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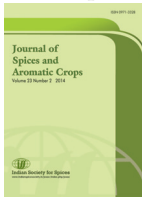

Variability and character association in paprika and paprika alike chillies

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Abstract

An experiment was conducted to estimate variability and character association in a set of 25 indigenous (paprika alike chillies) and 18 exotic (paprika) germplasm of paprika. Wide range of variation was observed for all the characters except for capsaicin content, weight of seeds, fruit girth and length. The maximum range of variation was recorded for yield plant^{-1} followed by color value, plant height and number of seeds fruit^{-1}. Among the various traits, maximum coefficient of variation was observed for capsaicin content, followed by weight of pericarp fruit^{-1}, yield plant^{-1} and weight of seeds fruit^{-1} in the indigenous lines of paprika. Similarly, in the exotic and combined germplasm of paprika and paprika alike chillies, maximum range of variation was registered with yield plant^{-1}, followed by color value, number of seeds fruit^{-1} and plant height and narrow range of variation was observed with capsaicin content. In the combined germplasm, maximum coefficient of variation was recorded with capsaicin content, followed by weight of pericarp fruit^{-1}, yield plant^{-1} and color value. Weight of pericarp, number and weight of seeds fruit^{-1} were identified as important yield components and selection should be focused on these traits for improvement of paprika and paprika alike chillies.

Keywords: character association, correlation, paprika, paprika alike chillies, variability

Paprika (*Capsicum annuum* L.), a form of chilli is mainly valued for its high color, low or nil pungency and oleoresins, which has a great commercial importance world wide. Three major products traded in the world market are: paprika, oleoresin and dried chilli (both in whole and powder form). The quality of paprika products is based on the visual and extractable color, pungency level and lesser extent on the nutritional value (Verma 2003). In India, indigenous types of chillies such as 'Byadagi chilli' with fruits having high color and low pungency and Warangal Chappatta (Tomato chilli) having high color value are similar to qualities of paprika types that are grown in Spain and Hungary (Shiva *et al.* 2008), and are much preferred by oleoresin manufacturers for extraction of paprika alike oleoresin. Knowledge of the association on various characters with yield and the

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components *inter se* would provide better criteria for direct selection through components for improvement in yield and quality. Information available on variability in the indigenous and exotic germplasm of paprika for yield, quality and its attributing parameters and their relationships are very scanty. In light of the above, the present study was undertaken to assess the variability present in the germplasm of paprika (exotic) and paprika alike chillies (indigenous) for yield and quality contributing characters, and degree of association among them, which in turn would aid in identifying characters amenable to genetic improvement and development of promising lines to meet the requirements of the paprika industry.

The present investigation was carried out at Experimental Farm, ICAR-Indian Institute of Spices Research, Kozhikode (Kerala) during 2006-07 and 2007-08. Paprika (exotic) and paprika alike chillies (indigenous) lines collected from various sources through field survey and correspondence were purified initially using insect-proof nylon cage, as suggested by Bosland (1993) and the seeds thus collected from each accession were stored separately in butter-paper cover in desiccators. The seeds were raised in nursery and transplanted to pots after one-month under rain-shelter for two seasons (January to June) and the data were pooled and analyzed. The potting media comprised of one part each of dried leaf mould, well-decomposed farm yard manure, river sand and garden soil. The trial was laid out in completely randomized design with 25 indigenous germplasm (paprika alike chillies) and 18 exotic collections (paprika), replicated thrice. Ten plants were maintained for each genotype in each replication. Cultural practices were practiced uniformly for all the plants in pots.

Observations on morphological parameters *viz.*, days to 50% flowering, plant height, fruit length, fruit girth, weight of pericarp, number of seeds fruit^{-1}, weight of seeds fruit^{-1}, yield plant^{-1} were recorded from 10 plant in each replication for each genotype for two seasons, according to IPGRI descriptor (1995). Ripened red fruits were harvested and dried in controlled condition. Dried pods were powdered and used for the estimations. The total extractable color of the fruit pericarp was analyzed by ASTA method using a UV-visible UV160A Shimadzu spectrophotometer at 460 nm using acetone as blank and the color value was expressed as ASTA units (ASTA 1997). Capsaicin content was estimated on a Shimadzu HPLC system with UV Detector, SPD 10Avp detector and LC-6A HPLC pump was used. Mobile phase flow rate was 1.5 mL min^{-1}. Column: Reverse phase ODS Column C -18. 250 × 4.6 mm, internal diameter is 5μm particle size. Injection volume 25 μL (25 μL of prepared chilli extract in alcohol; standard-Capsaicin 1 mg mL^{-1} alcohol). The pungency was expressed as per cent capsaicin. The data thus collected were subjected to standard statistical analysis as per Gomez & Gomez (1986) and Townend (2002).

