Genetic variability, correlation and path analysis of some morphological characters in chilli

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ABSTRACT

Forty-nine genotypes of chilli were evaluated to study the genetic variability as well as association for 12 growth and fruit characters. There was significant variation among the genotypes. Fruit yield (g)/plant, number of fruits/plant, fruit length (cm), placenta length(cm), fruit weight (g), number of seeds/fruit and plant height (cm) showed high values of GCV and PCV. High heritability in broad sense coupled with high GA in % grand mean( ) was recorded for fruit yield/plant, number of fruits/plant, fruit length, days to 50% flowering and plant height indicating such characters were controlled by additive gene action The phenotypic path-coefficient analysis revealed that number of fruits/plant, fruit weight and 1000 seed weight had positive and high direct effect on fruit yield indicating their reliability as selection criteria to improve yield of chilli.

***Key words*:** Correlation, genetic variability and path coefficient.

Chilli is one of the most important vegetable cum spice crops in India. In spite of its high nutritive value, well acceptability among consumers and wide range of genetic variability, the optimum productivity in chilli still remain to be achieved. Therefore, much concerted efforts are necessary to improve its yield and yield attributes. Selection from the exixting variations is the oldest and most effective breeding procedure. The magnitude of heritable variation of the genetic components is very important to understand their genetic constitution which has a close bearing on its response to selection. Further, selection of one trait invariably affects a number of associated traits which evokes necessity to find out the interrelationship of various yield components both among themselves and with the yield. The present study was, therefore, undertaken to determine the extent of genetic variability for important growth and fruit characters to yield as well as to determine interrelationship among the characters and their direct and indirect effects on yield of chilli.

MATERIALS AND METHODS

Forty-nine genotypes of chilli collected mostly from chilli growing areas of West Bengal along with 3 from Andhra Pradesh and one each from Karnataka and New Delhi were included in the present investigation. Experiment was carried out at Central Research Farm, Goyeshpur, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal following Randomized Block Design with 3 replications. Planting was done at a spacing of 45 cm between plants and rows during autumn-winter season (September to March) of 2005-06. Recommended agronomic practices for the region were adopted to raise the crop. Five plants were selected randomly from each plot to record observations on 12 characters. Differences between genotypes for different characters were tested for significance using analysis of variance.Genotypic Coeffient of Vriation (GCV) and Phenotypic Coefficient of Variation (PCV) were estimated as per Burton (1952); Heritability (h^2) and Genetic Advance (GA) were estimated according to Hanson *et al*. (1956) and Jonson *et al*. (1955a) respectively and path analysis was done following Dewey and Lu (1959) .

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RESULTS AND DISCUSSION

All the 12 characters under study showed highly significant variation among the genotypes indicating their importance in the study of genetic variability. Estimates for the PCV, and GCV, heritability in broad sense (h^2), and GA as % of mean for these characters are presented in the Table 1. Proximities between GCV and PCV for all the characters except fruit width. indicated that these characters were controlled by the genetic makeup of the genotypes. High GCV values for fruit yield/plant, number of fruits/plant, plants height, fruit length, placenta length, fruit weight, number of seeds/fruits, and days to 50% flowering obtained in the present investigation corroborate the findings of Choudhary and Samadia (2004); Manju and Sreelathakumary (2002).

Genotypic co-efficient of variation and the heritability estimates were worked out to determine the amount of heritable variation. The GCV × selection differential, estimates the maximum effectiveness of selection and heritability indicates how closely the goal can be achieved (Singh *et al.* 1968). In the present investigation, very high broad sense heritability (85% and above) recorded for the characters, fruit yield/plant, plant height, plant canopy width, days to 50% flowering, fruit length, placenta length, fruits/plant, fruit weight and 1000 seed weight were in conformity with earlier findings (Choudhary

and Samadia, 2004; Bhagyalakshmi *et al.*,1990). Above average to high heritability estimates (60-85%) were recorded for fruit pedicel length, fruit width and number of seeds/fruit. The high estimates of heritability in the quantitative characters are useful since these values help selection on the basis of phenotypic performance.

In the present study, very high GA as % of mean was recorded for fruit yield/plant (98.16) and number of fruits/plant (82.17) and average to high GA was recorded for the characters plant height, days to 50% flowering, fruit length, fruit weight, placenta length and number of seeds/fruit ranging from 40-60% which corroborate the findings of Chowdhary and Samadia (2004).

