurred in red ripe fruit yield per plant. Genotype C-6 had the highest fruit yield followed by genotypes C-10 and C-5. Dry fruit yield is affected by production system used, particularly in the tropics. Genotype C-6 had the highest dry fruit yield followed by genotypes C-5 and C-10. Genotypes C-10, C-1 and C-4 had high ascorbic acid contents. Genotypes C-10, C-1 and C-2 had the greatest oleoresin content. Genotypes C-10, C-1 and C-9 had the lowest capsaicin content. Colour is an important attribute of paprika. Genotypes C-10, C-1, C-7 and C-3 had the greatest maximum capsanthin content.

Evaluation of paprika genotypes based on the mean performance indicated that the genotypes possessed better values for different parameters (Table 2). Genotype C-6 ('U.S.609') performed better for plant height, number of primary branches, days to first flowering, days from anthesis to harvest, number of fruit $plant^{-1}$, fruit length, fruit diameter, thousand seed weight, fresh ripe fruit yield $plant^{-1}$, and dry fruit yield $plant^{-1}$. Genotype C-5 ('Hekla') performed better for plant height, number of primary branches, fruit length, thousand seed weight, fruit diameter, and fresh ripe fruit yield $plant^{-1}$. Genotype C-10 ('KTPL-19') performed well for ascorbic acid content, oleoresin content, capsaicin content and capsanthin content followed by C-1 ('Arka Abhir').

Variability analysis indicated differences due to genotype (Table 3). Phenotypic variance was higher than genotypic variance for all characters. The genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) was high for fresh ripe fruit yield $plant^{-1}$, dry fruit yield $plant^{-1}$, number of primary branches, fruit length, and fruit diameter. The coefficient of phenotypic and genotypic variation did not differ much in magnitude, indicating that the characters are not much influenced by environmental factors, simple selection itself may prove better based on phenotypic values.

Table 2. Mean performance of paprika genotypes

Genotype	PH	NPB	DFF	DTAH	NFPP	FL	FD	FW	NSPF	TSW	FFY	DFY	AAC	OC	CC	CPC
C-1	81.05	2.46	38.63	42.86	22.40	8.33	3.06	7.26	58.46	3.46	137.26	55.56	80.36*	13.25*	0.24*	150.49*
C-2	85.51	2.46	37.36	49.46	21.16	7.70	3.20	6.56	52.36	3.23	135.86	55.00	72.19	12.56*	0.38	142.60
C-3	71.71	2.80	34.00	46.93	17.10	13.93*	3.33	7.80	63.40	3.73	132.03	53.36	73.34	12.23	0.27	151.07*
C-4	98.70*	1.16	38.26	41.73*	24.26	10.80	3.73	6.26	54.23	3.53	148.00	60.16	81.30*	12.37	0.29	146.14
C-5	106.83*	2.93*	36.46	49.00	26.73	12.73*	4.73*	6.76	59.46	4.00*	172.53	71.63	79.23*	12.46	0.31	149.42*
C-6	108.62*	3.40*	32.03*	38.70*	32.36*	15.90*	5.06*	8.10*	63.83	4.26*	257.96*	104.86*	76.12	12.45	0.32	147.41
C-7	82.74	2.56	35.50	41.40*	24.50	9.66	4.83*	5.30	48.33	3.93	128.60	51.96	82.15*	12.49	0.27	153.08*
C-8	91.37	1.43	36.66	40.66*	21.10	9.33	3.20	6.06	44.86	2.66	127.76	51.06	77.62	11.57	0.30	150.22*
C-9	101.95*	1.83	37.63	40.53*	19.66	9.60	3.03	6.43	45.50	2.40	125.73	50.30	74.18	11.58	0.26*	149.20*
C-10	102.72*	2.26	35.56	42.63	23.46	11.13*	3.50	7.63	40.63	3.20	173.96	71.33	83.11*	13.55*	0.19*	154.00*
Mean	93.12	2.33	36.12	43.39	23.27	10.91	3.70	6.82	53.110	3.443	153.97	62.52	77.963	12.45	0.285	149.36
CV (%)	2.69	11.35	3.99	2.37	10.06	2.37	10.34	10.70	10.63	10.80	9.23	9.74	0.11	1.68	4.21	0.04
SEd	2.51	0.26	1.445	1.032	2.343	0.259	0.390	0.730	5.649	0.372	14.227	6.388	0.091	0.210	0.012	0.069
CD (0.05)	5.28	0.55	3.036	2.168	4.922	0.545	0.819	1.533	11.868	0.782	29.891	13.420	0.190	0.440	0.026	0.145

*Significant at 5 % level.

PH=plant height (cm); NPB=number of primary branches; DFF=days to first flowering; DTAH=days from anthesis to harvest; NFPP=number of fruit plant^{-1}; FL=fruit length (cm); FD=fruit diameter (cm); FW=fruit weight (g); NSPF=number of seed fruit^{-1}; TSW=1000 seed weight (g). FFY=fresh ripe fruit yield plant^{-1} (g); DFY=dry fruit yield plant^{-1} (g); AAC=ascorbic acid content (mg/100 g); OC=oleoresin content (%); CC=capsaicin content (%); CPC=capsanthin content (ASTA).

