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ASSESSMENT OF GENETIC VARIABILITY IN F₁ HYBRIDS OF CHILLI (CAPSICUM ANNUUM L.)

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The study was carried out during kharif 2023 at Dr.YSRHU-College of horticulture, Anatharajupeta with 78 genotypes (66 F, hybrids and 12 parents) of chilli in a randomized block design with two replications to estimate the genetic variability, heritability and genetic advance for thirteen yield and yield attributing traits. Analysis of variance revealed the significant differences among the genotypes for all the traits studied indicating the presence of sufficient variability in the studied material. The phenotypic coefficient of variation (PCV) was slightly higher than the corresponding genotypic coefficient of variation (GCV) for all the characters indicating the some degree of environment influence on their genetic expression. High PCV recorded in days to full maturity, average dry fruit yield per plant, number of primary branches per plant, fruit diameter, fresh wt/fruit, number of seeds per fruit, oleoresin, average fresh fruit yield per plant (1000 seed wt and fruit **ABSTRACT** length. A high GCV was observed in days to full maturity, average dry fruit weight per plant, fruit diameter and fresh wt/fruit, number of seeds per fruit, oleoresin, number of primary branches per plant, average fresh fruit yield per plant and 1000 seed weight. High heritability coupled with high genetic advance as % of mean was observed for fresh wt/fruit, 1000 seed wt, number of seeds per fruit, plant height, plant spread, number of fruits per plant, average fresh fruit weight, fruit length, days to full maturity, fruit diameter, days to 50 % flowering and number of primary branches. High values of PCV, GCV and high heritability coupled with high genetic advance as % of mean suggesting that existence of wide range of genetic variability, broad genetic base, less environmental influence, predominance of additive gene action and selection for these traits based on phenotypic would be rewarding.

Key words: Chilli, GCV, PCV, heritability and genetic advance

Introduction

Chilli (*Capsicum annuum* L.), an important spice and vegetable crop, is grown globally for its green and ripe fruits. It belongs to the family Solanaceae with a chromosome number of 2n = 2x = 24. The genus *Capsicum* encompasses a diverse range of species, including approximately 25 wild species and five cultivated ones: *Capsicum annuum* L., *Capsicum frutescens* L., *Capsicum chinense* Jacquin, *Capsicum pubescens* Ruiz & Pavon, and *Capsicum baccatum* L. Among these, *Capsicum annuum* L. is the most widely cultivated, featuring both hot peppers (pungent fruits) and sweet peppers (non-pungent fruits). The primary centre of origin of chilli is said to be Mexico and secondary centre is Guatemala and Bulgaria (Salvador, 2002). India is the world's largest producer, consumer and exporter of chilli. India is the world leader in chilli production followed by China, Thailand, Ethiopia and Indonesia. In India, chilli cultivation has spread in the states of Andhra Pradesh, Telangana, Madhya Pradesh Karnataka, Orissa, West

Characters	Mean	CV	PCV	GCV	Heritability	Genetic advance
		(%)	(%)	(%)	(%)	as % of mean
Plant height	92.15	2.43	16.60	16.42	97.8	33.47
Plant spread	75.62	2.13	13.02	12.85	97.3	26.11
No. of primary branches	3.37	14.18	27.31	23.34	73.0	41.10
Days 50% flowering	43.78	5.00	13.73	12.79	86.8	17.62
Days to full maturity	99.11	3.30	29.58	29.18	88.4	59.31
No. of fruits per plant	154.14	4.84	13.78	13.23	97.3	26.17
Fruit length	12.29	3.85	20.82	19.54	92.2	37.78
Fruit Diameter	0.96	7.20	27.25	27.21	88.1	37.78
Fresh wt/fruit (g)	4.82	1.40	27.25	27.21	99.7	56.00
Avg fresh fruit yield per plant (g)	688.90	6.23	23.57	22.73	93.0	45.17
Avg dry fruit yield per plant (g)	158.50	5.80	28.66	28.06	95.9	56.61
No. of seeds per fruit	70.13	3.82	26.48	26.20	97.9	53.41
1000 seed weight (g)	5.87	2.34	21.42	21.30	98.8	43.61

Table 1: Estimates of components of genetic variability for various characters of F₁ hybrids and parents in chilli.

