www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(9): 510-513

www.thepharmajournal.com
Received: 19-06-2022
Accepted: 25-07-2022

Senjem Semba
Department of Vegetable Science, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh, India

Chandra Deo
Professor, Department of Vegetable Science, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh,India

Corresponding Author:
Senjem Semba
Department of Vegetable Science, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh, India

Study of PCV, GCV, heritability and genetic advance for yield and quality traits in chilli (*Capsicum annuum* L.) genotypes

Senjem Semba and Chandra Deo

Abstract
The present research was carried out at Vegetable Research Farm, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh with fifteen genotypes of chilli during 2017-2018 and 2019-2020. The result showed that high PCV and GCV were recorded for plant height, leaf length, leaf width, fruit length, fruit width, pedicel length, fruit weight, no. of fruit per plant, no. of seed per fruit, capsaicin content, reducing sugar, chlorophyll content and fruit yield per plant. Whereas, high heritability coupled with high genetic advance as percent of mean were showed by plant height, no. of primary branches, leaf length, leaf width, fruit length, fruit width, pedicel length of fruit, fruit weight, no. of fruit per plant, dry weight per fruit, dry weight of 100 fruits, ascorbic acid content, no. of seed per fruit, capsaicin content, green fruit TSS, total sugar, reducing sugar, non-reducing sugar, chlorophyll content and fruit yield per plant which indicates predominance of additive gene action. High GCV, PCV and high heritability coupled with high genetic advance as percent of mean was recorded for plant height, leaf length, leaf width, fruit length, fruit width, pedicel length of fruit, fruit weight, no. of fruit per plant, no. of seed per fruit, capsaicin content, reducing sugar, chlorophyll content and fruit yield per plant. The selection on the basis of such characters with high GCV, PCV and high heritability coupled with high genetic advance as percent of mean would be more effective for improvement of this crop.

Keywords: Chilli, variability, heritability, improvement, PCV, GCV

Introduction
Chilli (*Capsicum annuum* L.) belongs to the family Solanaceae with chromosome number 2n=24. Chilli is grown especially for its local consumption and export potential. Chilli is consider as a spice as well as vegetable crop. In India chilli is consider as an important crop. Due to the fact that it is consumed in most of the household since it has been utilised in most of the Indian cuisine. Chilli is valued for its pungency and taste. Chilli fruits are also a rich source of vitamin C. In India, there is a necessity to increase the chilli fruit yield, due to rising human population which will lead to more consumption. So, to meet the demand there is a need to develop new varieties and hybrids with high productivity. Lack of superior genotypes is a hindrance in breeding programme for developing high yield crops. So, assessment on local landrace chillies can be a solution in breeding programme to select superior genotypes to increase the yield and other quality characters of chilli. Improvement programme in any crop depends on existence of variability present in the crop. The extent of variability is measured by GCV and PCV which gives information regarding the relative amount of variation in different characters. Heritability is important for selection based on crop improvement as it indicates the extent of transmissibility of a character from parent to its progeny. (Johnson *et al.*, 1955) [8] reported that heritability estimation along with genetic advance is usually more useful than the heritability alone in predicting the effectiveness of selecting the best individuals. Presence of high variability in chilli crops offers much scope for its improvement. The present study was undertaken with the aim of estimation of PCV, GCV, heritability and genetic advance as percent of mean for yield and quality characters in chilli genotypes.

Materials and Methods
The present study was conducted at Vegetable Research Farm, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh during year 2017-18 and 2019-20. The healthy, disease free and good quality seeds were used for sowing. The experimental material comprised of 15 genotypes of chilli. The experiment was laid out in