Table 3. Genetic variability components in paprika genotypes

Character	PV	GV	PCV	GCV	ECV	H^2	GA
Plant height (cm)	162.11	152.62	13.67	13.26	3.3068	94.15	26.52
Primary branches	0.540	0.435	31.49	28.26	13.8969	80.54	52.26
Days to first flowering	6.198	3.066	6.8747	4.8350	4.8871	49.46	7.01
Days from anthesis to harvest	15.074	13.476	8.947	8.459	2.9128	89.40	16.48
No. of fruit plant^{-1}	23.070	14.84	20.64	16.55	12.3274	64.31	27.34
Fruit length (cm)	6.747	6.646	23.801	23.622	2.9091	98.51	48.30
Fruit diameter (cm)	0.784	0.556	23.492	19.787	12.6635	70.94	34.33
Fruit weight (g)	1.294	0.496	16.68	10.33	13.1005	38.33	13.17
No. of seed fruit^{-1}	98.14	50.28	18.65	13.35	13.0261	51.23	19.87
1000 seed weight	0.485	0.277	20.21	15.28	13.2343	57.15	23.80
Fresh ripe fruit yield plant^{-1} (g)	1848.084	1544.453	27.9200	25.5236	11.3169	83.57	48.07
Dry fruit yield plant^{-1} (g)	323.032	261.828	28.7447	25.8787	12.5119	81.05	47.99
Ascorbic acid content	15.02	15.01	4.970	4.968	0.1424	99.92	10.23
Oleoresin content	0.426	0.360	5.239	4.817	2.0608	84.53	9.12
Capsaicin content	0.003	0.002	18.14	17.37	5.2333	91.68	34.27
Capsanthin content	11.14	11.13	2.234	2.233	0.0567	99.94	4.60

PV=phenotypic variance; GV=genotypic variance; PCV=phenotypic coefficient of variation; GCV=genotypic coefficient of variation; ECV=environment coefficient of variation; H^2=heritability; GA=genetic advance as percent of mean.

These results are supported by the earlier findings of Krishna *et al.* (2007).

High magnitude of PCV and GCV were observed for, number of fruits plant^{-1}, fruit weight and yield plant^{-1} in chilli was reported by Janaki *et al.* (2015). Heritability values were high for all the characters except fruit weight. High heritability indicated that there were more additive genes for these characters. Fruit length, fresh ripe fruit yield plant^{-1}, primary branches and dry fruit yield plant^{-1} had higher genetic advance values, as percent of mean, and higher estimates of heritability. Patel *et al.* (2015) reported that the characters day to flowering, plant height, number of primary branches plant^{-1}, number of secondary branches plant^{-1}, number of fruits plant^{-1}, average fruit length, average fruit girth, green fruit yield plant^{-1} and capsaicin content exhibited high genetic advance coupled with high heritability.

This may be due to predominance of additive gene effects. Datta & Das (2013) reported the similar results of high heritability with genetic advance for red fruit yield in chillies.

Fresh fruit yield had a positive and significant, association with number of fruit plant^{-1}, fruit length, plant height, days from anthesis to harvest and number of primary branches plant^{-1}. Ascorbic acid showed a significant negative association, whereas oleoresin, capsanthin and capsaicin contents had negative correlations with yield. Significant correlations of the fresh fruit yield indicates the possibility of direct and indirect effective selection for further improvement and were the most important associates of fruit yield in paprika. Similar reports on chilli were made by Smitha & Basavaraja (2006) and Vikram *et al.* (2014) in chillies. There was considerable variability present in the genotypes with genotype C-6 having high mean values 11 characters followed by C-5 (7) and C-10 (6) indicating these genotypes can be utilized for improvement in paprika.

Table 4. Genotypic correlation coefficients in paprika genotypes

	NPB	DFF	DTAH	NFPP	FL	FD	FW	NSPF	TSW	AAC	OC	CC	CPC	FFY
PH	-0.274	0.954	0.936	0.931	0.895	0.009	0.411	0.891	-0.100	0.966	0.957	-0.443	0.963	0.917*
NPB		-0.266	-0.254	-0.043	-0.102	0.936	0.722	-0.194	0.970	-0.280	-0.210	0.961	-0.276	0.816*
DFF			0.981	0.868	0.838	-0.009	0.425	0.918	-0.082	0.990	0.987	-0.425	0.990	-0.216
DTAH				0.856	0.864	-0.013	0.427	0.941	-0.080	0.975	0.981	-0.435	0.982	0.826*
NFPP					0.900	0.253	0.551	0.884	0.139	0.900	0.905	-0.245	0.887	0.944*
FL						0.154	0.536	0.924	0.064	0.878	0.884	-0.317	0.888	0.930*
FD							0.815	0.042	0.982	-0.008	0.045	0.862	-0.015	0.039
FW								0.465	0.814	0.412	0.483	0.572	0.421	0.418
NSPF									-0.019	0.923	0.934	-0.400	0.932	0.563
TSW										-0.093	-0.029	0.913	-0.097	-0.065
AAC											0.993	-0.453	0.997	-0.862*
OC												-0.397	0.993	-0.567
CC													-0.454	-0.426
CPC														-0.659

* Significant at 5 % level.

PH=plant height (cm); NPB=number of primary branches; DFF=days to first flowering; DTAH=days from anthesis to harvest; NFPP=number of fruit plant^{-1}; FL=fruit length (cm); FD=fruit diameter (cm); FW=fruit weight (g); NSPF=number of seed fruit^{-1}; TSW=1000 seed weight (g); FFY=fresh ripe fruit yield plant^{-1} (g); AAC=ascorbic acid content (mg/100 g); OC=oleoresin content (%); CC=capsaicin content (%); CPC=capsanthin content (ASTA)

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