Bengal, Gujarat, Tamil Nadu, Assam, Maharashtra, Punjab, Rajasthan, Uttar Pradesh, and Nagaland with an area of 8.72 lakh ha and production of 25.97 lakh tonne. (Spice Board, 2023-2024). Even though India ranks first in production due to many limiting factors mainly due to lack of superior genotypes or improved cultivars for use in breeding programmes to develop potential hybrids. So, there is a need to develop new varieties and hybrids with high productivity to meet demand. The critical assessment of nature and magnitude of variability in the germplasm stock is one of the important pre-requisite for formulating the effective breeding methods (Krishna et al., 2007). The crop improvement depends on the magnitude of genetic variability present in germplasm and the extent to which the desirable characters are heritable. Greater the variability in a population, there will be the greater chance for effective selection for desirable types (Vavilov, 1951). Genotypic and phenotypic coefficients of variation (GCV and PCV) are useful in detecting the amount of variability present in the available genotypes. Heritability and genetic advance helps in determining the influence of environment in expression of characters and the extent to which improvement is possible after selection (Robinson et al., 1949). Higher the heritable variation, greater will be the possibility of fixing the characters by selection.

Materials and Methods

An experiment was conducted at, Dr. Y. S. R. Horticultural University- COH, Anantharajupeta. The. The experimental material comprised of 12 parents (LCA-808, LCA-807, LCA-806, LCA-805, LCA-804, LCA-657, LCA-625, LCA-485, LCA-484, LCA-481, LCA-479 and LCA 355). These parents were crossed in Half diallel fashion and developed 66 F_1 hybrids. The resulting 66 F_1 hybrids along with their 12 parents were evaluated during *Kharif*, 2023 in a Randomized Block Design with two replications of each genotype at a spacing of 75 cm \times 30 cm. The crop was raised as per the standard package of practices. The observations were recorded on five randomly selected plants for twelve characters *viz.*, plant height (cm), plant spread (cm), number of primary branches, days to 50% flowering, days to fruit maturity, number of fruits per plant, fruit length (cm), fruit diameter (cm), fresh wt/fruit average fresh fruit yield per plant (g), average dry fruit yield per plant, number of seeds per fruit and 1000 seed weight (g).

Analysis of variance was carried out as per the procedure given by Panse and Sukhatme (1985). The genotypic and phenotypic coefficients of variation were computed as per Burton and Devane (1953) and categorized as per Sivasubrahmanian and Menon (1973) while the heritability in broad sense and genetic advance were calculated as per Allard (1960) and categorized as per Johnson *et al.*, (1955). The coefficients of variation were categorized as high (>20 %), moderate (10- 20 %) and low (<10 %), Similarly, heritability was categorized as high (>80 %), moderate (50-80 %), and low (<50 %) and genetic advance as per cent over the mean categorized as low (0-10 %), moderate (11-20 %), high (>21 %).

Results and Discussions

The results of the coefficient of variation (CV) for parental lines and cross combinations are presented in Table 1. Among all genotypes coefficient of variation ranged from 1.40 to 14.18 %. The high CV was recorded in the no. of primary branches (14.18 %). It was followed by fruit diameter (7.20 %) and average fresh fruit yield per plant (6.23 %). The lowest CV was reported in fresh wt/fruit (0.25 %). The phenotypic coefficient of variation (PCV) varied from 13.02 to 29.58 and the highest percentage of PCV was obtained in days to full maturity (29.58%) followed by average dry fruit yield per plant (28.66%), no. of primary branches (27.31%), fruit diameter and fresh wt/fruit (27.25 g), number of seeds per fruit (26.48%), oleoresin (24.71%), average fresh fruit yield per plant (23.57%) 1000 seed wt (21.42%) and fruit length (20.82%) and moderate PCV recorded in plant height (16.60%), no. of fruits per plant (13.78%), days to 50% flowering (13.73%) and plant spread (13.02%).

