



Study of genetic variability and characters association for yield and it's contributing traits in chilli (*Capsicum annum*) under the grid region of Madhya Pradesh

Aniruddha singh kaurav¹, Vinod Jatav^{1*}, Anjan Roy¹, Hirdesh Kumar Verma¹, Deepak Maurya²,

Pushendra Kumar¹ and Pinkey Dukpa¹

¹School of Agriculture, ITM University Gwalior-475001 (Madhya Pradesh), India

²School of Agricultural Sciences, GD Goenka University, Sohna -122 103, Gurugram, Haryana, India

ABSTRACT

The present experiment was carried to estimate the genetic variability, correlation and path analysis in yield and yield contributing horticultural traits in chilli. Analysis of variance revealed significant differences among all the genotypes for all the characters and explained the presence of considerable variability exists among the genotypes for all the fifteen traits. The Magnus of the phenotypic coefficient of variation (PCV) for all characteristics was found higher than the magnitude of the genotypic coefficient of variation (GCV). High GCV accompanied by high PCV was recorded for number of fruits per plant (23.99 and 21.46%), while for yield per plant PCV was found high (22.41%) and GCV was moderate (14.22%). Both PCV and GCV were found moderate for fruit length (19.05 and 18.22%), average fruit weight (15.31 and 10.04%), and fruit diameter (13.09 and 10.39%). Whereas for primary branches per plant and yield per ha PCV were found moderate (14.82 and 12.935) and GCV were recorded low (8.90 and 7.76%). Both PCV and GCV were estimated low for days to first flowering (9.14 and 8.28%), plant height (8.91 and 7.76%), days to 50 % flowering (8.10 and 6.81%), days to first fruit harvesting (8.89 and 7.22%) and days to first fruit setting (6.91 and 4.88%).direct effects on overall yield Total yield per plant (g).

KEYWORDS: Variability, heritability, genetic advance, correlation and path analysis

INTRODUCTION

The chilli, an important member of the solanaceae family, is grown as a tropical and subtropical crop. It can be added to food or used as a spice. Owing to the process of oleoresin extraction, it also has an industrial use. The green fruit of the chilli plant is one of the best sources of antioxidant vitamins, such as vitamins A, C, and E, which prevent cancer. The main Indian states that grow chillies are Andhra Pradesh, Karnataka, Maharashtra, Orissa, Tamil Nadu, Madhya Pradesh, and Rajasthan. With 1.98 million tonnes produced, India leads the world in chilli production, with 43% coming from Bangladesh, China, Ethiopia, Thailand, and Pakistan. The chilli is one of the most important vegetable crops and is highly valued for its flavor, pungency, and scent. There is a lot of variability in this crop, so the story goes (Nandi, 1992; Munshi and Behera, 2000). The degree to which genotypes can be improved depends on the genetic variety of the available material. Phenotypic variability is the product of the interaction between the genotype and environment, and it often does not accurately reflect the genotype. Thus, efforts have been made to determine some of the quantitative characteristics of chilli, such as the amount of heritable and non-heritable components, as well as genetic metrics like genotypic and phenotypic coefficient of variation, heritability, and genetic advance as a percentage of mean. According to multiple researchers' studies on genetic diversity, PCV was found to be higher than GCV for every trait examined (Mishra *et.al.*, 2001, Bendale *et.al.*, 2006 and Kadwey *et.al.*, 2016). Fruit length, total fruit yield per plant, leaf chlorophyll, and the number of fruits per plant were the factors that showed higher PCV in relation to leaf area. (Gupta *et.al.*, 2009; Varkey *et.al.*, 2005). Leaf area had the highest GCV, which was followed by fruit length, fruit yield per plant as a whole, leaf chlorophyll, and fruit number per plant. A very high heritability was discovered. Plant height, leaf area, fruit length, number of fruits per plant, average fruit weight, leaf length, and leaf chlorophyll all showed high estimates of heritability. (Bharadwaj and others, 2007)

