



STUDIES ON GENETIC VARIABILITY, HERITABILITY AND CORRELATION IN DIFFERENT GENOTYPES OF CHILLI (*CAPSICUM ANNUM* L) FOR FRUIT YIELD CHARACTERS

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ABSTRACT

The experiment results of the present investigation revealed significance differences observed among the genotypes for all the traits. The results from the present investigation concluded significant differences for all the characters among 15 genotypes included in the study, indicating sufficient variation among them the genotypes CA 916, LCA 357 & LCA 206. These were identified as desirable genotypes with high mean performance for length of chilli and weight of green chilli. Fresh weight of green chilli/plant and weight of dry chilli exhibited high estimates of GCV & PCV. Heritability coupled with genetic advance as percent of mean with fresh weight of green chilli/plant, weight of dry chilli. Fresh weight of green chilli/plant showed high positive significant association with weight of green chilli, plant height at genotypic and phenotypic levels. Weight of green chilli showed positive direct effect on fresh weight of green chilli/plant at genotypic and phenotypic levels.

Keywords: Genetic variability, Heritability, Genetic advance, correlation, path analysis.

1. INTRODUCTION

Chilli (*Capsicum annum* L. $2n=24$) is one of the most important vegetable as well as spice crop belongs to family solanaceae. It originated from the tropical America where wild forms have been found growing on the banks of Amazon and in Eastern Peru. India is a major producer, exporter and consumer of chilli. It is a often cross pollinated crop bearing a pod like fruit (berry) and has predominant position among the spices grown all over India. It is being grown as green/red chillies in U.P. during summer, rainy and winter season. Chilli is an indispensable condiment in India. It is used for industrial purpose due to extraction of oleoresin. Its Green fruit is one of the richest sources of anti-oxidant, vitamins such as vitamin A, C and E, and these antioxidant in food protect the occurrence of cancer. The capsaicin alkaloid is responsible for pungency and it has medicinal value also. At ripening stage, fruit become red in colour due to presence of capsanthin pigment.

Chilli is grown in both tropical and subtropical areas at altitudes ranging from sea level to 2000 meters above (Joshi and Singh, 1975). A temperature ranging from 20°-25° C is ideal for chilli cultivation. As rainfed crop, down pour is detrimental as it leads to poor fruit set, besides causing rotting of the fruit (Bose *et al.*, 2003)

In agriculture, path analysis has been used by plant breeders to assist in identifying traits that are useful as selection criteria to improve crop yield (Dewey and Lu, 1959; Milligan *et al.*, 1990). The availability of genetic variability among population is most important for judicious selection and breeding to desired plant genotypes. Plant breeding according to Dubley and Moll (1969) can be divided into three stages; assembly or creation of a pool of variable germplasm, selection of superior individuals from the pool and the utilization of selected individuals in the process to evolve a superior variety. By reason of the evolutionary history of a cultivar, it is becoming increasingly clear that what could be termed as the total energy of traits with economic significance is not present even in the best cultivars.

Importance of genetic variability in any breeding material is prerequisite as it provides not only a basis for selection but also some valuable information regarding selection of diverse parents for use in hybridization programme. In this context present investigations was carried out to know Studies on Genetic Variability, Heritability and correlation in different genotypes of Chilli (*Capsicum annum* L.) for fruit yield characters which is the heel of hour

2. MATERIALS AND METHODS

Present investigation was carried out at the Field Experimentation Centre, Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, U.P. (India) during *kharif* -2017. The experimental

materials consist of 15 genotypes obtained from Dept. of GPB, SHUATS. The experiment was laid out in Randomized Complete Block Design with 3 replications. The spacing of row to row 45cm and plant to plant 60cm. The fertilizer dose of 20:40:40 NPK kg/ha is applied as Nitrogen as two splits, phosphorus and potassium as basal dose. All recommended package of practices was followed during the cropping period to raise a good crop. Observations were recorded in each plot and replication by taking five plants randomly for 9 quantitative characters *viz.* Mean data for 9 characters *viz.*, plant height, Number of primary branches plant, days to 50% flowering, days to first picking, Fruiting span, Fruit length (cm), Fruit weight of green chilli (g), Fruit weight of dry chilli (g), Fresh weight of green chilli/plant. The data was subjected to the statistical analysis the correlation coefficients and are estimated as suggested by Al Jibouriet *al.* (1958), path coefficient analysis (Dewey and Lu, 1959).

3. RESULTS AND DISCUSSION

The analysis of variance revealed highly significant to significant differences among the genotypes for all the nine characters studied (Table 1). In the present study variation among the characters are estimated by Genotypic Coefficient of Variation (GCV) and Phenotypic Coefficient of Variation (PCV). The PCV was slightly higher than the GCV for few characters indicates the interaction of genotypes with the environment (Table 2). High GCV and PCV were recorded for seed yield per plant (21.27 and 21.27) followed by harvest index (19.51 and 20.60). Estimates of heritability is a good index for predicting the transmission of characters from parents to their offspring (Falconer, 1981). High heritability (broad sense) was recorded for characters *i.e.*, seed index and days to maturity (97 %) followed by pods per plant (92 %). The genotypic and phenotypic correlation coefficient and path analysis were computed among 9 characters (Table 3), (Table 4).

