Biological Forum – An International Journal **15(11): 96-99(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Estimates of Genetic variability for Yield and its Attributes and Scope of Selection in Chilli (*Capsicum annuum* L.)

Dharmendra Bahadur Singh[1*], G.C. Yadav[2], Prashant[1], Nitesh Kumar Singh[1] and Anuj Tiwari[1]
[1]Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya (Uttar Pradesh), India.
[2]Professor, Department of Horticulture, Babasaheb Bhimrao Ambedkar University (A Central University) Lucknow (Uttar Pradesh), India.

(Corresponding author: Dharmendra Bahadur Singh)*
(Received: 02 September 2023; Revised: 30 September 2023; Accepted: 16 October 2023; Published: 15 November 2023)
(Published by Research Trend)

ABSTRACT: Selection of the superior traits in plants one of the important phenomena of natural selection. Genetic variability in plants also considered one of the important bases of the natural selection, which can open a new way of trait selection in crops. The present investigation was carried out on chillies (*Capsicum annuum* L.) crop during autumn and winter season of 2021–2022, with the aims of to determine the genetic variability among the genotypes and the heritability in general and genetic advance in percentage of mean. The experimental sample size included 40 genotypes including one check (Kashi Anmol), in a Randomised Complete Block Design with three replications. Observation was based upon thirteen quantitative characteristics. For all characteristics, the phenotypic coefficients of variation (PCV) estimations were greater than the genotypic coefficients of variation (GCV). Ascorbic acid had the greatest phenotypic and genotypic coefficient of variation, followed by fruit yield per plant, average fruit weight, fruit length, fruit circumference, pedicle length, plant height, number of fruits per plant, primary branches per plant, and secondary branches per plant. The heritability estimates for various traits ranged from 26.00 (days to mature red ripe stage) to 99.7 (ascorbic acid). The percentage of mean genetic advancement varied from 4.11 to 78.59 percent ascorbic acid (days to mature green stage). As a result of the aforesaid findings, it is possible to infer that there is significant potential for successful crop modification for better yield and yield attributing trait in existing chilli germplasm.

Keywords: Chilli (*Capsicum annuum* L.), variability, GCV, PCV, heritability, genetic advances.

INTRODUCTION

Chilli is a major vegetable crop which growing throughout the country. It has the chromosomal number 2n=24 and belongs to the Solanaceae family. Chilli is one of Asia's most significant and widely produced spice crops. India, China, Ethiopia, Myanmar, Mexico, Peru, Vietnam, Pakistan, Ghana, and Bangladesh are the world's major chilli-growing nations. India leads the pack in terms of chilli exports. It accounts for around 33% of total spice exports from India and accounts for approximately 16% of global spice trade. Andhra Pradesh, Karnataka, Maharashtra, Orissa, Tamil Nadu, Madhya Pradesh, West Bengal, and Rajasthan are the primary chilli-growing states in India. In India, 411 thousand hectares are cultivated for green chilies, yielding 4363 thousand MT, whereas 702 thousand hectares are planted for dried chillies, or spice, producing 2049 thousand MT (Anony, 2020). Greater variety increases the likelihood of creating novel forms. A suitable breeding plan to take use of the inherent diversity of the original population, variables such as the genotypic and phenotypic coefficient of variations, heritability, and genetic advancement for the various traits are very crucial. Heritability in the broad sense of a quality which is significant to breeders because it indicates the likelihood and amount of improvement through selection. It assesses the link between parents and their progeny, it is commonly employed in estimating the degree to which a character may be transferred from parents to off-spring. On the other hand, high heritability is insufficient for efficient selection in advanced generations unless it is accompanied with a significant degree of genetic progress (Burton & Devane 1953). Strong heritability estimates combined with strong genetic progress give enough opportunity for additional advancement in future generations. Phenotypic variability varies in response to environmental conditions, whereas genetic variability remains constant and is more useful to a plant breeder for use in selection or hybridization.