MATERIALS AND METHODS

A field experiment was carried out at the CRC-1 farm Department of Horticulture, School of Agriculture, ITM University Gwalior during the period October 2022 to February 2023. The experimental site was located at an altitude of 196 m above mean sea level and the area enjoys a warm sub tropical climate. In this experiment 15 varieties/hybrids of chilli were evaluated in randomized block design with three replications. The seedlings were raised in nursery and one month old seedlings were transplanted into the main field at a spacing of 50 x 50 cm. All cultural operations like weeding, fertilizer application, irrigation, earthing

up and spraying of pesticides were done as per the recommendations. Observations were recorded on five randomly selected competitive plants per replication for each entry on fifteen traits, viz., . Days to first flowering, Days 50% flowering, Days of first fruit setting, Days of first harvest, number of fruits per plant, fruit length (mm), fruit diameter (mm), Average fruit weight (g), Number of primary branches per plant, plant height (cm), Total yield per plant (g), Yield per (Q/ha), Data of five plants from each genotype was averaged replication wise and mean data was used for statistical analysis. To produce a crop of superior quality, the suggested agronomic package of practices and plant protection measures were implemented. The components of the variance and its coefficient of variation were computed, per Burton (1952). Genetic advancement as a percentage of mean and heritability in the wide sense were estimated using methods described by Jain (1982) and Miller *et.al.* (1958), respectively.

RESULT AND DISCUSSION:

Analysis of variance and mean performance of genotypes

The estimates of variability on the basis of genotypic variance, phenotypic variance, genotypic coefficient of variation and phenotypic coefficient of variation, heritability and genetic advance as per cent of mean are presented in Table (1). Variability is the most important characteristic feature of any population. Estimation of genetic variability is an important pre-requisite for realizing response to selection as the progress in breeding depends upon its amount, nature and magnitude of genetic variability. The breeder should have the capability of distinguishing the genetic and non-genetic components of variation occurring in a population. In the present investigation, a similar analysis of variability was carried out. An insight into the magnitude of variability present in a crop species and heritability of characters is essential as it provides the basis of effective selection. The present study meets out, the extent of variability available in 15 genotypes collected from different sources and the scope of selection through heritability and genetic advance estimates was analyzed and the results obtained are discussed here under. The analysis of variance revealed significant differences among the 15 genotypes for all the traits studied.

Heritability and genetic advance as percent mean

The maximum heritability was recorded in The heritability in broad sense ranged from 26.00 per cent in case of days to mature red ripe stage to 99.7 per cent for fruit length. High estimates of heritability (>75%) were recorded for six characters viz. fruit length (99.7%) followed by average Day of fist fruit harvesting (83.76%),

Number of fruit per plant (80.02%), fruit length (98.41%), plant height (76.0%), fruit diameter (63.05%). Average fruit weight (43.02%) was fruit circumference (64.0%) followed by number of primary branches (36.6%) and Total yield per plant (40.29) and lower heritability (<50%) was primary branches per plant (44.00%), followed by secondary branches per plant (30.00%), days to mature green fruit (29.00%) and days to mature red ripe stage (26.00%). Characters. Highest value of genetic advance in per cent of mean was shown by fruit length (78.59). While days to mature green fruit exhibited lowest value (4.11) for this parameter. The characters which observed very high estimates of genetic advance was fruit length (91.48) and lowest genetic advance in per cent of mean was estimated for fruit yield per plant (0.10). Similar results were also reported by Farwah *et.al.* (2020), Haralayya *et.al.* (2020) and Saisupriya *et.al.* (2022b). High heritability coupled with high genetic advance in per cent of mean were recorded for fruit length (99.7% and 78.59%), average fruit weight (89.00% and 53.00%), fruit yield per plant (87.00% and 63.89%), fruit length (82.00% and 39.99%), plant height (80.00% and 26.85%), no. of fruit per plant (80.00% and 23.62%) indicating that these traits were little influenced by environment. Thus, require low selection intensity for improvement. Similar results were also reported by Nahak *et.al.* (2018) and Lakshmidhevamma *et.al.* (2021).

