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Genetic Variability Studies for Growth, Yield and Quality Traits in Chilli (*Capsicum annuum* L.) Germplasm under Sub Tropical conditions of Jammu

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ABSTRACT: The present genetic variability studies in chilli (*Capsicum annuum* L.) was laid out at SKUAST, Chatha, Jammu in 2022. The experiment was conducted in Randomized Complete Block Design (RCBD) with three replications comprising 20 genotypes to study genetic variability, heritability, genetic advance and genetic advance as percent of mean among 17 different characters. Analysis of variance elucidated significant variations among the genotypes for all the characters studied. The GCV and PCV were high for number of fruits per plant (32.43% and 34.09%), yield per plant (32.18% and 33.73%), yield per hectare (32.18% and 33.73%), fruit weight (28.56% and 30.12%), number of seeds per fruit (26.61% and 28.68%) and capsaicin content (21.87% and 24.12%). High heritability was noticed for yield per plant (91.01%) and yield per hectare (91.01 %), number of fruits per plant (90.48%), fruit weight (89.88%), seed vigour index (88.59%), number of seeds per fruit (86.05%), capsaicin content (82.23%), number of primary branches per plant (81.86%), oleoresin content (81.70%), plant height (80.05%), fruit length (79.06%), fruit width (75.09%) and seed germination (60.92%). However, high genetic advance was obtained by yield per plant (388.16), followed by seed vigour index (188.32%), number of fruits per plant (121.00) and yield per hectare (99.38) and genetic advance as percent of mean was higher in case of number of fruits per plant (63.54%), yield per plant (63.25%), and yield per hectare (63.25%), fruit weight (55.77%), number of seeds per fruit (50.84%) and capsaicin content (40.86%), indicated that most of the traits studied were chiefly controlled by additive gene effect and thus selection may be rewarding.

Keywords: Chilli, Genetic variability, heritability, genetic advance, genetic advance as percent of mean.

INTRODUCTION

Chilli (*Capsicum annuum* L., 2n = 2x = 24) is one of the most important solanaceous vegetable as well as spice crop grown for its green and ripe fruits. It originated in the New World tropics and sub tropics. It adds flavour, vitamin C, pungency and is the constituent of many foods.

Mexico is the center of diversity for *C. annuum* L. and it was brought to India by Portuguese from Brazil prior to 1885. The pungency in chillies is due to crystalline volatile alkaloid *capsaicin*, and the red colour of chillies is due to the presence of pigment *capsanthin*.

It is grown in almost all parts of tropical and subtropical regions of the world. It was domesticated around 7,000 BC and believed to be introduced to the rest of the world by Columbus (Bosland and Votava 2000).

It is highly substantial to assess the genetic variability present in the genotypes for quantitative and qualitative characters. The extent of genotypic and phenotypic coefficient of variations is an effective measure of determining the amount of variability available in the genetic resources. Heritability and genetic advance is necessary in measuring the effect of environment in expression of the characters and the amount of improvement possible through selection (Datta and Das 2013).

The censorious screening of nature and amplitude of variability in the germplasm is one of the main pre-requisites for working out an effective breeding strategy

for the genetic improvement of any crop which largely depends on the amount of genetic variability and the extent of heritability of economically important characters as well as the influence of environment in the expression of these characters (Jogi *et al*., 2017).

MATERIALS AND METHODS

The present genetic variability studies in chilli (*Capsicum annuum* L.) was laid out at Vegetable Experimental Farm, Division of Vegetable Science and Floriculture, SKUAST, Chatha, Jammu during 2022-2023. The experiment was conducted in Randomized Complete Block Design (RCBD) with 3 replications comprising 20 genotypes. The healthy seedlings were transplanted on 20th March 2022 in the plot size of 2.5m × 1.5m and a planting space of 45cm × 60cm. All the standard package of practices were followed as recommended by package of practices of SKUAST-Jammu, Vegetable Science and Floriculture division for obtaining a healthy and crop stand in chilli. Observation on 17 different growth, yield and quality characters were recorded. The statistical analysis was executed for all observed characters under the study with the help of MS Excel, and R Studio. The analysis of variance as described by Gomez and Gomez (1983) for Randomized Complete Block Design was followed to subject the mean values of each genotype in each replication and all the characters to the analysis. To study genetic variability, heritability, genetic advance and genetic advance as percent of mean. The data collected on 17 different characters to identify promising genotypes, suitable for sub tropical conditions of Jammu.