MATERIAL AND METHODS

The current research work "Estimates of genetic variability for yield and its attributes, as well as the scope of selection in chilli (*Capsicum annuum* L.) has been conducted at the main experiment site of Department of Vegetable Science's at Acharya

Narendra Deva University of Agriculture and Technology in Kumarganj, Ayodhya (U.P.) in a Randomised Block Design with three replications over the autumn-winter season of 2021-22 to evaluate the performance of 40 genotypes for several variables to quantify the level of variability and scope of selection in chilli. Each treatment included twelve plants in two rows with a spacing of 60 × 50 cm and a net plot area of 3.0×1.8 m^2. The seedlings were shown in last week of August, on the nursery bed and transplanted on first week of October, 2021. To produce a successful harvest, all the necessary agronomic practises and plant protection measures were implemented. The observation included days to 50% flowering, days to mature green fruit, days to mature red ripe stage, plant height (cm), primary branches per plant, secondary branches per plant, no. of fruit per plant, fruit length (cm), pedicel length (cm), fruit circumference (mm), average fruit weight (g), ascorbic acid (mg/100g), fruit yield per plant (kg) were recorded. The estimations of variability (GCV and PCV), heritability, and genetic progress were carried out by the methods proposed by Burton and De Vane (1953).

RESULT AND DISCUSSION

The mean sum of squares in ANOVA demonstrated considerable variability across the 40 genotypes for all characters at 5% and 1% of probability. The extremely substantial discrepancies may be attributed to the genetic makeup of the germplasm line and the various regions from where they were recorded, as shown in Table 1. The genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability (Broad sense), and genetic progress as a percentage of mean were calculated for the character under consideration. The assessment of genotypic coefficient of variation is crucial for breeders since genetic variance alone does not allow them to establish which characteristics have the highest degree of variability. As a result, precise relative comparisons may be done using phenotypic and genotypic coefficients of variation. In general, the phenotypic coefficients of variability were larger than the genotypic coefficients of variability for all the features studied, indicating that environment had a significant influence in trait expression.

Table-2 shows the estimations of genotypic and phenotypic coefficients of variation for thirteen chilli germplasm characteristics. For all the traits, the estimates of phenotypic coefficients of variation (PCV) were greater than genotypic coefficients of variation (GCV). Ascorbic acid had the highest phenotypic and genotypic coefficients of variation (38.26% and 38.21%), followed by fruit production per plant (35.75% and 33.3%), average fruit weight (29.08% and 27.36%), fruit length (23.63% and 21.42%), and fruit circumferences (19.08% and 15.26%). Moderate estimates of PCV and GCV were recorded for pedicle length (16.26% and 11.95%), plant height (16.23% and 14.54%), no. of fruit per plant (14.37% and 12.84%), primary branches per plant (14.00% and 9.26%), secondary branches per plant (13.78% and 7.60%). Similar, results have been reported by Gorka *et al.* (2016); Singh *et al.* (2017); Jogi *et al.* (2017). Moderate PCV along with GCV were recorded for days to 50% flowering (8.43% and 6.36%), same result also reported by Janaki *et al.* (2015); Saisupriya *et al.* (2022).

The phenotypic and genotypic coefficients of variations were lower GCV and PCV for days to maturity (Mature Green Stage 6.91% and 3.71%) and mature red ripe stage (6.35% and 3.26%) for these traits which has less variation.

Heritability in the broad sense of a quality is significant to breeders because it indicates the likelihood and amount of improvement through selection. Because it assesses the link between parents and their children, it is commonly employed in estimating the degree to which a character may be transferred from parents to offspring. On the other hand, high heritability is insufficient for efficient selection in advanced generations unless it is accompanied with a significant degree of genetic progress (Burton & Devane 1953). Strong heritability estimates combined with strong genetic progress give enough opportunity for additional advancement in future generations.

Table 1: Analysis of variance (mean squares) for thirteen quantitative characters in chilli.

