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Genetic variability, correlation and path analysis of important traits in selected LAM chilli genotypes

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Abstract
Twenty one genotypes of chilli were evaluated to study the genetic variability as well as association for 8 growth and fruit characters. There was significant variation among the genotypes. Green Fruit yield (g)/plant, days to 50% flowering and number of fruits/plant showed high values of GCV, PCV and high GA in % mean. High heritability in broad sense was recorded for days to first fruit maturity, Green Fruit yield (g)/plant and days to 50% flowering. The phenotypic path-coefficient analysis revealed that days to 50% flowering, number of fruits/plant, and average fruit length had positive and high direct effect on green fruit yield indicating their reliability as selection criteria to improve yield of chilli.

Keywords: Correlation, genetic variability and path coefficient.

1. Introduction
Chilli (*Capsicum annuum* L.) is one of the most valuable commercial spice crop of India and is grown for domestic as well as for export markets. The yield levels of the present-day recommended cultivars are not adequate and are also not stable performers. Therefore, much combined efforts are crucial to improve its yield and yield attributing traits. Improvement in any crop is proportional to the magnitude of its genetic variability present in germplasm. Greater the variability in a population, there are the better chance for effective selection for desirable types. The magnitude of heritable variation of the genetic components is very vital to understand their genetic composition which has a close bearing on its selection response. For initial improvement of any work, information regarding the genetic variability in the population is a criterion. Existence of high variability in this crop offers abundant scope for its development. Henceforth, an effort was made to estimate genetic variability, heritability and genetic advance in the existing LAM chilli genotypes.

2. Materials and Methods
Among the twenty one genotypes of chilli, seventeen genotypes collected from LAM research station, Guntur, Andhra Pradesh, one from UAS, GKVK, Bengaluru, two from IIHR, Bengaluru and one from F_1 hybrid private seed company were included in the present investigation. Experiment was carried out at experimental plots of Department of Genetics and Plant Breeding (GPB), University of Agricultural Sciences (UAS), Gandhi Krishi Vignana Kendra (GKVK), Bengaluru. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Each genotype was grown in a single row of five-meter length consisting of 12 plants per row with a spacing of 0.40 m between plants within a row and 0.75 meter between rows. All the recommended package of practices was followed to raise a good crop. Five plants were selected randomly from each plot to record observations on 8 characters.

2.1 Statistical Analysis
Differences between genotypes for different characters were tested for significance using analysis of variance. Genotypic Coeffient of Variation (GCV) and Phenotypic Coefssficient of Variation (PCV) were estimated as per Burton (1952) [1]; Heritability (h2) and Genetic Advance (GA) were estimated according to Hanson *et al*. (1956) [5] and Jonson *et al*. (1955) respectively and path analysis was done following Dewey and Lu (1959) [4].

3. Results and Discussion
All the 8 characters under study showed extremely significant variation among the genotypes specifying their importance in the study of genetic variability. Estimates for the PCV, and

GCV, heritability in broad sense (h2) and GA as % of mean for these characters are presented in the Table 1. Proximities between GCV and PCV for all the characters indicated that these characters were controlled by the genetic makeup of the genotypes. High GCV values for green fruit yield/plant, days to 50% flowering, number of fruits/plant and average fruit length. The present investigation corroborates the findings of Choudhary and Samadia (2004) [3]; Manju and Sreelathakumary (2002) [8].