The range of genotypic coefficient of variation (GCV) was 12.85 to 29.18 %. A high GCV was observed in days to full maturity (29.18 %) followed days to full maturity (29.18 %), average dry fruit yield per plant (28.06), capsaicin (27.45), fruit diameter and fresh wt/ fruit (27.21%), no. of seeds per fruit (26.20 %), oleoresin (24.61%), no. of primary branches (23.34 %), average fresh fruit yield per plant (22.73%), 1000 seed wt (21.30 %) and moderate GCV % observed in fruit length (19.54 %), plant height (16.42), number of fruits per plant (13.23), plant spread (12.85) and days to 50 % flowering (12.79).

The phenotypic coefficient of variation (PCV) was greater than the genotypic coefficient variation (GCV) among all characters which might be due to environmental influence, these were found in accordance with the findings of Janaki *et al.*, 2017. The higher PCV and GCV values indicated a greater amount of variability among the various genotypes. Hence, it helps make the selection based on the character Similar findings were reported by Bhardwaj *et al.*, (2007) and Sharma *et al.*, (2010) and Sharma and Singh, (2018).

The heritability range varied from 73.0 to 99.7 % in all genotypes. Among all genotypes, the characters showed high heritability in fresh weight per fruit (99.7 %), 1000 seed weight (98.8 %), number of seeds per fruit (97.9 %), plant height (97.8 %), fruit length (92.2 %), average fresh fruit weight (93.0 %), days to full maturity (88.4 %), days to 50 percent flowering (86.8%), fruit diameter (88.1%) and number of primary branches (73.0 %). Genetic advance as per cent of mean (GA %) was highest in the days to full maturity (59.31 %), average dry fruit yield per plant (56.61), Fresh wt/fruit (g) (56.00 %), No. of seeds per fruit (53.41 %) among all genotypes, low genetic advance as per cent of mean was observed in days to 50 % flowering (17.62 %).

High to moderate heritability and high genetic advance as per cent of mean were recorded among all the parameters like fresh wt/fruit (g), 1000 seed wt, no. of seeds per fruit, plant height, plant spread, no.of fruits per plant, plant height, plant spread, no.of fruits per plant, avg dry yield per plant (g), average fresh fruit yield per plant (g), fruit length, days to full maturity, fruit diameter, days 50 % Flowering and no. of primary branches. It indicated that these characters were slightly influenced by the environment and controlled by the additive gene action, hence useful for simple selection. Similar findings were obtained by Janaki *et al.*, 2017. Arup *et al.*, (2011), Rajyalakshmi and Vijayapadma (2012), Gupta *et al.*, (2009), Suryakumari *et al.*, (2010) and Janaki *et al.*, (2015) and Rohini, (2015).

Conclusion

The present study can be concluded that significant differences were observed among the genotypes for all the traits indicating the presence of wide range of variability in the genotypes. The phenotypic coefficient of variation (PCV) was slightly higher than the corresponding genotypic coefficient of variation (GCV) for all the characters indicating the some degree of environment influence on their genetic expression. The characters viz. days to full maturity, average dry fruit yield per plant, no. of primary branches, fruit diameter, fresh wt/fruit, no. of seeds per fruit, average fresh fruit vield per plant, 1000 seed weight and fruit length exhibited high values of PCV, GCV and high heritability coupled with high genetic advance as % of mean suggesting that existence of wide range of genetic variability, broad genetic base, less environmental influence, predominance of additive gene action and making the simple selection more effective for their further improvement.

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