Analysis of variance showed significant differences among the genotypes for all the traits studied. The range, mean, standard deviation and coefficient of variation for various parameters presented in Tables 1, 2 & 3 revealed sufficient variability in the indigenous and exotic germplasm of paprika for morphological, yield and quality traits. Such wide variation indicated the scope for improving the population for these characters as suggested by Cherian (2000) earlier. Wide range of variation was observed for all the characters except for capsaicin content, weight of seeds, fruit girth and length. The maximum range of variation was recorded for yield plant^{-1}, followed by color value, plant height and number of seeds fruit^{-1}. Among the various traits, maximum coefficient of variation was observed for capsaicin content, followed by weight of pericarp fruit^{-1}, yield plant^{-1} and weight of seeds fruit^{-1}, while minimum variation was recorded for days to 50% flowering in the indigenous germplasm (Table 1). Similarly, in the exotic and combined germplasm of paprika and paprika alike chillies, maximum range of variation was registered with yield plant^{-1}, followed by color value, number of seeds fruit^{-1} and plant height and narrow range of variation with capsaicin content (Tables 2 & 3). Coefficient of variation ranged from 13.26-80.76%, the maximum being

Table 1. Variability in the indigenous (paprika alike chillies) germplasm of paprika

Character	Range	Mean	SD	CV %
Days to 50% flowering	56.00 - 78.00	65.52	5.29	8.08
Plant height (cm)	86.67 - 178.33	117.51	27.55	23.44
Fruit length (cm)	7.03 - 16.76	12.33	1.91	15.51
Fruit girth (cm)	3.63 - 9.23	6.91	1.32	19.17
Weight of pericarp fruit^{-1} (g)	3.74 - 26.37	7.90	4.32	54.70
Number of seeds fruit^{-1}	42.00 - 122.00	83.00	19.36	23.32
Weight of seeds fruit^{-1} (g)	0.350 - 1.716	0.968	0.25	26.33
Yield plant^{-1} (g)	302.46 - 1112.64	652.94	206.29	31.59
Color value (ASTA units)	94.10 - 330.65	217.77	54.39	24.98
Capsaicin content (%)	0.01 - 1.26	0.570	0.37	65.52

Table 2. Variability in the exotic germplasm of paprika

Character	Range	Mean	SD	CV %
Days to 50% flowering	47.00 - 78.00	59.11	7.84	13.26
Plant height (cm)	88.33 - 188.33	146.10	33.36	22.70
Fruit length (cm)	8.66 - 17.36	13.54	2.15	15.84
Fruit girth (cm)	4.87 - 10.43	7.86	1.40	17.83
Weight of pericarp fruit^{-1} (g)	3.10 - 39.21	9.78	7.90	80.76
Number of seeds fruit^{-1}	37.00 - 147.00	89.33	25.61	28.67
Weight of seeds fruit^{-1} (g)	0.605 - 1.696	1.201	0.23	19.10
Yield plant^{-1} (g)	206.23 - 999.18	540.41	246.85	45.68
Color value (ASTA units)	51.50 - 356.65	222.59	74.07	33.28
Capsaicin content (%)	0.006 - 0.540	0.30	0.15	51.32

Table 3. Variability in the combined germplasm of paprika and paprika alike chillies