Johnson *et al*. (1955) suggested that heritability estimates along with genetic gain is usually more helpful than the heritability alone for selecting superior individuals. In the present experiment, very high heritability coupled with very high GA for fruit yield/plant and number of fruits/plant; high heritability with high GA for plant height, days to 50% flowering, fruit length, placenta length, fruit weight, and number of seeds/fruit indicated that these characters were controlled by the additive action of polygene and might be considered for selection criteria. These were in conformity with the reports of Bhagyalaksmi *et al* (1990), Varalakshmi and Babu (1991) and Manju and Sreelathakumary (2002). Genotypic and phenotypic correlations presented in Table 2 indicated fruit yield/plant to have significant and positive association with number of fruits/plant (r = 0.834), 1000 seed weight (r = 0.411) and fruit weight (r = 0.447) substantiating the findings of Khurana *et al.* (1993) and Munshi *et al.* (2000). Fruit length exhibiting significant negative correlation (r = -0.411) with fruit width. Seed number/fruit and 1000 seed weight appeared to be the contributing characters towards increased fruit weight since they exihibited significant and positive association with fruit weight. Similar results have earlier reported by (Chowdhary and Samadia (2004). Therefore, fruit yield could be increased through increase in the component characters like number of fruits/plant, fruit weight and1000 seed weight.

To describe the phenotypic correlation values further path coefficient analysis was done to identify characters having significant direct and indirect effects on fruit yield (Table 3). Highest positive direct effect on yield was registered by the number of fruits/plant (0.804) followed by fruit weight (0.384) and 1000 seed weight (0.128) which was also reported earlier (Rani, 1996). Interestingly, these characters also exhibited significant positive correlation with yield and therefore, should be considered as important selection criteria for yield improvement of chilli. Some other characters like plant height, seeds/fruit, fruit length, fruit width and placenta length also showed direct positive effect on fruit yield but the magnitudes were low. Two characters viz. plant canopy width and days to 50% flowering had negative direct effect on yield. Residual effect of the path analysis was very low (0.071) suggesting the characters considered in the study was sufficient and justified.

REFERENCES

Burton, G. W. 1952. Quantitative inheritance in grasses. *Proc. 6th Int. Grassld. Congr* ., **1**:277-83.

Bhagyalakshmi, P. V., Ravi Shankar, C, Subrahmanyam, D. and Ganesh Babu, V. 1990. Study on heritability, genetic advance and character association in chilli (*C. annuum* L.) *South Indian Hort.* , **38** : 15-17.

Choudhary, B. S. and Samadia, D.K. 2004. Variability and character association in chilli land races and genotypes under arid environment. *Indian J. Hort.* , **61** : 132-36.

Dewey, D. R. and Lu, H. K. 1959. A correlation and path co-efficient analysis of component of Crested wheat grass production. *Agron. J*., **51** : 515-18.

Hanson, C. H., Robinson, H. F. and Comstock, R. E. 1956. Biometrical studies of yield in segregating population Korean lespedza. *Agron. J*.,**48**:268-72.

Johnson, H. W., Rabinson, H. F. and Comstock, R. E. 1955. Estimate of genetic and environmental variability in soybean, *Agron. J*., **47** : 314-18.

Khurana, S.C., Pandita, M.L., Thakral, K.K. and Singh, C.B. 1993. Correlation and path analysis studies in chilli. *Maharashtra J. Hort.*, **7** : 76-80.

Manju, P. R. and Sreelathakumary, I. 2002. Genetic variability, heritability and genetic advance in hot chilli (*Capsicum chinense* Jacq).. *J. Tropical Agric.* , **40** :4-6.

Munshi, A. D., Behra, T. K. and Singh, G. 2000. Correlation and Path coefficient analysis in chilli. *Indian J. Hort.* , **57** : 157-59.

Rani, P. U. 1996. seed weight and seed number and their relationship with other characters in chilli. *Madras Agric. J.* , **83** : 259-64.

Singh, R. B., Gupta, M. P., Mor, B. R. and Jain, D. K. 1968. Variability and correlation studies on yield and quality characters in hirsutum cotton. *Indian J. Genet*. ,**28**: 216-22.

Varalakshmi, B and Babu, K. H. 1991. Genetic divergence, heritability and genetic advance in chilli (*Capsicum annuum* L.) *Indian J. Genet.* , **51**:174–78.