Table 1: Sources of genotype(s).

Sr. No.	Genotype(s)	Source
1.	SJC-01	SKUAST, Jammu
2.	SJC-02	SKUAST, Jammu
3.	Pusa Sadabahar	IARI, New Delhi
4.	Pusa Jwala	IARI, New Delhi
5.	DKC-8	Y.S.P. UHF Solan, Nauni.
6.	Suraj Mukhi	Pocha Agro Seeds, Jammu
7.	Hot Queen	Garg Seeds, Punjab
8.	Hy-509	Akhil India Private Limited, Jammu
9.	TNAU-1	Tamil Nadu Agricultural University, Coimbatore
10.	TNAU- 2	Tamil Nadu Agricultural University, Coimbatore
11.	TNAU -3	Tamil Nadu Agricultural University, Coimbatore
12.	TNAU -4	Tamil Nadu Agricultural University, Coimbatore
13.	TNAU- 5	Tamil Nadu Agricultural University, Coimbatore
14.	TNAU -6	Tamil Nadu Agricultural University, Coimbatore
15.	TNAU -7	Tamil Nadu Agricultural University, Coimbatore
16.	TNAU -8	Tamil Nadu Agricultural University, Coimbatore
17.	TNAU -9	Tamil Nadu Agricultural University, Coimbatore
18.	Bareilly Local	Bareilly
19.	Mahabaleshwar Local	Mahabaleshwar
20.	Chandigarh Local	Chandigarh

RESULTS AND DISCUSSION

Genotypic and phenotypic coefficient of variation. The perusal of the data presented in the Table 2 elucidated that genotypic coefficient of variation was less than phenotypic coefficient of variation which indicated that the influence of environment is high on these traits and ranged from (4.84% and 9.61%) for days to first picking to (32.43% and 34.09%) for number of fruits per plant. High genotypic and phenotypic coefficient of variation was recorded for number of fruits per plant (32.43% and 34.09%), yield per plant and yield per hectare (32.18% and 33.73%), fruit weight (28.56% and 30.12%), number of seeds per fruit (26.61% and 28.68%) and capsaicin content (21.87% and 24.12%). Moderate genotypic and phenotypic coefficient of variation was noticed for seed vigour index (19.92% and 21.16%), fruit length (18.15% and 20.42%), oleoresin content (17.34% and 19.18%), fruit width (17.13% and 19.77%), number of primary branches per plant (15.35% and 16.96%), plant height (11.65% and 13.02%), whereas lower was obtained for days to first picking (4.84% and 9.61%), ascorbic acid content (5.54% and 9.65 %), Seed germination (7.81% and 10.00%), red fruit dry matter content (8.48 % and 12.15%) and days to 50% flowering (8.84% and 12.62%). High GCV and PCV revealed that these genotypes had sufficient amount of variability for these characters and improvement for growth, yield and yield contributing and quality characters could be practiced through selection. Similar results for no of fruits per plant, fruit length, number of

seeds per fruit and yield (q/ha) was obtained by Jyothi *et al*. (2011); Bhoomika *et al*. (2022), days to 50 % flowering by Kumar *et al*. (2020). Similar results were reported by Hameedi *et al*. (2022); Datta and Das (2013); Jogi *et al*. (2017); Kumar *et al*. (2019); Patel *et al*. (2022); Krishna *et al*. (2021); Singh *et al*. (2017).

Broad sense heritability (h^2). Heritability is a good measure for understanding the portion of genetic variability to the phenotypic variability and is a good index of the transmittance of traits from parents to their off spring. In the present study estimation of heritability (h^2) ranged from (25.34%) for days to first picking to (91.01%) for yield per plant. High heritability was obtained for yield per plant and yield per hectare (91.01%), number of fruits per plant (90.48%), fruit weight (89.88%), Seed vigour index (88.59%), number of seeds per fruit (86.05%), capsaicin content (82.23%), No. of primary branches per plant (81.86%), oleoresin content (81.70%) plant height (80.05%), fruit length (79.06%) and fruit width (75.09%). Medium heritability was recorded for seed germination (60.92%), days to 50% flowering (49.11%), red fruit dry matter content (48.76%), and ascorbic acid content (32.99%). Whereas low heritability was observed for days to first picking (25.34%). High heritability of these characters divulged that there was large proportion of phenotypic variance to genotypic variance and hence selection for these characters is rewarding. Similar results for number of fruits per plant, fruit length, number of seeds per fruit and yield (q/ha) was obtained by Jyothi *et al*. (2011); Bhoomika *et al*. (2022), days to 50 % flowering by Kumar *et al*. (2020). Similar results were reported by Hameedi *et al*. (2022); Datta and Das (2013); Jogi *et al*. (2017); Kumar *et al*. (2019); Patel *et al*. (2022); Krishna *et al*. (2021); Singh *et al*. (2017).