Correlation coefficient analysis

The nature and magnitude of association between yield and its components traits is necessary for effective selection in advance generations. Nature of population under consideration and the magnitude of correlation coefficient could often be influenced by the choice of the individuals upon which the observations are made. Correlations between character pairs are due to linkage of genes or pleiotropy of genes. Therefore, selection of one trait influence the other linked or pleiotropically affected traits. Considerable importance has been attached to correlation studies in the plant improvement because they are helpful in making effective selection. The phenotypic and genotypic correlation coefficient computed among the thirteen characters under study had been presented in table 4.4 and 4.5. In general, genotypic correlation coefficients were higher than the corresponding phenotypic correlation coefficients, suggesting therefore, a strong inherent relationship in different pairs of characters in chilli genotypes. The most important trait fruit yield per plant had exhibited highly significant and positive phenotypic correlation with average fruit weight (0.925), no. of fruits per plant (0.595) and fruit circumference (0.464). Average fruit weight, no. of fruit per plant and fruit circumference was found significantly an positively correlated among themselves. Thus, the selection for average fruit weight, no.

of fruit per plant and fruit circumference or either of it may automatically improve the total fruit yield per plant. Many earlier research workers have also reported significant and positive association of total fruit yield plant with average fruit weight, no. of fruit per plant and fruit circumferences. Similar association of traits in chilli had also been reported by pujar et al. (2017), Vidya et al. (2018), Srinivas et al. (2020) and Chavan et al. (2021)

Table No 1:- Analysis of variance, mean and range of characters

Sources of variation	Replication	Treatments	Error	Total
df	2	14	28	44
Days to first flowering	10.75	51.66	7.35	69.76
Days to 50% flowering	5.44	72.61	8.75	86.8
Days to first fruit setting	9.8	49.48	12.37	71.65
Days of first fruit harvest	25.26	131.86	8.00	165.12
Number of fruits per plant	37.04	566.82	43.54	647.4
Fruits length (mm)	7.44	33.19	38.42	79.05
Fruits diameter (mm)	2.15	16.68	2.72	21.55
Avg. fruits weight (g)	2.25	0.80	6.8	9.85
Number of primary branches per plant	0.06	2.70	4.53	7.29
Plant height (cm)	13.66	10.50	6.81	30.97
Total yield per plant (g)	10.72	3.02	11.95	25.69
Yield (Q/ha)	10.83	2.68	10.13	13.64

*Significant at 1% level of significance, **Significant at 5% level of significance

Table No.2:- Mean performance of 15 genotypes for 12 characters in Chilli.