4. SUMMARY AND CONCLUSION

The material for the present study comprised among 15 genotypes of chilli were evaluated for 9 characters, *viz.* Plant height (cm), Number of primary branches plant, Days to 50% flowering, Days to first picking, Fruiting span, Bearing Habit, Fruit length (cm), Fruit weight of green chilli (g), Fruit weight of dry chilli (g), Fresh weight of green chilli/plant, Fruit shape, Fruit colour during *khariif*, 2017 at the field experimentation Centre, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, U.P. The observations were recorded on five randomly selected plants per genotype in each replication for 9 characters

- The analysis of variance indicated significant differences among 15 genotypes for all characters studied. The estimates of mean sum of squares showed comparatively wide range of variations for the characters.
- The genetic variability studies indicated that materials used in the present investigation possessed considerable variability which provides sufficient basis for selection by breeder. A perusal of genetic parameters revealed high phenotypic and genotypic coefficients of variation for number of pods per plant, number of clusters per plant, seed yield per plant and plant height, the values of phenotypic and genotypic coefficients of variation were low for protein content, days to maturity, number of seeds per pod and days to 50% flowering. The other characters namely biological yield, harvest index, number of primary branches per plant, seed index expressed moderate variability.
- The results on heritability (broad sense) that majority of the character *viz.*, number pods per plant, plant height, seed yield per plant, number of clusters per plant, harvest index, seed index,
- biological yield, days to 50% flowering, number of primary branches per plant, days to maturity exhibited higher heritability estimates. Genetic advance was found to be highest for plant height, number of pods per plant, harvest index. The estimates of heritability coupled with higher genetic advance as percent of mean was observed number of pods per plant, number of clusters per plant, seed yield per plant, plant height, biological yield, harvest index.
- Path coefficient analysis at genotypic level revealed that the characters *viz.*, Fruiting span (2.726), weight of green chilli (1.879) had positive direct effect. And number of length of chilli (-1.621), dry weight of chilli (-1.258), days to 50% flowering (-0.732), plant height (-0.528), primary branches per plant (-0.162) had negative direct effect.
- Path coefficient at phenotypic level revealed that the characters *viz.*, weight of green chilli (0.682), plant height (0.201), fruiting span (0.129), number of primary branches per plant (0.0962), days to 50% flowering (0.026), showed positive direct effect. And the characters like days to first picking (-0.180), length of chilli (-0.143), and dry weight of chilli (-0.011) showed negative direct effect.

Table 4.1. Analysis of variance for Yield characters in chilli genotypes.

Sl.N.	Source of variation / characters	Mean sum of squares	
		Treatments D.f=14	Error D.f=28
01	Plant height	127.73**	31.76
02	Number of primary branches per plant	1.004	0.084
03	Days to 50% flowering	3.403**	0.724
04	Days to first picking	4.641**	1.678
05	Fruiting span	2.97**	0.62
06	Length of chilli	0.07	0.015
07	Weight of green chilli	0.0032	0.0006
08	Weight of dry chilli	0.0015	0.00016
09	Fresh weight of green chilli/plant	80190.93**	853.07

*Significant at 5% level,**Significant at 1% level

S.NO	Characters	Range		Mean	GCV	PCV	h ² (bs) (%)	Genetic advance	Genetic advance as per cent of mean
		Max.	Min.						
1	Plant height	103.47	80.06	91.95	6.15	8.68	50	8.25	8.98
2	Number of primary branches	4.7	2.4	3.79	14.61	16.50	78	1.01	26.64
3	Days to 50% flowering	48.67	44.67	47.36	2.00	2.69	55	1.45	3.05
4	Days to first picking	99.67	94.66	97.98	1.01	1.67	37	1.25	1.27
5	Fruiting span	49.00	45.67	47.35	1.87	2.51	56	1.36	2.87
6	Length of chilli	4.3	3.7	4.08	3.55	4.70	57	0.23	5.51
7	Weight of green chilli	0.354	0.253	0.297	10.00	13.18	58	0.05	15.63
8	Weight of dry chilli	0.1670	0.0927	0.1159	18.34	21.49	73	0.04	32.24
9	Fresh weight of green chilli/plant	1010.02	453.77	641.67	25.34	25.75	97	329.73	51.39

Table 2. Coefficient of variations, heritability, genetic advance and genetic advance as percent of mean for fruit yield chacters in chilli

Table 3 Genotypic correlation coefficient of fruit yield and its component characters in Chilli

Character	No.of primary branches/plant	Days to 50% Flowering	Days to First Picking	Fruiting Span	Length of Chilli	Weight of Green Chilli	Weight of dry chilli	Fresh weight of green chilli/plant
Plant Height cm	-0.260*	0.002	-0.630**	0.083	-0.314**	0.496**	-0.153	0.4027**
Primary Branches/ Plant	1.000	-0.813	0.198*	0.226*	0.059	0.135	-0.066	0.1232
Days to 50% Flowering		1.000	-0.134	0.238*	-0.144	-0.139	0.020	- 0.0307
Days to First Picking			1.000	-0.228*	0.065	0.085	0.557**	-0.2595**
Fruiting Span				1.000	-0.152	0.135	0.040	0.2976**
Length of Chilli					1.000	-0.246*	-0.521**	-0.3222**
Weight of Green Chilli						1.000	-0.122	0.9510**