Sr. No.	Traits	Source of variation		
	D.F.	Replication	Treatments	Error
		2	31	62
1.	Days to 50% flowering	24.00	38.73**	7.81
2.	Days to mature green stage	180.80	39.08**	17.62
3.	Days to mature red ripe stage	350.50	55.21**	26.59
4.	Plant height	8.96	254.64**	19.23
5.	Primary branches per plant	0.15	0.41**	0.12
6.	Secondary branches per plant	0.72	1.13**	0.48
7.	No. of fruit per plant	8.25	185.48**	14.41
8.	Fruit length	2.45	9.51**	0.64
9.	Pedicel length	0.003	0.60**	0.13
10.	Fruit circumference	0.69	9.33**	1.47
11.	Average fruit weight	0.14	1.86**	0.07
12.	Ascorbic acid	1.46	5732.11**	5.52
13.	Fruit yield per plant	0.0006	0.009**	0.0004

*, ** Significant at 5% & 1%, respectively

Table 2 shows estimates of heritability (broad sense) and genetic progress for several traits. In general, heritability ranged from 26.00 per cent in the case of days to develop red ripe stage to 99.75% for ascorbic acid.

High estimates of heritability (>75%) were recorded for six characters *viz*. ascorbic acid (99.7%) followed by average fruit weight (89.0%), fruit yield per plant (87.0 %), fruit length (82.0%), plant height (80.0%), no. of fruit per plant (80.0%). However, moderate heritability (>50% and <75%) was recorded in fruit circumference (64.0%) followed by days to 50% flowering (57.0 %) and pedicel length (54.00) and lower heritability (<50%) in 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%) in all 13 characters.

Highest value of genetic advance in per cent of mean was shown by ascorbic acid (78.59),while days to mature green fruit exhibited lowest value (4.11) for this parameter. The high estimates of genetic advance characters were observed in ascorbic acid (89.87) and lowest in fruit yield per plant (0.10). Similar result was also reported by Farwah *et al. (*2020); Haralayya *et al.* (2020); Patel *et al.* (2022); Saisupriya *et al.* (2022).

High heritability coupled with high genetic advance in per cent of mean were recorded inascorbic acid (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); Kumar *et al.* (2019); Lakshmidevamma *et al*. (2021).

Table 2: Estimates of range, grand mean, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability in broad sense, genetic advance (Ga) and Ga in per cent of mean for thirteen characters in chilli germplasm.

Sr. No.	Characters/ traits	Range		Grand mean	PCV %	GCV %	ECV %	Heritability broad sense (%) (h^2bs)	Genetic Advance (Ga)	Gen. Adv as % of Mean ($\overline{Ga}$)
		Min.	Max.							
1.	Days to 50% flowering	44.33	60.33	50.48	8.43	6.36	5.54	57.00	4.99	9.88
2.	Days to mature green stage	65.33	78.67	72.01	6.91	3.71	5.83	29.00	2.96	4.11
3.	Days to mature red ripe stage	85.67	105.00	94.71	6.35	3.26	5.45	26.00	3.27	3.45
4.	Plant height	42.40	76.60	60.91	16.23	14.54	7.2	80.00	16.35	26.85
5.	Primary branches per plant	2.57	4.00	3.37	14.00	9.26	10.51	44.00	0.43	12.61
6.	Secondary branches per plant	5.00	7.70	6.08	13.78	7.60	11.50	30.00	0.53	8.64
7.	No. of fruit per plant	43.67	74.33	58.83	14.37	12.84	6.45	80.00	13.90	23.62
8.	Fruit length	5.173	12.66	8.03	23.63	21.42	9.98	82.00	3.21	39.99
9.	Pedicle length	2.34	3.99	3.31	16.26	11.95	11.02	54.00	0.60	18.10
10.	Fruit circumference	6.367	14.35	10.61	19.08	15.26	11.45	64.00	2.67	25.14
11.	Average fruit weight	1.640	4.37	2.82	29.08	27.36	9.87	89.00	1.50	53.00
12.	Ascorbic acid	46.100	207.47	114.36	38.26	38.21	2.06	99.7	89.87	78.59
13.	Fruit yield per plant	0.087	0.28	0.17	35.75	33.3	13.01	87.00	0.11	63.89

CONCLUSIONS

The all-yield attributing characters showing high genetic advance provide a broad way for the improvement in genotypes for specific character. Thus, there exist ample scope for improvement in available germplasm to develop new improved varieties of chilli in future.

FUTURE SCOPE

Information on the variability in terms of genotypic and phenotypic components was obtained from the current experiment. Genetic progress and heredity as a percentage of mean. In the future, it will be helpful to select genotypes based on these characteristics to create elite genotypes of chillies that produce more green chillies. Chilli production may be directly increased by selecting for those specific qualities that have been found to have high heritability and strong genetic progress as a percentage of mean.