Genotypes/Traits	Days to first flowering	Days to 50% flowering	Days to first fruit setting	Days of first fruit harvest	Number of fruits per plants	Fruits length (mm)	Fruits diameter (mm)	Avg. fruits weight (g)	Number of primary branches per plant	Plant height (cm)	Total yield per plant (g)	Yield/ha (Q/ha)
G-5 chilli	42.67	66.85	72.67	92.67	84.83	84.00	22.00	4.00	3.00	55.14	234.27	93.71
Sardar-31	46.67	58.67	72.33	90.67	56.35	134.67	20.00	3.67	3.67	62.32	171.28	68.51
Parx	52.33	74.67	76.33	92.67	67.19	97.67	22.33	4.33	3.00	63.00	181.72	72.69
Heera	44.67	74.00	71.00	92.00	59.53	128.67	20.00	4.33	3.33	57.67	184.93	73.97
Rajesthani Special	50.67	73.67	78.33	91.67	36.92	111.33	22.33	4.33	4.00	62.33	209.43	83.77
Chilli Jawala	46.00	68.67	72.33	78.67	58.09	136.00	20.00	4.33	3.00	48.15	201.25	80.50
Arachri	43.00	66.33	72.33	73.33	84.05	87.33	24.00	3.67	4.00	58.36	229.29	91.72
Pusa Jwala	48.00	64.33	73.67	93.33	61.61	124.00	20.00	4.00	3.00	59.67	215.93	86.37
Rama krishna	54.00	73.00	70.00	88.00	73.75	126.67	21.00	4.33	3.00	66.40	208.85	83.54
Sardar-5	46.67	67.67	76.33	87.00	64.96	127.33	20.33	4.67	3.33	64.67	261.10	104.44
Laxmi	50.33	60.00	65.67	96.33	56.44	140.00	14.67	5.33	3.67	58.67	204.29	81.72
Diana	45.00	64.00	74.00	91.33	35.48	105.00	19.33	4.33	3.33	54.00	106.68	42.67
VNR-332	45.00	66.67	72.33	79.33	60.44	89.67	19.00	3.67	3.33	65.67	209.36	83.74
Albeli	42.00	71.00	69.33	93.00	56.68	93.67	24.67	5.33	3.33	62.67	178.24	71.30
VNR-109	38.67	65.33	62.33	94.00	66.47	85.00	21.67	4.00	4.00	58.33	197.07	78.83
Mean	46.38	67.66	71.93	88.93	61.52	111.40	20.76	4.29	3.40	59.80	199.58	79.83
CD1%	6.11	6.67	7.93	6.38	14.88	13.98	3.72	1.11	0.9	5.8	77.99	22.68
CD5%	4.53	4.94	5.88	4.73	11.03	10.36	2.76	0.82	0.67	4.36	57.81	16.81
SEm	1.56	1.7	2.03	1.6	3.8	3.5	0.95	0.28	0.23	1.5	19.9	5.8
CV	5.84	4.37	4.88	3.18	10.72	5.56	7.95	11.56	11.83	4.36	17.32	10.34

Table No.3:- Variability, Heritability (%) and Genetic advance mean (%).

Parameters	Max	Min	GM	GV	PV	EV	GCV%	PCV (%)	ECV %	Heritability (%)	GA	GA% mean
Days to First Flowering	54	38.67	46.30	14.7	22.12	7.35	8.28	9.14	5.84	66.77	6.4	13.94
Days to 50% flowering	74.67	58.67	67.66	21.28	30.04	8.7	6.81	8.1	4.37	70.86	8	11.82
Days to first fruit setting	78.33	62.33	71.93	12.37	24.74	12.37	4.88	6.91	4.88	50.00	5.12	7.12
Days of First fruit harvesting	96.33	73.33	88.93	41.28	49.29	8	7.22	7.89	3.18	83.76	12.11	13.62
Number of fruit per plant	84.83	35.48	61.51	174.42	217.96	43.54	21.46	23.99	10.72	80.02	24.33	39.56
Fruit length (mm)	140	84	111.4	412.30	450.73	38.42	18.22	19.05	5.56	91.48	40	35.9100
Fruit diameter in (mm)	24.67	14.67	20.75	4.65	7.38	2.72	10.39	13.09	7.95	63.05	3.52	17
Average fruit (Gram)	5.33	3.67	4.2	0.18	0.43	0.24	10.04	15.31	11.56	43.02	0.58	13.57
Number of primary branches per plant	4	3	3.4	0.09	0.25	0.16	8.9	14.82	11.83	36.26	0.37	11.07
Plant Height	66.40	48.15	59.8	21.58	28.39	6.8	7.76	8.91	4.36	76.00	0.3433	13.95
Total Yield per plant	261.10	106.68	199.57	806.47	2001.42	1194.94	14.22	22.41	17.32	40.29	37.13	18.6

Yield per Ha (Q)	104.44	42.67	79.23	56.95	158.096	101.13	7.763	12.93	10.34	36.03	9.332	9.59
---------------------	--------	-------	-------	-------	---------	--------	-------	-------	-------	-------	-------	------