Genotypic co-efficient of variation and the heritability estimates were worked out to determine the amount of heritable variation. The GCV x selection differential, estimates the maximum effectiveness of selection and heritability indicates how closely the goal can be achieved (Singh *et al.* 1968) [11]. In the present investigation, very high broad sense heritability (68% and above) recorded for the characters, green fruit yield/plant, days to 50% flowering and days to first fruit maturity were in conformity with earlier findings of (Choudhary and Samadia, 2004; Bhagyalakshmi *et al.*,1990) [3, 2]. 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 green fruit yield/plant (63.63) and average to high GA was recorded for the characters days to 50% flowering and average fruits/plant ranging from 40- 60% which corroborate the findings of Chowdhary and Samadia (2004). Johnson *et al*. (1955) [6] suggested that genetic gain along with heritability estimates is usually more useful than the heritability alone for selecting superior individuals. In the present experiment, very high heritability coupled with very high GA for green fruit yield/plant, days to 50% flowering and average number of fruits/plant 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) [12], Manju and Sreelathakumary (2002) [8]. Genotypic and phenotypic correlations presented in Table 2 indicated green fruit yield/plant to have significant and positive association with days to 50% flowering (r = 0.71), average fruit length (r = 0.38), 10 fruit weight (r = 0.38), plant height(r = 0.38), average fruit weight (r = 0.71), average number of fruits/plant 1000 seed weight (r = 0.411) and fruit weight (r = 0.37) substantiating the findings of Khurana *et al.* (1993) [7] and Munshi *et al.* (2000) [9]. Plant height, average fruit weight, average fruit length and fruit width exhibiting significant negative correlation with days to 50% flowering. Average fruit length and average fruit width appeared to be the contributing characters towards increased 10 fruit weight. Since, they exihibited significant and positive association with 10 fruit weight. Similar results have earlier reported by Chowdhary and Samadia (2004). Fruit yield could be increased through increase in the component characters like Days to 50% flowering, average fruit length and 10 fruit 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 recorded by days to 50% flowering (0.99) followed by number of fruits/plant (0.69) and average fruit length (0.25). Interestingly, Days to 50% flowering and average fruit length characters also exhibited significant positive correlation with yield and therefore, should be considered as important selection criteria for yield enhancement of chilli. Residual effect of the path analysis was very low (0.0894) suggesting the characters considered in the study was appropriate and justified.

Table 1: Genetic Variability Parameters for Different Characters.

Characters	Mean	CV	Range	GCV	PCV	h^2 (Broad Sense)	Genetic Advancement 5%	Genetic Advance as % of Mean 5%
G YLD	226.5032	25.9593	88-424	37.55	45.65	0.68	144.13	63.63
PLT HT	64.4913	13.5633	40-77	11.47	17.76	0.42	9.84	15.25
10 FW	6.4494	13.5689	44016.00	11.46	17.76	0.42	0.98	15.24
VFL	0.6448	13.5489	0.40-0.78	11.49	17.76	0.42	0.10	15.30
FW	0.0654	14.9538	0.04-0.08	10.67	18.37	0.34	0.01	12.76
D50F	59.8702	20.4478	29-102	29.85	36.18	0.68	30.38	50.73
D1MATU	111.0794	2.6367	98-122	6.50	7.01	0.86	13.78	12.41
FRT/PLT	51.3152	27.8062	25-89	28.65	39.93	0.52	21.73	42.35

Table 2: Genotypic and Phenotypic Correlation Coefficient.

		x2	x3	x4	x5	x6	x7	x8
x1	P	0.24	0.24	0.25	0.23	0.99	0.17	0.68
	G	0.3337	0.3337	0.3337	0.3304	0.9955	0.1409	0.5909
x2	P		1.00 ***	0.99***	0.97***	0.34**	-0.08	0.38**
	G		1	1	0.9966	0.4226	-0.2682	0.5485
x3	P			0.99***	0.97***	0.34**	-0.08	0.38**
	G			1	0.9965	0.4227	-0.2679	0.5486
x4	P				0.97***	0.35**	-0.08	0.38**
	G				0.9971	0.4227	-0.2719	0.5481
x5	P					0.32**	-0.07	0.37**
	G					0.4176	-0.2697	0.5904
x6	P						0.16	0.71***
	G						0.1153	0.6262
x7	P							0.21
	G							0.1701
x8	P							1.00
	G							1

Table 3: Phenotypic Path Coefficient analysis for Fruit Yield Per Plant.

Characters	x2	x3	x4	x5	x6	x7	x8	Phenotypic correlation GFY/PT
x2	-9.357	8.8113	0.4151	0.02	0.3604	0.0004	-0.0013	0.249
x3	-9.357	8.8113	0.4151	0.02	0.3602	0.0004	-0.0013	0.2488
x4	-9.3564	8.8107	0.4151	0.02	0.3623	0.0004	-0.0013	0.2509
x5	-9.1441	8.6112	0.4056	0.0205	0.3403	0.0003	-0.0012	0.2326
x6	-3.2643	3.0725	0.1456	0.0067	1.0331	-0.0008	-0.0024	0.9906
x7	0.7783	-0.7308	-0.0356	-0.0015	0.1736	-0.0046	-0.0007	0.1788
x8	-3.5797	3.3695	0.1594	0.0076	0.7371	-0.001	-0.0033	0.6897

R SQUARE = 0.9920 RESIDUAL EFFECT = 0.0894

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