Acknowledgement. The first authors are thankful to the whole Department of Vegetable Science for providing necessary facilities to conduct an experiment and specially my Advisor Dr. G.C. Yadav for their kind suggestions and inspirations during research work.

REFERENCES

Anonymous (2020). National Horticultural Board database, Ministry of Agriculture, Government of India, Gurgaon.

Burton, G. W. & Devane, E. W. (1953). Estimating heritability intallfescue (*Festuca arundiancea*) from replicatedclonal material. *Proejtunniens, 9*, 12-15.

Farwah, S., Hussain, K., Rizvi, S.,Hussain, S. M., Rashid, M. & Saleem, S. (2020). Genetic variability, heritability and genetic advance studies in chilli (*Capsicum annuum* L.) genotypes. *International Journal of*

Chemical Studies, *8*(3), 1328-1331.

Gorka, S., Kumar, S., Samnotra, R. K. & Rattan, P. (2016). Variability and path coefficient studies inchilli (*Capsicum annuum* L.). *Green Farming*, *7*, 831-834.

Haralayya, B., Kumar, H. D. M., Adivappar, N., Gangaprasad, S., Gurumurthy, B. R. & Krishna, V. (2020). Genetic variability, heritability and genetic advance of yield attributing trait in doubled haploid lines of chilli (*Capsicum annuum* L.) cv., by adgidabbi. *International Journal of Current Microbiology and Applied Sciences*, *9*(8), 3749-3754.

Janaki, M., Naidu, L. N., Ramana, C. V. & Rao, M. P. (2015). Assessment of genetic variability, heritability and genetic advance for quantitative traits in chilli (*Capsicum annuum* L.). *The Bioscan*, *10*, 729-733.

Jogi, M. Y., Madalageri, M. B., Mallimar, M., Bawoor, S., Vittal, M. & Porika, H. (2017). Genetic variability studies in chilli (*Capsicum annuum* L.) for growth and early yield. *International Journal of Current Microbiology and Applied Sciences*, *5*, 858-862.

Kumar, C. S., Sahu, G. S., Tripathy, P., Pradhan, B. & Dash, S. K. (2019). Studies on genetic variability in chilli (*Capsicum annuum* L.) germplasm. *Journal of Pharmacognumbersy and Phytochemistry*, *8*(2), 1992-1994.

Lakshmidevamma, T. N., Jagadeesha, R. C., Hanchinamani, C. N. & Arunkumar, K. T. (2021). Genetic variability, heritability and genetic advances in chilli (*Capsicum annuum*). *International Journal of Chemical Studies*, *9*(1), 2210-2213.

Patel, S. K., Patel, D. A., Patel, N. A., Patel, R., Vadodariya, J. M. & Patel, U. N. (2022). Assessment of genetic variability based on morphological and biochemical markers in red chilli (*Capsicum annuum* L.). *Biological Forum – An International Journal*, *14*(4), 1283-1288.

Saisupriya (2022). Analysis of Genetic Variability, Heritability and Genetic Advance for Yield and Yield Related Traits in Chilli (*Capsicum annuum* L.). *International Journal of Bio-resource and Stress Management*, *13*(4), 387-393.

Nahak, S. C., Nandi, A., Sahu, G. S., Tripathy, P., Dash, S. K., Patnaik, A., & Pradhan, S. R. (2018). Studies on variability, heritability and genetic advance for yield and yield contributing characters in chilli (*Capsicum annuum* L.). *Journal of Pharmacognosy and Phytochemistry*, *7*(1), 2506-2510.

Singh, P., Jain, P. K., Sharma, A. (2017). Genetic Variability, Heritability and Genetic Advance in Chilli (*Capsicum annum* L.) Genotypes. *International Journal of Current Microbiology and Applied Sciences*, *6*, 2704-2709.

How to cite this article: Dharmendra Bahadur Singh, G.C. Yadav, Prashant, Nitesh Kumar Singh and Anuj Tiwari (2023). Estimates of Genetic variability for Yield and its Attributes and Scope of Selection in Chilli (*Capsicum annuum* L.). *Biological Forum – An International Journal*, *15*(11): 96-99.