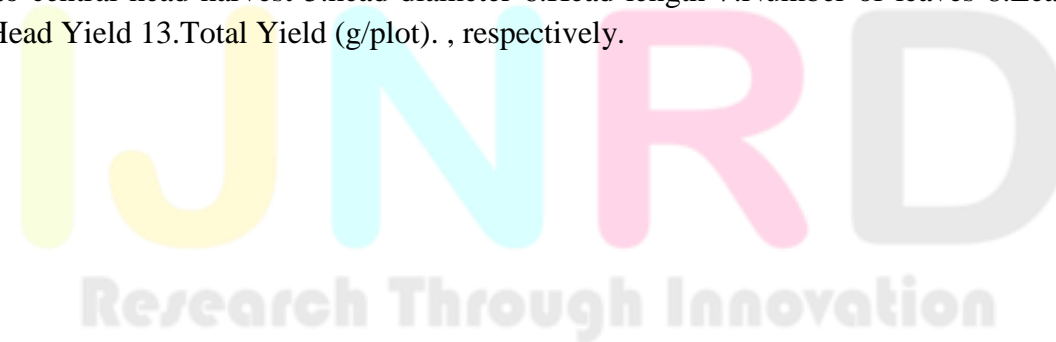


Table No. 4:- Genotypic and phenotypic correlation of chilli.

Particular	Days to First Flowering	Days to 50% flowering	Days to first fruit setting	Days of First fruit harvesting	Number of fruit per plant	Fruit length (mm)	Fruit diameter in (mm)	Average fruit (g)	Number of primary branches per plant	Plant Height	Total Yield per plant	Yield per Ha.
Days to First Flowering	1 **	0.333	0.4996	0.15	-0.2	0.6051*	-0.3606	0.3671	-0.378	0.461	0.092	0.243
Days to 50% flowering	0.333	1 **	0.4454	-0.08	0.043	-0.187	0.6052*	0.1875	-0.362	0.229	0.059	0.117
Days to first fruit setting	0.4996	0.4454	1 **	-0.22	-0.26	0.077	0.3359	-0.3451	-0.453	0.151	-0.07	-0.03
Days of First fruit harvesting	0.1502	-0.0842	-0.22	1 **	-0.31	0.155	-0.2422	0.5549*	-0.138	0.123	-0.36	-0.376
Number of fruit per plant	-0.1972	0.0432	-0.26	-0.31	1 **	-0.347	0.3286	-0.3072	-0.24	0.083	0.819	-0.089
Fruit length (mm)	0.6051*	-0.1866	0.077	0.155	-0.347	1 **	-0.6738	0.3595	-0.242	-0.1	0.037	0.186
Fruit diameter in	-0.3606	0.6052*	0.3359	-0.2422	0.3286	-0.6738	1 **	-0.1306	0.0655	0.153	0.194	-0.14

(mm)												
Average fruit In Gram	0.3671	0.1875	-0.3451	0.5549*	-0.3072	0.3595	-0.1306	1 **	-0.249	-0.01	-0.3	0.206
Number of primary branches per plant	-0.3784	-0.3617	-0.453	-0.138	-0.24	-0.242	0.0655	-0.249	1 **	0.082	-0.15	0.68
Plant Height	0.4606	0.2286	0.151	0.123	0.083	-0.1	0.153	-0.01	0.082	1 **	0.264	0.391
Total Yield per plant	0.0917	0.0592	-0.07	-0.36	0.819	0.037	0.194	-0.3	-0.15	0.264	1 **	0.777
Yield per Hec.	0.2433	0.1166	-0.03	-0.376	-0.089	0.186	-0.14	0.206	0.68	0.391	0.777	1 **

*Significant at 1% level of significance, **Significant at 5% level of significance (G)- Genotypic (P)- Phenotypic Ch-1 to Ch-13 Denoting, Day to initiation of head 2.Plant height 3.Plant spread 4.day to central head harvest 5.head diameter 6.Head length 7.Number of leaves 8.Leaf length 9.leaf width 10.Lateral head number 11.lateral head yield 12.Average Head Yield 13.Total Yield (g/plot). , respectively.



