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Generation mean analysis in Chilli (*Capsicum annuum*)

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Abstract The six generations of these crosses were evaluated during summer, 2008 for fruit number, fruit length, fruit width and green fruit yield. The data generated was subjected to test epistasis and six generation mean analysis. It was found that, all the types of gene action i.e. additive, dominance and interaction components were found to be play a role in their inheritance, but their degree differed with crosses. This could be due to the differences in magnitude of gene effects and genetic background of parents. Based on these results, the breeding method that could be suggested for varietal improvement are heterosis breeding and selection of desirable transgressive segregants.

Keywords: Generation mean analysis, Chilli **(*Capsicum annuum*)**

Introduction

The yield in chilli is a composite character influenced mainly by fruit number, fruit length and fruit width. The knowledge of genetic architecture and inheritance pattern of yield and yield components is very essential for a breeder to plan breeding programme for getting efficient results in the succeeding generations. Hence, the present investigation was taken up with the objective of studying the genetic nature of green chilli yield, fruit number, fruit length and fruit width.

Material and Methods

The field experiment was carried out at All India Coordinated Vegetable Improvement Project, Department of Horticulture Mahatma Phule Krishi Vidyapeeth, Rahuri during the period 2006-07 to 2007-08. eight genetically diverse genotypes viz.; Phule Jyoti(P_1), Phule Mukta(P_2), AC-2(P_3), Surakta(P_4), AC-8(P_5), Guntur Sel.(P_6), Delhi Heart-2(P_7), and Agnirekha(P_8) crossed by half diallel mating design. Twenty-eight crosses were produced and evaluated during summer, 2007. The best three cross combinations were selected on the basis of yield and yield contributing characters. These three crosses were selfed to obtain the F_2 and backcrossed for setting BC_1 and BC_2.

All the six generations of above three crosses were planted in the main field during first week of March, 2008 at spacing of 75x60 cm. The experimental design adopted was RBD with three replications. Randomization of generations was done within all three crosses. In each of replications parents and F_1s were represented by one row, back crosses by three rows and F_2s by six rows of six metre length each. Observations were recorded on all the plants in each replications, for green chilli yield, fruit number, fruit length and fruit width. The data were analysed by performing test epistasis (Mather, 1949) and six generation mean analysis (Hayman, 1958).

Results and Discussion

Generation mean

Fruit length: The F_1 mean of cross (P_2xP_3) surpassed both of its parental means indicating over dominance for the character. Even the F_2 mean was higher than both of its parental means which could be due to the

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presence of large number of transgressive segregants. However, means of backcross generations slightly deviated from expectations (Table 1). In crosses P_1xP_2 and P_1xP_7 mean values showed incomplete dominance of longer fruits over short ones. The means of segregating generations and backcross generations of the both the crosses were behaved as per expectations (Table 1).

Fruit width: The F_1 means of three crosses laid between or slightly deviated over its parental lines indicating the partial and incomplete dominance for this character (Table 1). The means of segregating generations and backcross generations of the crosses were behaved as per expected lines (Table 1).

Fruit number: Higher F_1 mean of all three crosses viz.; P_1xP_2, P_2xP_3 and P_1xP_7 over its better parent means suggested over dominance in all three crosses for the character. The B_1 means were higher than B_2 means in the crosses P_1xP_2 and P_1xP_7 as recurrent parents involved in B_1s had higher means fruit number than that of recurrent parent involved in B2s. However, in cross P_2xP_3 the B_2 mean was higher than B_1 mean as recurrent parent involved in B_2 had higher means fruit number than that of recurrent parent involved in B_1. The means of segregating generations were per expectations. In all crosses F_1 means were higher than parental mean suggesting over dominance towards higher parent. Behavior of means of back cross generations was on expected lines (Table 1).

Green Fruit Yield/plant: The F_1 mean for green fruit fruit yield of all three crosses indicated over dominance for this trait. This magnitude be due to the heterosis too, the means of segregating generations were on expected lines (Table 1).The B_1 mean were higher than B_2 mean in $P_1x\ P_2$ and $P_1x\ P_7$ as per expectations.