Randomized Block Design (RBD) with three replications and spacing of 60cm x 45 cm. All the agronomical practices were adopted to raise healthy crops. Five randomly selected plants of each genotypes from each replication were taken and the average was worked out for different traits. Observations were recorded for twenty four characters namely plant height (cm), days to first flowering, days to first fruit set, first harvest, no. of primary branches, leaf length (cm), leaf width (cm), fruit length (cm), fruit width (cm), pedicel length of fruit (cm), fruit weight (g), no. of fruit per plant, dry weight per fruit (g), dry weight of 100 fruits (g), no. of seeds per fruit, fruit yield per plant (g), ascorbic acid content (mg/100g), capsaicin content in green fruit, green fruit TSS (°Brix), red fruit TSS (°Brix), total sugar (mg/g), reducing sugar (mg/g), non-reducing (mg/g) and chlorophyll content in leaf (mg/g). Phenotypic and genotypic coefficients of variation (PCV and GCV, respectively) were calculated as per the formula suggested by Burton and de Vane (1953) [3]. PCV and GCV were classified as recommended by Sivasubramanian and Menon (1973) [13] as low (0-10%), moderate (10-20%) and high (> 20%). Heritability in broad sense were calculated as per the method suggested by Burton and de Vane (1953) [3]. Analysis of variance was carried out as per the procedure given by (Gomez and Gomez, 1984) [6]. Heritability percentage was categorised as demonstrated by Robinson *et al*. (1949) [11] as low (0-30%), moderate (30-60%) and high (> 60%). Genetic advance were calculated as per the methods illustrated by Johnson *et al*., (1955) [8]. Genetic gain is the percentage ratio of genetic advance and population mean as suggested by Johnson *et al*. (1955) [8]. The genetic advance as percent of mean was categorised into low, moderate and high as suggested by Johnson *et al*. (1955) [8] i.e. low (0-10), moderate (10-20) and high (>20).

Result and Discussion

Analysis of variance showed significant differences among the genotypes for all the characters studied. The estimates of (PCV) and (GCV), heritability (broad sense), genetic advance and genetic advance as percent of mean were statistically worked out and have been presented table 1.

The data presented in (Table 1) for all the characters studied, PCV was found higher than the corresponding GCV for all the characters. This indicates the influence of environment on the expression of these characters. The high estimates of (PCV) phenotypic coefficient of variation and genotypic coefficient of variation (GCV) were observed for plant height (PCV 25.62% and GCV 24.95%), leaf length (PCV 25.69% and GCV 25.03%), leaf width (PCV 22.82% and GCV 21.64%), fruit length (PCV 36.49% and GCV 35.49%), fruit width (PCV 28.46% and GCV 27.36%), pedicel length (PCV 26.31% and GCV 25.04%), fruit weight (PCV 25.12% and GCV 23.70%), no. of fruit per plant (PCV 38.5% and GCV 37.29%), no. of seed per fruit (PCV 38.15% and GCV 37.29%), capsaicin content (PCV 28.88% and GCV 28.34%), reducing sugar (PCV 24.43% and GCV 24.09%), chlorophyll content (PCV 24.29% and GCV 23.83%) and fruit yield per plant (PCV 44.14% and GCV 42.27%) demonstrating a wide range of genetic variability for these traits. Hence, there is a good scope for further improvement of such characters with high PCV and GCV through selection. Amit *et al*. (2014) [2] also observed high PCV and GCV for characters number of fruit per plant and fruit weight. Krishna *et al*. (2021) [10] also observed high PCV and GCV for character fruits yield per plant. Singh *et al*. (2017) [12] also reported high PCV and GCV for number of fruit per plant and average fruit weight. Nagaraju *et al.* (2018) [9] also reported that high PCV and GCV for characters plant height, fruit length, fruit width, fruit weight, number of seeds per fruit and capsaicin content.

Heritability is a good index of the transmission of characters from parents to offspring (Falconer, 1967) [5]. In the present study, heritability (bs) estimates ranged from 41.7% to 97.2%. In the present study, high heritability estimates was recorded for reducing sugar (97.2%), chlorophyll content (96.3%), capsaicin content (96.2%), no. of seed per fruit (95.5%), green fruit TSS (94.8%), plant height (94.8%), leaf length (94.9%), fruit length (94.6%), no. of fruit per plant (93.9), no. of primary branches (93.4%), total sugar (93.2%), fruit width (92.5%), fruit yield per plant (91.7%), pedicel length of fruit (90.6%), leaf width (89.9%), fruit weight(89%), dry weight per fruit (88.4%), non-reducing sugar (88.30%), ascorbic acid content (88.2%), dry weight of 100 fruit (84.6%), red fruit TSS (75.7%) and days to first flowering (69.1%). Chattopadhyay *et al*. (2011) [4] also registered high heritability for ascorbic acid content and number of fruits per plant. Abrham (2019) [1] reported high heritability for fruit length. Krishna *et al*. (2021) [10] observed high heritability for characters plant height, number of fruits per plant, fruit length, fruit weight, no. of seeds per fruit and fruits yield per plant. These above earlier works based on high heritability support similar findings with present research. The characters with high heritability indicates less influenced by environment effect in their expression and thus, helps in effective selection of these traits based on phenotypic expression.

