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Genetic variability, heritability and correlation association studies for yield and its components in Chilli (*Capsicum annum* L.)

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Abstract

Chilli is a often cross pollinated crop in the Solanaceae family of the Solanales order. It is a important vegetable crop all over the world and one of the highest source of vitamin C. A field experiment was conducted during *rabi* season 2020 at S.G. College of Agriculture and Research Station, Kumharawand, Jagdalpur. This experiment consisted of 20 genotypes including 17 genotypes local and 3 standard cultivars (Pusa Jwala, Kashi Anmol, Sunidhi) and cultivated in RBD. Highest phenotypic coefficient of variation and genotypic coefficient of variation was observed in green fruit yield per hectare followed by fruit weight and green fruit yield per plant. Heritability (bs) coupled with genetic advance as percentage of mean was found to be highest for all the characters except days to first picking. Association analysis revealed high positive and significant correlation of green fruit yield per plant with green fruit yield per plant, fruit weight and number of fruit per plant at both genotypic and phenotypic levels.

Keywords: Genetic, variability, heritability, correlation, *Capsicum annum* L.

Introduction

Chillies and peppers belong to the same species, *Capsicum annum* L. It is a tropical and sub-tropical vegetable and often cross pollinated crop grown for fruits (berry) either green or red ripe or dried according to the market requirement. It is one of the most important vegetable crop as well as spice crop grown in India with great export potential. Chilli contains vitamin A (292.04 IU), vitamin C (143.7 µg) vitamin K (14 µg) vitamin E (0.69 mg) and other minerals (Singh and Chaudhary, 2004) [4]. In India, green chilli covers an area of 366 thousand ha area with an annual production of 3.7 million tonne and the productivity of 10.21 mt/ha respectively (NHB 2019-20). Whereas in Chhattisgarh it covers 35912 ha area with 246438 metric tonne production and having productivity of 6.86 mt/ha (Anon., 2020) [1]. During present days India has emerged as the major producer, consumer and exporter of chilli. It is presently grown extensively throughout the country both under rainfed and irrigated conditions in almost all the states and contributes almost one fourth of the world production. Fruit appear in different shapes, sizes and colours. It is highly valued for its green or red ripe fruits with characteristic pungency, colour and flavour. It is consumed as fresh, dried or in powder form (Pujar *et al.*, 2017) [5]

Materials and Methods

The present experiment was carried out in RBD with three replications and with 60 cm × 45 cm spacing between row to plants with 6.42 m² net plot size at Shaheed Gundadhoor College of Agriculture and Research Station, Kumharawand, Jagdalpur during *Rabi* 2020. The genetics of 12 yield traits in 20 genotypes of chilli 17 diverse local genotype and three checks Pusa Jwala, Kashi Anmol and Sunidhi were evaluated under the Section of Genetics and Plant Breeding. Jagdalpur located at 19.07⁰ North latitude and 82.03⁰ Eastern latitude. Observations were recorded on twelve quantitative parameters *viz.*, plant height (cm), days to flower initiation, days to fruit set, days to first picking, number of primary branches, number of secondary branches, fruit length (cm), fruit diameter (mm), fruit weight (g), number of fruits plant⁻¹, green fruit yield plant⁻¹, green fruit yield hectare⁻¹. Five random plants were selected from each plot and tagged for recording the biometrical observations.

Analysis of variance was worked out as per the procedure given by Panse and Sukhatme (1985) [6]. The genotypic and phenotypic coefficients of variation were computed as per Burton and Devane (1953) [7] while the heritability in broad sense and genetic advance were

calculated as per Allard (1960) [8] and categorized as per Johnson *et al.* (1955) [10] and correlation coefficient analysis have been carried out by Johnson *et al.*, (1955) [10].

Result and Discussion

Analysis of variance

ANOVA revealed that all the 12 characters under study showed significant variation among the genotypes which is present in Table: 1. The variation due to genotypes was significant at 5 percent level and 1 percent level of probability. These findings were supported by Farwah *et al* (2020) [11].