Character	Range	Mean	SD	CV %
Days to 50% flowering	47.00 - 78.00	62.84	7.15	11.38
Plant height (cm)	86.67 - 188.33	129.48	32.90	25.41
Fruit length (cm)	7.03 - 17.36	12.84	2.08	16.19
Fruit girth (cm)	3.63 - 10.43	7.31	1.42	19.46
Weight of pericarp fruit^{-1} (g)	3.10 - 39.21	8.69	6.07	69.85
Number of seeds fruit^{-1}	37.00 - 147.00	85.65	22.13	25.84
Weight of seeds fruit^{-1} (g)	0.350 - 1.716	1.07	0.27	25.19
Yield plant^{-1} (g)	206.23 - 1112.64	605.83	228.34	37.69
Color value (ASTA units)	51.50 - 356.65	219.78	62.58	28.48
Capsaicin content (%)	0.006 - 1.26	0.46	0.33	71.51

with weight of pericarp fruit^{-1}, followed by capsaicin content, yield plant^{-1}, color value and number of seeds fruit^{-1}, and minimum with days to 50% flowering in the exotic germplasm (Table 2). However, in the combined germplasm, maximum coefficient of variation was recorded with capsaicin content, followed by weight of pericarp fruit^{-1}, yield plant^{-1} and

color value (Table 3). Similar variations for various traits in paprika and paprika alike chillies were also reported by Anu *et al*. (2002), Leela *et al*. (2004) and Kumar *et al*. (2012). Wide variation suggested the presence of high genetic variability, while narrow or minimal variation indicated the desirability of selection.

The combined correlation coefficient for paprika and paprika alike chillies is presented in Table 4. The important economic trait *viz*., yield was found to have highly significant and positive correlation with weight of pericarp fruit^{-1}, followed by days to 50% flowering and significant negative association with plant height. Significant and positive correlation was found between other important characters, i.e., number of seeds fruit^{-1} with weight of pericarp fruit^{-1} and fruit length; weight of seeds fruit^{-1} with weight of pericarp, number of seeds, fruit girth and fruit length. However, the quality parameters namely color value had significant negative correlation weight of pericarp, number of seeds fruit^{-1} and yield plant^{-1}. Likewise, capsaicin content exhibited significant negative association with weight of seeds fruit^{-1}. Overall, the important parameters responsible for yield of fruits such as days to 50% flowering, weight of pericarp (fruit), number and weight of seeds fruit^{-1} were found to be positively correlated with each other suggesting that effective improvement in paprika and paprika alike chillies through these components could be achieved by simple selection. These results are in agreement with the findings of Kumar *et al.* (2012). The higher the weight of the pericarp (fruit) as well as the seeds, the better would be the yield of fruits plant^{-1}, implying that pericarp of the fruits along with the seeds contributed to yield of the fruits and hence, these characters can be used as selection indices in the improvement of paprika and paprika alike chillies (Bharadwaj *et al*. 2007). However, quality parameters namely color value and capsaicin content were negatively associated with yield and its associated parameters like weight of pericarp, number and weight of seeds fruit^{-1} indicating that these qualitative traits are not affected by the quantitative traits.

On the basis of variability and correlation studies, the study revealed sufficient variability in the indigenous and exotic germplasm of paprika for morphological, yield and quality traits. Such wide variation indicated the scope for improving the population. Days to 50% flowering, weight of pericarp, number and weight of seeds fruit^{-1} are important yield contributing traits, which should be taken into consideration during the selection process.

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Table 4. Correlation coefficient (r) among various characters in paprika and paprika alike chillies

Character	DF	PH	FL	FG	WP	NOS	WOS	YP	CV	CC
DF	1.000	-0.252	-0.117	0.046	0.007	0.170	0.167	0.357*	-0.125	0.208
PH		1.000	0.048	-0.055	-0.149	-0.134	0.189	-0.328*	0.192	-0.283
FL			1.000	0.236	0.217	0.339*	0.329*	0.144	-0.013	-0.210
FG				1.000	0.084	0.213	0.443**	0.041	-0.030	-0.207
WP					1.000	0.565**	0.536**	0.517**	-0.607**	-0.311
NOS						1.000	0.477**	0.301	-0.521**	-0.241
WOS							1.000	0.244	-0.231	-0.375*
YP								1.000	-0.330*	-0.168
CV									1.000	0.087
CC										1.000

*Significant at P<0.05; **Significant at P<0.01; DF=Days to 50% flowering; PH=Plant height (cm); FL=Fruit length (cm); FG=Fruit girth (cm); WP=Weight of pericarp fruit^{-1} (g); NOS=Number of seeds fruit^{-1}; WOS=Weight of seeds fruit^{-1} (g); YP=Yield plant^{-1} (g); CV=Color value (ASTA units); CC=Capsaicin content (%)

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