Table 1: Genetic variability parameters for different characters

Characters	Mean	Range	Coefficient of variation (%)	Genotypic coefficient of variation (GCV)	Phenotypic coefficient of variation (PCV)	Heritability in broad sense % (H)	Genetic advance (GA)	Genetic advance as % of mean
1.Plant height (cm)	60.76	33.50-97.30	6.72	24.15	25.07	92.80	29.12	47.92
2.Plant canopy width(cm)	53.93	38.43-76.60	6.96	17.87	19.18	86.80	18.50	34.30
3.Days to 50% flowering	47.23	24.00-64.00	4.52	22.97	23.41	96.30	21.93	46.43
4Fruit length (cm)	6.30	4.16-12.64	6.46	28.00	28.73	94.90	3.54	56.19
5.Fruit width (cm)	1.16	0.55-1.66	15.24	20.21	25.32	63.70	0.39	33.62
6.Fruit pedicel length(cm)	3.05	2.56-4.46	5.65	12.44	13.67	82.90	0.71	23.27
7.Placenta length (cm)	5.89	3.55-11.25	7.05	27.61	28.50	93.90	3.25	55.17
8.No. of fruits/plant	48.19	19.20-98.34	14.83	42.33	44.85	89.10	39.65	82.27
9.Fruit weight (g)	2.44	1.38-4.28	8.78	25.53	25.11	87.80	1.11	45.49
10.No. of seeds/fruit	76.40	28.31-115.50	11.27	24.41	26.89	82.40	34.88	45.65
11.1000 seed weight (g)	5.06	3.41-6.75	6.26	15.05	16.30	85.30	1.45	28.65
12.Fruit yield /plant	119.14	48.03-279.49	11.36	48.92	50.22	94.90	116.95	98.16

Table 2: Genotypic and phenotypic correlation coefficient

Characters		2	3	4	5	6	7	8	9	10	11	12
1	P	0.616**	0.679**	-0.009	0.269	0.326*	-0.038	-0.148	0.379**	-0.082	0.378**	0.044
	G	0.704	0.709	-0.002	0.330	0.384	-0.048	-0.181	0.411	-0.080	0.460	0.039
2	P		0.449**	0.008	0.329*	0.135	-0.032	0.055	0.383**	0.011	0.420**	0.215
	G		0.490	0.006	0.523	0.143	-0.030	0.081	0.408	0.031	0.497	0.262
3	P			-0.197	0.357**	0.317*	-0.232	-0.164	0.476**	0.072	0.509**	0.068
	G			-0.202	0.431	0.367	-0.252	-0.179	0.509	0.075	0.561	0.064
4	P				-0.411**	0.263	0.952**	0.184	0.036	-0.337*	0.071	0.220
	G				-0.497	0.292	1.017	0.193	0.050	-0.401	0.051	0.229
5	P					-0.083	-0.410*	-0.054	0.524**	0.358**	0.236	0.228
	G					0.004	-0.552	-0.049	0.661	0.472	0.387	0.272
6	P						0.203	-0.075	0.071	-0.290*	0.298*	-0.016
	G						0.246	-0.083	0.097	-0.367	0.339	0.008
7	P							0.180	-0.007	-0.359**	-0.012	0.194
	G							0.178	0.011	-0.410	0.003	0.194
8	P								-0.020	-0.078	0.192	0.834**
	G								-0.006	-0.082	0.233	0.867
9	P									0.293*	0.387**	0.447**
	G									0.348	0.442	0.485
10	P										-0.041	0.097
	G										-0.043	0.116
11	P											0.411**
	G											0.465

* Significant at P = 0.05, ** Significant at P = 0.01

Table 3: Phenotypic path coefficient analysis for fruit yield per plant

Chara-cters	1	2	3	4	5	6	7	8	9	10	11	Phenotypic correlation with fruit yield/plant
1	**0.017**	-0.027	-0.037	0.000	0.024	0.000	-0.003	-0.119	0.145	-0.005	0.048	0.044
2	0.010	**-0.043**	-0.024	0.000	0.029	0.000	-0.002	0.044	0.147	0.001	0.054	0.215
3	0.011	-0.019	**-0.054**	-0.006	0.031	0.000	-0.016	-0.132	0.183	0.004	0.065	0.068
4	0.000	0.000	0.011	**0.029**	-0.036	0.000	0.067	0.148	0.014	-0.021	0.009	0.220
5	0.004	-0.014	-0.019	-0.012	**0.088**	0.000	-0.029	-0.043	0.201	0.022	0.030	0.228
6	0.005	-0.006	-0.017	0.008	-0.007	**0.000**	0.014	-0.060	0.027	-0.018	0.038	-0 .016
7	-0.001	0.001	0.013	0.028	-0.036	0.000	**0.071**	0.145	-0.003	-0.022	-0.002	0.194
8	-0.002	-0.002	0.009	0.005	-0.005	0.000	0.013	**0.804**	-0.008	-0.005	0.025	0.834
9	0.006	-0.016	-0.026	0.001	0.046	0.000	0.000	-0.016	**0.384**	0.018	0.050	0.447
10	-0.001	0.000	-0.004	-0.010	0.031	0.000	-0.025	-0.063	0.113	**0.062**	-0.005	0.097
11	0.006	-0.018	-0.027	0.002	0.021	0.000	-0.001	0.154	0.149	-0.003	**0.128**	0.411

Residual effects 0.071, Direct effects are in main diagonal (bold).