It was observed that considerable amount of variation was exhibited by the genotypes for all the traits. High phenotypic and genotypic coefficient variation were observed for green fruit yield per hectare (46.10%, 46.33%), green fruit yield per plant (45.48%, 45.62%), fruit weight (45.36%,45.93%), fruit length (44.84%,45.53%), number of fruit per plant (36.20%, 36.64%), and fruit diameter (31.95%,32.55%). GCV and PCV was moderately observed for height of plant (18.71%,19.28%) number of primary branches per plant (14.90%,17.09%), number of secondary branches per plant (14.46%,17.54%), days to flower initiation (13.93%,16.48%) days to fruit set (10.64%,14.50%) and days to first picking (11.33%,13.85%). Here PCV was greater than GCV revealing the effect of environment on character expression. The results indicated that there is scope for further improvement of these characters. Similar findings were reported by Jogi *et al.* (2016), Maurya *et al.* (2017) [12, 13]. The heritability estimates ranged from 66.94% – 99.37% and genetic advance as percentage of mean estimates ranged from 19.10 % - 93.39%. High broad sense heritability coupled with high genetic advance as % mean was observed for characters like plant height, days to flower initiation, days to fruit set, number of primary branches, number of secondary branches, fruit diameter, fruit length, fruit weight, number of fruits per plant, green fruit yield per plant and green fruit yield per hectare and moderate broad sense heritability coupled with genetic advance as percentage of mean observed for days to first

picking. Heritability was high in these characters except for days to first picking indicating additive gene effects. Consequently these characters can be improved by simple selection scheme. High heritability and GA% mean have been reported in chilli by Minz (2016) [14], Maurya (2017) [13] and Farwah (2020) [11] for plant height, number of fruit per plant, fruit weight, fruit length, green fruit yield per plant. Estimates for the PCV and GCV and heritability in broad sense and GA% mean are presented in table 2.

Correlation coefficient analysis

Correlation coefficient was worked out at phenotypic and genotypic level for all possible combination of yield and its attributing traits in chilli (Table 3). Results indicated that the genotypic coefficient of correlation was higher in magnitude than the corresponding phenotypic coefficient of correlation. The genotypic correlation coefficient among different characters noted that green fruit yield per hectare had highly significant positive correlation with green fruit yield per plant (0.999**) followed by fruit weight (0.647**), number of fruit per plant (0.501**), fruit length (0.619**). while highly negative correlation were recorded with days to fruit set (-0.537**), days to first picking (-0.493**) and days to flower initiation (-0.440**) respectively. The phenotypic correlation coefficient among different characters revealed that green fruit yield per hectare had significant highly positive correlation with fruit yield per plant (0.995**) fruit weight (0.637**), fruit length (0.605**) and number of fruit/plant (0.498**), while highly negative correlations were observed with days to fruit set (-0.451**), days to first picking (-0.411**) and days to flower initiation (-0.372**) respectively. The present investigation of positive and significant correlation for number of fruits per plant, fruit length and fruit weight were similar to finding of Bundela *et al* (2018) [15]. For green fruit yield per plant, fruit length, number of fruits per plant was observed by Vaishnavi *et al* (2017). For fruit length and number of fruits per plant was reported by Chattopadhyaya *et al* (2011) [16], for fruit weight and number of fruits per plant was observed by Shrinivas *et al* (2020).

Table 1: Analysis of variance for yield and its component of Chilli (*Capsicum annum* L.)

Source of variation	DF	Plant height (cm)	Days to flower initiation	Days to fruit set	Days to first picking	Number of primary branch	Number of secondary branch	Fruit diameter (mm)	Fruit length (cm)	Number of fruit / plant	Fruit weight (g)	Green fruit yield / plant (g)	Green fruit yield (q/ha)
Replication	2	2.91	40.95	40.06	23.78	0.43	2.93	0.72	0.75	9.06	0.17	20.13	2.21
Treatment	19	375.57**	231.56**	204.27**	217.33**	5.41**	13.40**	31.38**	25.62**	1542.99**	11.21**	14608.56**	2047.15**
Error	38	7.54	27.27	24.90	30.72	0.52	1.19	0.39	0.26	12.49	0.09	30.75	6.88

*Significant at 0.05 probability level, **Significant at 0.01 probability level

Table 2: Estimates of genotypic and phenotypic coefficient of variation, heritability and genetic advance for different traits in Chilli