CONCLUSION

It uses it the overall results of the inquiry, it was determined that there was a significant amount of variance across the germplasm lines for all the traits, indicating that there was room for selections to improve Chilli cultivars. According to genetic factors and a correlation research, total yield (G-5 chilli), (Sardar-5), Arachri and plant spread should all be prioritized for the selection of superior genotypes. Sardar-5 Chilli, Arachri, G-5 chilli, pusa jawala, and VNR-332 Chilli were determined to have the highest yields out of fifteen genotypes. These germplasm may be recommended for widespread farmer cultivation following careful evaluation in multilocational experiments, and these superior genotypes can be applied to breeding programme.

REFERENCES:

- Bendale, V. W., Palsuledesai, M. R., Bhawe, S. G., Sawant, S. S. and Desai, S. S. 2006.** Genetic evaluation of some economic traits in chilli. *Crop Research*, 31: 401-403.
- Bharadwaj, D. N., Singh, S. K. and Singh, H. L. 2007.** Genetic variability an association of component characters for yield in chilli. *International Journal of Plant Sciences*, 2: 93 -96.
- Burton, G. W. 1952. Quantitative inheritance in grasses.** *Proceedings of Proceeding of 6th international grassland congress*, 1: 277-283.
- Choudhary, B. S. and Samadia, D. K. 2004.** Variability and character association in chilli landraces and genotypes under arid environment. *Indian Journal of Horticulture*, 61:132-136.
- Dipendra, G. and Gautam, B. P. 2002.** Variability, heritability and genetic advance in chilli (*capsicum spp.*). *Agricultural Science Digest*, 22 (2): 102-104
- Dutta, S. and Das. 2013.** Characterization and genetic variability Analysis in chilli. *Germplasm. SAARC Journal of Agriculture*, 11(1): 91-103.
- Gopalakrishnan, T. R., Nair, C. S. J., Joseph, S. and Peter, K. V. 1984.** Studies on yield attributes in chilli. *Indian Cocoa Arecanut Spices Journal*, 8: 72-75.
- Cherian, E.V. 2000.** Genetic variability in *Capsicum chinense* Jacq. M.Sc. (Hort.) thesis, Kerala Agricultural University, Thrissur, p. 82.
- Vijayalakshmi, Y., Rao, M.R. and Reddy, E.N. 1989.** Genetic variability in some quantitative characters in chilli. *Indian Cocoa Arec. Spices J.* 1: 84-86.
- Jabeen, N., Ahmad, N. and Tanki, M.I. 1998.** Genetic variability in hot pepper (*Capsicum annum L.*). *Agric. Sci. Digest* 18: 23-26.
- Rajput, J.C., Palve, S.B., Jamadagni, B.M. and Salvi, M.J. 1981.** Variability, heritability, genetic advance and correlation studies in chilli. *Indian Cocoa Arec. Spices J.* 6:100-101.

Singh, G. P., Maurya, K. R., Prasad, B. and Singh, A. K. 1994. Genetic variability in *Capsicum annum* L. J. appl. Biol. 4: 19-22.

Kadwey S, Dadiga A and Prajapati S. (2016). Genotypes performance and genetic variability studies in hot chilli (*Capsicum annum* L.). Indian Journal of Agriculture Research 50:55-60.

Bendale, V. W., Palsuledesai, M. R., Bhawe, S. G., Sawant, S. S. And Desai, S. S. 2006. Genetic evaluation of some economic traits in chilli. Crop Research, 31: 401-403.

Mishra, A., Sahu, G. S. and Mishra, P. K. 2001. Variability in fruit characters of chilli. Orissa Journal of Horticulture, 29: 107-109.

Kumari, V.; Singh, J.; Sharma, D. and Mishra, S. 2017. Evaluation of chilli genotypes for growth and fruit yield attributing traits under Chattisgarh plain conditions. Int. J. Curr. Microbio. App. Sci. 6:3478-3483.

