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Short Communication

Genetical study for quality traits in bell pepper [*Capsicum annuum* (L.) var. *grossum* Sendt.]

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Bell pepper [*Capsicum annuum* (L.) var. *grossum* Sendt.] popularly known as Sweet pepper or Shimla Mirch is an off season summer vegetable grown extensively in the mid hills of Himachal Pradesh, and returns a good profit for the growers. Therefore, the present study was framed with the objectives to determine the component traits of variation, magnitude of correlation between yield and quality traits alongwith path coefficient in the available germplasm that could support further improvement in quality production of capsicum.

Twenty five genotypes of bell pepper (collected from different parts of country, AVRDC, Taiwan and Kyungpook National University, Taegu, Korea) *viz.*, Nishat-1, SKAU-616-1, SKAU-614, SKAU-609, SKAU-633-1, SKAU-82-1, SKAU-648, SKAU-601, SKAU-613-1, SKAU-625-4, SKAU-609-1, Capsicum-143570, Capsicum-203602, Russian Yellow, HC-201, EC-218688, California Wonder, Mid Way, Local Belgam, UHF-494, Kandaghat Selection, Rajer Collection, EC-464107, EC-464115 and EC-464119 were raised during 2004-05 in randomised block design with three replications. The plants were spaced 45 cm apart between and within rows. Fruits of 10 randomly selected plants were harvested at marketable stage for recording fruit yield/plant. Samples taken from each plant grown were cut into small pieces and mixed in equal proportion for estimating ascorbic acid (mg) by titrimetric [1], total soluble solids (TSS %)with the help of ERMA hand refractometer [2], pericarp thickness with Vernier Caliper and capsaicin content (%) by colorimetric method as described by Bajaj [3].

The analysis of variance was based on linear model suggested by Fisher [4]. The genotypic coefficient of variation, heritability, genetic advance, genotypic and phenotypic coefficients of correlation and path coefficient at genotypic and phenotypic level were calculated as per .standard procedure [5].

The analysis of variance showed that the genotypes differ significantly among themselves for the characters studied, indicating presence of adequate variability. The findings are in line with those of Mishra *et al.*, [6] and Kumar *et al.*, [7]. The range, mean values, phenotypic and genotypic coefficient of variations, heritability and genetic advance as percentage of mean for pericarp thickness, TSS, ascorbic acid content, capsaicin content and marketable fruit yield per plant are presented in Table 1.

The phenotypic coefficients of variation (pcv) were slightly higher than their corresponding genotypic coefficient of variation (gcv) that is owing to environmental influence. The phenotypic and genotypic coefficients of variations expressed in per cent were comparatively high for capsaicin content and marketable fruit yield and moderate to low for TSS, ascorbic acid and pericarp thickness. The characters having high gcv possessed better potential for improvement through selection. The estimates of heritability act as a predictive instrument in expressing the reliability of phenotypic value. Therefore, it helps the breeder to make selections for a particular character when heritability is high. The genetic advance is a useful indicator of the progress

Table 1. Range, mean, phenotypic coefficient of variation (pcv), genotypic coefficient of variation (gcv), heritability and genetic advance in bell pepper.

Trait	Range	Mean	pcv (%)	gcv (%)	Heritability (h^2 %)	Genetic advance (% of mean)
Total soluble solids (%)	6.03-6.27	6.1±0.03	01.2	00.7	35.0	0.8
Ascorbic acid (mg/100g)	90.6-137.1	108.0±4.6	13.3	11.1	69.9	19.2
Capsaicin content (%)	0.013-0.150	0.067±0.003	53.6	53.6	98.3	104.2
Pericarp thickness (mm)	1.8-4.7	3.06±01.0	18.3	17.4	90.1	33.9
Marketable fruit yield/plant(g/plant)	145.6-513.5	309.2±25.51	38.3	13.5	86.0	86.0

that can be expected as a result of exercising selection on the pertinent population. The heritability was moderate (ascorbic acid 69.9%) to high (capsaicin content 98.3%, pericarp thickness 90.1% and marketable fruit yield/plant 86.0%) for the characters studied. It was low for TSS (35.0%). The highest genetic advance was predicted for capsaicin content (104.2) followed by marketable fruit yield. However, it was low in case of ascorbic acid (19.2) and total soluble solids (0.82). The higher estimates of heritability coupled with high to moderate genetic advance for capsaicin content and marketable fruit yield/plant and pericarp thickness indicated that heritability of the trait is mainly owing to additive effects and consequently a high genetic gain is expected from selection under such a situation. However, moderate heritability accompanied by low genetic advance for ascorbic acid content is an indicative of epistatic gene action and the heritability is being exhibited due to favourable influence of the environment rather than genotypes. Low heritability associated with low genetic advance for TSS is indicative of non-additive gene action and consequently low gain is expected from selection is such a situation. Similar results were obtained by earlier workers [7 and 8]. The genotypic correlations were higher than their corresponding phenotypic for all the traits under study suggesting strong inherent association between these traits at genotypic level (Table 2).

Table 2. Phenotypic (P) and genotypic (G) correlation coefficients among marketable yield and quality traits in bell pepper

Character		Pericarp thickness	TSS	Ascorbic acid	Capsaicin content
Marketable yield/plant	P	–0.151	–0.152	–0.212	–0.297
	G	–0.172	–0.307	–0.301	–0.317
Pericarp thickness	P		–0.109	0.379	0.176
	G		–0.229	0.461	0.187
TSS	P			0.002	–0.052
	G			0.960	–0.046
Ascorbic acid	P				0.251
	G				0.322

At phenotypic and genotypic level, capsaicin content showed positive association with pericarp thickness and ascorbic acid, and ascorbic acid with pericarp thickness and TSS, thus indicating that selection for capsaicin content would simultaneously lead to an improvement in pericarp thickness, ascorbic acid and TSS. The genotypic correlations were partitioned into direct and indirect effects to know the relative importance of the components (Table 3). Pericarp thickness, TSS, ascorbic acid and capsaicin content had negative correlation with marketable yield/plant. However, all these traits exhibited high positive direct path. The negative genotypic correlation of these traits with marketable fruit yield and negative indirect effects was counter balanced by high positive direct path. The low magnitude of residual effect at phenotypic level (0.0446) and negative at genotypic level (–0.0129) indicated that the traits included in the present investigation accounted for most of the variation present in the dependent variable i.e. fruit yield/plant. These results are in broad conformity with Khurana *et al.* [8] and further, to keep balance between fruit yield and quality traits in bell pepper, it is necessary that genotypes with high fruit yield be given weightage after that other quality traits.

Table 3. Path coefficients showing at phenotypic (P) and genotypic (G) levels/direct and indirect effects of quality traits on marketable yield in bell pepper

Character		Pericarp thick-ness	TSS	Ascorbic acid	Cap-saicin content	Corr. coeffi-with yield
Pericarp thickness	P	–0.047	0.001	0.010	–0.009	–0.151
	G	0.526	–0.104	0.084	0.038	–0.172
TSS	P	0.005	–0.008	0.000	0.003	–0.152
	G	–0.120	0.453	0.017	–0.009	–0.307
Ascorbic acid	P	–0.018	0.000	0.026	–0.013	–0.212
	G	0.242	0.044	0.181	0.065	–0.301
Capsaicin content	P	–0.008	0.000	0.006	–0.052	–0.297
	G	0.099	–0.021	0.058	0.203	–0.317

Residual effect P = 0.0446; G = -0.0129; The bold values indicated direct effect while others indirect.

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