Genotypes	Mean	Min	Max	Var (g)	Var (p)	Heritability (bs) (%)	GA	GA% mean	GCV (%)	PCV (%)
Plant height (cm)	59.19	32.66	82.43	122.68	130.22	94.21	22.15	37.42	18.71	19.28
Days to flower initiation	59.25	44.53	78.70	68.09	95.37	71.40	14.36	24.24	13.93	16.48
Days to fruit set	63.48	48.87	81.44	59.79	84.69	70.60	13.38	21.08	12.18	14.50
Day to first picking	69.60	55.47	88.50	62.20	92.93	66.94	13.29	19.10	11.33	13.85
Number of primary branch	8.58	6.17	11.85	1.63	2.15	76.00	2.29	26.75	14.90	17.09
Number of secondary branch	13.95	10.97	18.33	4.07	5.26	77.38	3.66	26.20	14.46	16.44
Fruit diamete (mm)	10.06	6.61	17.97	10.33	10.72	96.33	6.50	64.59	31.95	32.55
Fruit length (cm)	6.48	2.09	12.59	8.45	8.71	97.01	5.90	90.98	44.84	45.53
Number of fruit / plant	62.40	24.13	102.98	510.17	522.66	97.61	45.97	73.67	36.20	36.64
Fruit weight (g)	4.24	2.22	11.63	3.71	3.80	97.52	3.92	92.28	45.36	45.93
Fruit yield / plant (g)	153.27	54.53	290.57	4859.27	4890.0	99.37	143.15	93.39	45.48	45.62

Table 3: Genotypic and phenotypic correlation coefficient analysis for green fruit yield and its components in *Capsicum annum* L.

Characters		Plant height (cm)	Days to flower initiation	Days to fruit set	Day to first picking	Number of primary branch	Number of secondary branch	Fruit diameter (mm)	Fruit length (cm)	Number of fruit / plant	Fruit weight (g)	Fruit yield / plant (g)	Green fruit yield (q/ha)
Plant height (cm)	G	1.000	0.173	0.188	0.160	0.131	-0.187	0.140	0.083	-0.155	0.393**	0.095	0.121
	P	1.000	0.193	0.201	0.184	0.090	-0.145	0.142	0.086	-0.143	0.385**	0.088	0.116
Days to flower initiation	G			0.996**	1.003**	0.409**	0.017	-0.022	-0.156	-0.689**	0.104	-0.455**	-0.440**
	P			0.975**	0.972**	0.262*	0.063	-0.005	-0.115	-0.558**	0.091	-0.390**	-0.372**
Days to fruit set	G				0.998**	0.416**	-0.012	0.044	-0.241	-0.756**	0.071	-0.554**	-0.537**
	P				0.981**	0.267*	0.039	0.049	-0.188	-0.609**	0.065	-0.472**	-0.451**
Day to first picking	G					0.395**	0.052	0.006	-0.183	-0.706**	0.067	-0.510**	-0.493**
	P					0.265*	0.077	0.012	-0.131	-0.557**	0.059	-0.425**	-0.411**
Number of primary branch	G						0.580**	0.307*	-0.077	-0.412**	0.216	-0.080	-0.047
	P						0.513**	0.248	-0.099	-0.365**	0.179	-0.064	-0.041
Number of secondary branch	G							0.057	0.240	-0.034	0.058	0.155	0.158
	P							0.042	0.182	-0.030	0.032	0.134	0.143
Fruit diameter (mm)	G								-0.636**	-0.397**	0.311*	-0.034	-0.014
	P								-0.613**	-0.386**	0.297*	-0.035	-0.013
Fruit length (cm)	G									0.344**	0.406**	0.633**	0.619**
	P									0.339**	0.402**	0.619**	0.605**
Number of fruit / plant	G										-0.287*	0.520**	0.501**
	P										-0.274*	0.513**	0.498**
Fruit weight (g)	G											0.628**	0.647**
	P											0.620**	0.637**
Fruit yield / plant (g)	G												0.999**
	P												0.995**
Green fruit yield (q/ha)													1.000

*, ** significant at 0.05% and 0.01% level, respectively

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