Genetic advance and genetic advance as percent of mean. Genetic advance is a good estimates of how much gain you may get from phenotypic selection, the genetic advance of the 17 characters revealed to be ranged from (0.27) for capsaicin content, to (388.16) for yield per plant. High genetic advance was recorded by yield per plant at the tune of (388.16), followed by seed vigour index (188.32), number of fruits per plant(121.00) and yield per hectare (99.38), number of seeds per fruit (20.70), plant height (19.84), seed germination (11.37), however lower genetic advance was observed for capsaicin content (0.27).

Genetic advance as % of mean ranged from (5.02%) for days to first picking, to (63.54%) for number of fruits per plant. High genetic advance as % of mean was observed for number of fruits per plant (63.54%), yield per plant and yield per hectare (63.25%), fruit weight (55.77%), number of seeds per fruit (50.84%), capsaicin content (40.86%), seed vigour index (38.62%), fruit length (33.25%), oleoresin content (32.28%), number of primary branches per plant (28.61%) and plant height (21.48%). Moderate genetic advance as % of mean was obtained for days to 50% flowering (12.76%), seed germination (12.55), red fruit dry matter content (12.20%), and lower genetic advance as % of mean was noticed for days to first picking (5.02%) and ascorbic acid content (6.56%).

Table 2: Estimates of mean, range, components of variance, heritability, genetic advance and genetic advance as per cent of mean for growth, yield and quality characters of chilli (*Capsicum annuum* L.).

Sr. No.	Characters	Mean	Range		GCV (%)	PCV (%)	h^2 (%)	GA	GAM
			Max	Min					
1.	Days to 50% flowering	48.98	61.67	40.33	8.84	12.62	49.11	6.25	12.76
2.	Days to first picking	72.48	83.67	64.00	4.84	9.61	25.34	3.64	5.02
3.	Fruit length (cm)	8.22	11.27	5.70	18.15	20.42	79.06	2.73	33.25
4.	Fruit width (cm)	1.05	1.57	0.77	17.13	19.77	75.09	0.32	30.58
5.	Fruit weight (g)	3.46	5.75	2.00	28.56	30.12	89.88	1.93	55.77
6.	No. of Fruits per plant	190.44	325.32	80.12	32.43	34.09	90.48	121.00	63.54
7.	Plant height (cm)	92.37	112.73	72.67	11.65	13.02	80.05	19.84	21.48
8.	No. of Primary Branches per plant	8.29	11.07	5.80	15.35	16.96	81.86	2.37	28.61
9.	Yield per plant (g)	613.73	1075.67	243.13	32.18	33.73	91.01	388.16	63.25
10.	Yield per hectare (q)	157.11	275.37	62.24	32.18	33.73	91.01	99.38	63.25
11.	No. of seeds per fruit	40.72	64.73	17.07	26.61	28.68	86.05	20.70	50.84
12.	Seed germination (%)	90.60	98.67	70.67	7.81	10.00	60.92	11.37	12.55
13.	Seed vigour index	487.62	683.89	365.17	19.92	21.16	88.59	188.32	38.62
14.	Red fruit dry matter content (g/100g)	18.16	21.33	14.93	8.48	12.15	48.76	2.22	12.20
15.	Ascorbic acid content (mg/100g)	140.42	158.89	123.89	5.54	9.65	32.99	9.21	6.56
16.	Capsaicin content (%)	0.65	0.88	0.32	21.87	24.12	82.23	0.27	40.86
17.	Oleoresin content (%)	11.52	15.60	7.77	17.34	19.18	81.70	3.72	32.28