In the present study, plant height, no. of primary branches, leaf length, leaf width, fruit length, fruit width, pedicel length of fruit, fruit weight, no. of fruit per plant, dry weight per fruit, dry weight of 100 fruits, ascorbic acid content, no. of seed per fruit, capsaicin content, green fruit TSS, total sugar, reducing sugar, non-reducing sugar, chlorophyll content and fruit yield per plant showed high heritability coupled with high genetic advance as percent of mean.These findings were in agreement with Nagaraju *et al*. (2018) [9] in which high heritability couple with high genetic advance as percent of mean were recorded for characters such as plant height, number of primary branches, no. of fruits per plant, fruit length, fruit width, fruit weight, number of seeds per fruit, capsaicin content, and ascorbic acid content. Yatung *et al*. (2014) [14] also reported high heritability with high genetic advance as per of mean for plant height, number of seed per fruit, number of fruit per plant, ascorbic acid and green fruit yield per plant. High heritability coupled with high genetic advance as percent of mean of such characters, indicates predominance of additive gene action for these characters and shows that selection is effective to improve these traits.

High GCV, PCV and high heritability coupled with high genetic advance as percent of mean was recorded for plant height, leaf length, leaf width, fruit length, fruit width, pedicel length of fruit, fruit weight, no. of fruit per plant, no. of seed per fruit, capsaicin content, reducing sugar, chlorophyll content and fruit yield per plant. Nagaraju *et al.* 2018 [9] also reported high PCV, GCV and high heritability coupled with high genetic advance as percent of mean were observed for characters like number of fruits per plant, fruit width, fruit weight and number of seeds per fruit. Janaki *et al.* 2017 [7] also reported for character number of fruits per plant with

high PCV, GCV and high heritability coupled with high genetic advance as percent of mean. Such characters with high PCV, GCV and high heritability coupled with high genetic advance as percent of mean suggests a wide range of genetic variability, predominance of additive gene action and lower influence of environmental factors in the expression of these traits with possible outcomes for improvement through selection.

Table 1: Estimates of PCV, GCV, heritability and genetic advance for yield and quality characters in chilli genotypes.

SL.No	Characters	PCV (%)	GCV (%)	Heritability (%)	Genetic Advance	Genetic advance as percent of mean
1.	Plant height(cm)	25.62	24.95	94.8	30.36	50.05
2.	Days to first flowering	9.11	7.57	69.1	7.30	12.97
3.	Days to first fruit set	9.779	6.54	44.8	5.84	9.017
4.	First harvest	8.464	5.46	41.7	6.39	7.27
5.	Number of Primary branches	20.56	19.86	93.4	1.90	39.55
6.	leaf Length(cm)	25.69	25.03	94.9	3.84	50.24
7.	Leaf width(cm)	22.82	21.64	89.9	1.67	42.27
8.	Fruit length(cm)	36.49	35.49	94.6	4.41	71.12
9.	Fruit width(cm)	28.46	27.36	92.5	0.79	54.21
10.	Pedicel Length of fruit(cm)	26.31	25.04	90.6	1.50	49.09
11.	Fruit weight(g)	25.12	23.70	89	1.98	46.07
12.	Number of fruit per plant	38.5	37.29	93.9	37.32	74.43
13.	Dry weight per fruit(g)	19.92	18.72	88.4	0.145	36.26
14.	Dry weight of 100 fruits(g)	19.90	18.30	84.6	13.92	34.7
15.	Number of seed per fruit	38.15	37.29	95.5	39.81	75.08
16.	Ascorbic acid content (mg/100g)	13.41	12.59	88.2	31.77	24.37
17.	Capsaicin content	28.88	28.34	96.2	0.29	57.28
18.	Green fruit TSS(°Brix)	16.42	15.99	94.8	1.41	32.08
19.	Red fruit TSS(°Brix)	8.061	7.014	75.7	0.97	12.57
20.	Total sugar (mg/g)	15.82	15.28	93.2	4.37	30.39
21.	Reducing sugar (mg/g)	24.43	24.09	97.2	2.57	48.93
22.	Non-reducing sugar (mg/g)	14.46	13.59	88.3	2.28	26.31
23.	Chlorophyll content(mg/g)	24.29	23.83	96.3	0.58	48.19
24.	Fruit yield per plant(g)	44.14	42.27	91.7	177.65	83.39