(gm)								
Weight of Dry Chilli							1.000	-
								0.1204

**Significant at 1% level and *Significant at 5% level

Table 4 Phenotypic correlation coefficient of fruit yield and its component characters in Chilli

Character	Number of branches per plant	Days to 50% Flowering	Days to First Picking	Fruiting Span	Length of Chilli	Weight of Green Chilli (gm)	Weight of Dry Chilli	Fresh weight of green chilli/plant
Plant Height cm	-0.178	-0.145	-0.203*	-0.042	-0.087	0.149	-0.105	0.327**
Primary Branches/ Plant	1.000	-0.533**	0.102	0.109	-0.012	0.116	-0.080	0.124
Days to 50% Flowering		*** 1.000	-0.129	0.160	-0.016	-0.015	0.025	-0.018
Days to First Picking			1.000	-0.049	0.039	0.116	0.359*	-0.151
Fruiting Span				1.000	-0.170	0.073	0.073	0.218*
Length of Chilli					1.000	-0.070	-0.339**	-0.236
Weight of Green Chilli (gm)						1.000	-0.079	0.722**
Weight of Dry Chilli							1.000	-0.100

Table 5. Direct (Diagonal) and indirect effects of fruit yield and its component characters in Chilli at genotypic level

Character	Plant height (cm)	Number of branches per plant	Days to 50% Flowering	Days to First Picking	Fruiting Span	Length of Chilli	Weight of Green Chilli (gm)	Wt of dry Green	Fresh Wt of Green chilli/plant
Plant Height cm	-0.528	0.917	-0.0083	2.223	-0.294	1.108	-1.752	0.542	0.402**
Primary Branches/ Plant	1.602	-0.162	5.011	-1.225	-1.392	-0.363	-0.833	0.412	0.123**
Days to 50% Flowering	-0.013	4.660	-0.732	0.771	-1.366	0.826	0.798	-0.117	-0.030

Days to First Picking	0.478	-0.151	0.102	-0.759	0.173	-0.049	-0.065	-0.423	-0.259
Fruiting Span	0.227	0.616	0.650	-0.623	0.726	-0.415	0.369	0.109	0.297
Length of Chilli	0.509	-0.095	0.233	-0.106	0.246	-0.621	0.399	0.845	-0.322
Weight of Green Chilli (gm)	0.933	0.254	-0.261	0.161	0.254	-0.463	1.879	-0.230	0.951
Weight of Dry Chilli	0.193	0.084	-0.025	-0.701	-0.050	0.656	0.154	-1.258	-0.120

Residual effect = (0.47)

Table 6. Direct (Diagonal) and indirect effects of yield and its component characters in Chilli at Phenotypic level

Character	Plant height (cm)	Number of branches per plant	Days to 50% Flowering	Days to First Picking	Fruiting Span	Length of Chilli	Weight of Green Chilli (gm)	Weight of Dry Chilli	Fresh Wt of Green chilli/plant
Plant Height cm	0.201	-0.035	-0.029	-0.041	-0.008	-0.017	0.030	-0.021	0.327
Primary Branches/ Plant	-0.017	0.096	-0.051	0.009	0.010	-0.001	0.011	-0.007	0.124
Days to 50% Flowering	-0.003	-0.014	0.026	-0.003	0.004	-0.0004	-0.0004	0.0007	-0.018
Days to First Picking	0.036	-0.018	0.023	-0.180	0.008	-0.007	-0.021	-0.064	-0.151
Fruiting Span	-0.005	0.014	0.020	-0.006	0.129	-0.022	0.009	0.009	0.218
Length of Chilli	0.012	0.002	0.002	-0.005	0.024	-0.143	0.010	0.048	-0.236
Weight of Green Chilli (gm)	0.102	0.079	-0.010	0.079	0.050	-0.048	0.682	-0.054	0.722
Weight of Dry Chilli	0.001	0.0010	-0.0003	-0.004	-0.0009	0.004	0.0009	-0.011	-0.100

Residual effect = (0.582)

5. CONCLUSION

The results from the present investigation concluded significant differences for all the characters among 15 genotypes included in the study indicating sufficient variation among them. The genotypes "CA 916, LCA 357 and LCA 206" were identified as desirable genotypes with mean performance for length of chilli, weight of green chilli, fresh weight of green chilli/plant, weight of dry chilli exhibited high estimates of GCV, PCV, heritability coupled with genetic advance as percent of mean with fresh weight of green chilli/plant, weight of dry chilli. Fresh weight of green chilli/plant showed high positive significant association with weight of green chilli, plant height at genotypic and phenotypic level. Weight of green chilli showed positive direct effect on fresh weight of green chilli/plant at genotypic and phenotypic level.

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