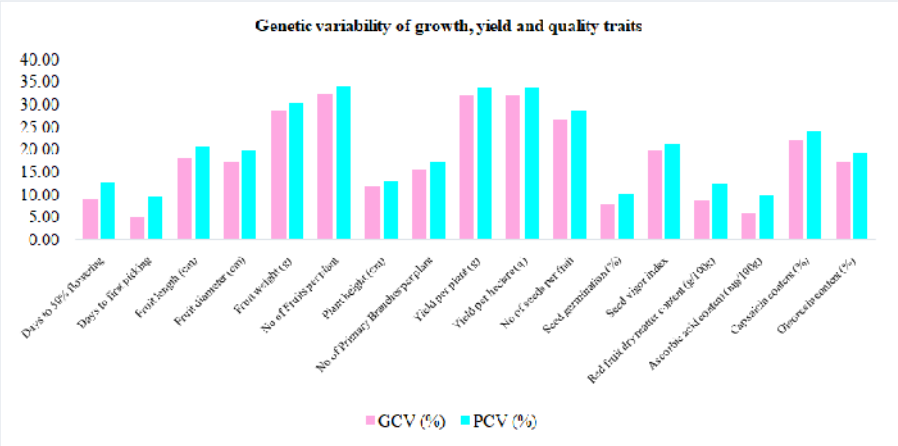

Fig. 1. Estimates GCV & PCV for growth, yield and quality traits.

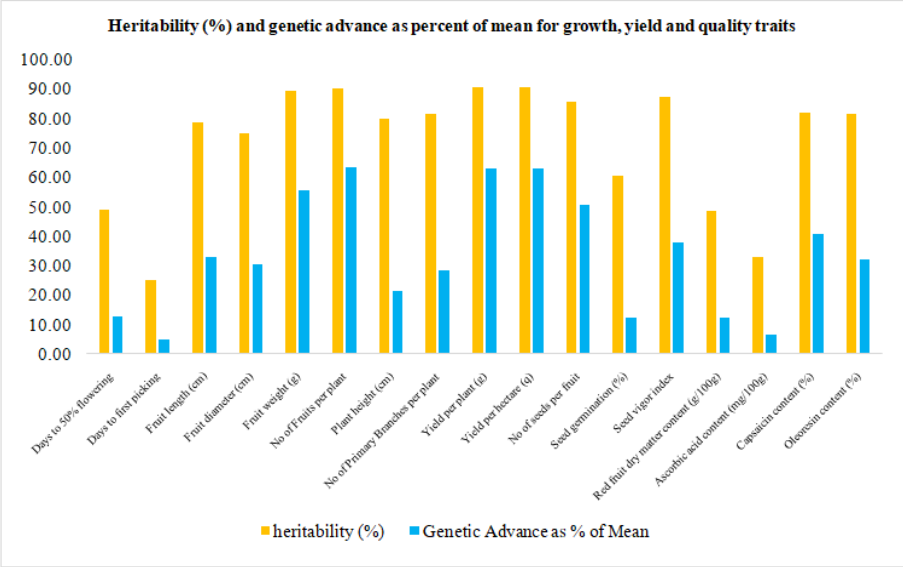

Fig. 2. Estimates of Heritability (%) and genetic advance as % of mean for growth, yield and quality traits.

High genetic advance coupled with high genetic advance as % of mean indicates that these characters have additive gene effect therefore mass selection, pure line selection, progeny selection and hybridization and selection with pedigree breeding would be the effective breeding procedures to be followed. Similar results for number of fruits per plant, fruit length, number of seeds per fruit and yield (q/ha) was obtained by Jyothi *et al*. (2011); Bhoomika *et al*. (2022), days to 50 % flowering by Kumar *et al*. (2020). Similar results were reported by Hameedi *et al*. (2022); Datta and Das (2013); Jogi *et al*. (2017); Kumar *et al*. (2019); Patel *et al*. (2022); Krishna *et al*. (2021); Singh *et al*. (2017).

CONCLUSION

The highest genotypic and phenotypic coefficient of variation, genetic advance and genetic advance as percent or mean was recorded for yield per plant, yield per hectare number of fruits per plant, fruit weight, number of seeds per fruit, capsaicin content, seed vigour index, number of primary branches per plant, oleoresin content, fruit length, fruit width, and plant height. Therefore, showing the importance of these characters in the selection of a genotype for growth, yield and quality in chilli.

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Conflict of Interest. None.

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