Conclusion

In the present study high PCV and GCV were recorded for plant height, leaf length, leaf width, fruit length, fruit width, pedicel length, fruit weight, no. of fruit per plant, no. of seed per fruit, capsaicin content, reducing sugar, chlorophyll content and fruit yield per plant. Whereas, high heritability coupled with high genetic advance as percent of mean were showed by plant height, no. of primary branches, leaf length, leaf width, fruit length, fruit width, pedicel length of fruit, fruit weight, no. of fruit per plant, dry weight per fruit, dry weight of 100 fruits, ascorbic acid content, no. of seed per fruit, capsaicin content, green fruit TSS, total sugar, reducing sugar, non-reducing sugar, chlorophyll content and fruit yield per plant which indicates predominance of additive gene action. High GCV, PCV and high heritability coupled with high genetic advance as percent of mean was recorded for plant height, leaf length, leaf width, fruit length, fruit width, pedicel length of fruit, fruit weight, no. of fruit per plant, no. of seed per fruit, capsaicin content, reducing sugar, chlorophyll content and fruit yield per plant. The selection on the basis of these characters with high GCV, PCV and high heritability coupled with high genetic advance as percent of mean would be more effective and reliable criteria for improvement programme of this crop.

Acknowledgements

The authors are thankful to the College of Horticulture and Forestry, Central Agricultural University, Pasighat Arunachal Pradesh for providing all the necessary facilities required for conducting the experimental works.

References

1. Abrham S. Genetic variability and heritability study of hot pepper (*Capsicum annuum* L.) genotypes in Wolaita, Southern Ethiopia. Global Journal of Science Frontier Research: D Agriculture and Veterinary. 2019;19(4):31-36.
2. Amit K, Ahad I, Kumar V, Thakur S. Genetic variability and correlation studies for growth and yield characters in chilli (*Capsicum annuum* L.). Journal of Spices and Aromatic Crops. 2014;23(2):170-177.
3. Burton GW, de Vane EH. Estimating heritability in tall fiscue (*Festuca arundinacea*) from replicated clonal materials. Agronomy Journal. 1953;45(10):478-481.
4. Chattopadhyay A, Sharangi AB, Dai N, Dutta S. Diversity of genetic resources and genetic association analyses of green and dry chillies of Eastern India. Chilean Journal of Agricultural Research. 2011;71(3):350-356.
5. Falconer DS. Introduction to quantitative genetics 4th ed. Longman, New York; c1967.
6. Gomez KA, Gomez AA. Statistical procedures for agricultural research. Second Edition. New York, NY: Wiley; c1984.
7. Janaki M, Ramana CV, Naidu LN, Babu JD, Rao KK, Krishna KU. Estimation of genetic variability parameters for yield and yield components in chilli (*Capsicum annuum* L.). Journal of Pharmacognosy and Phytochemistry. 2017;6(6):685-689.
8. Johnson HW, Robinson HF, Comstock RE. Estimate of genetic and environmental variability in soybean. Agronomy Journal. 1955;47(7):314-318.

9. Nagaraju MM, Reddy RVSK, Reddy KM, Naidu LN, Rani AS, Krishna KU. Assessment of genetic variability, heritability and genetic advance for quantitative, qualitative traits and ChLCV resistance in chilli (*Capsicum annuum* L.). Journal of Pharmacognosy and Phytochemistry. 2018;7(6):1467-1472.
10. Krishna MM, Topno SE, Bahadur V. Genetic variability studies in chilli (*Capsicum annum* L.). International Journal of Chemical Studies. 2021:9(1):2412-2415.
11. Robinson HF, Comstock RE, Harvey PH. Estimates of heritability and the degree of dominance in corn. Agronomy Journal. 1949;41(8):353-359.
12. Singh P, Jain PK, Sharma A. Genetic variability, heritability and genetic advance in chilli (*Capsicum annuum* L.) genotypes. International Journal of Current Microbiology and Applied Sciences. 2017;6(9):2704-2709.
13. Sivasubramanian S, Menon N. Heterosis and inbreeding depression in rice. Madras Agricultural Journal. 1973;60:1139-1144.
14. Yatung T, Dubey RK, Singh V, Upadhyay G, Pandey AK. Selection parameters for fruit yield and related traits in chilli (*Capsicum annuum* L.). Bangladesh Journal of Botany. 2014;43(3):283-291.