Gene action: Cross $P_1x\ P_2$

The significant values of all three parameters of ABC scaling tests for fruit number, green fruit yield, fruit length and fruit width indicated presence of all three type of non-allelic interactions for this characters (Table 2).The additive gene effects had a predominant role in the inheritance of fruit length. Similar results have been reported by Awasthi et al. (1976) for fruit length. In addition to this fruit length exhibited predominance of additive x dominance gene effects. Among the interaction components, additive x additive and dominance x dominance gene effects for fruit number and green fruit yield; dominance x dominance gene effects for fruit width had a role in their inheritance. Similar results have been observed by (Singh and Singh, 1976) for fruit width, Singh et al. (1983) for fruit number and fruit yield. Highly significantly values and same signs for the components (h) and (l), indicated complementary type of epistasis for green fruit yield per plant (Table 2).

Table 1: Mean ± SE for various attributes in six generation of three different crosses

Generations	Fruit length (cm)	Fruit width (cm)	Fruit number/plant	Green fruit yield/plant (kg)
Parents				
P1	9.27 ± 0.11	0.82 ± 0.01	528.23 ± 13.88	1.230 ± 0.01
P2	7.66±0.27	0.85 ± 0.01	456.70 ±29.57	0.740 ± 0.01
P3	8.26 ±3.41	0.73 ±0.01	534.03 ± 47.90	1.090 ± 0.03
P7	11.79 ±0.03	0.88 ± 0.01	462.70 ± 2.25	1.110 ±0.03
Crosses				
P1xP2				
F1	8.62±0.11	0.85±0.01	939.03±14.93	1.720±0.01
F2	8.95±0.19	0.84±0.02	723.43±37.10	1.020±0.05
B1	9.64±0.02	0.87±0.02	555.50±13.77	1.080±0.04
B2	8.23±0.15	0.88±0.01	530.13±20.02	0.970±0.10
P2xP3				
F1	11.51±0.05	0.84±0.01	972.03±9.21	2.050±0.04
F2	10.85±0.15	0.85±0.01	679.30±2.89	1.160±0.04
B1	9.38±0.05	0.88±0.01	592.13±18.13	1.300±0.11
B2	11.43±0.10	0.85±0.02	702.87±42.54	1.470±0.10
P1xP7				
F1	10.46±0.05	0.87±0.01	990.37±5.04	1.970±0.03
F2	10.86±0.06	0.81±0.01	621.10±27.69	1.150±0.07
B1	9.84±0.09	0.86±0.03	615.80±30.07	1.140±0.03
B2	12.14±0.15	0.89±0.01	515.83±14.68	1.120±0.01

Table 2: Scaling test, gene effects and gene action for various yield attributes in Crosses P_1 X P_2, P_2xP_3 and P_1xP_7.

Test	Cross P_1 X P_2				Cross P_2xP_3				Cross P_1xP_7			
	Fruit length (cm)	Fruit width (cm)	Fruit number/ plant	Green fruit yield/ plant (kg)	Fruit length (cm)	Fruit width (cm)	Fruit number/ plant	Green fruit yield/ plant (kg)	Fruit length (cm)	Fruit width (cm)	Fruit number/ plant	Green fruit yield/ plant (kg)
Scaling tests												
A	1.396 **	0.057	-386.266 **	-0.793 **	-0.353 *	0.060 *	-277.534**	-0.355	-0.160	0.020	287.966**	-0.920 **
B	0.187	0.063**	-335.466 **	-0.521 **	3.076	0.127**	-100.334	-0.197	2.043**	0.037	421.100**	-0.822 **
C	1.616	-0.020	0.733	-1.324 **	4.503	0.113	-250.667**	-1.469 **	1.377**	-0.190 **	488.233**	-1.689 **
Gene effects												
m	8.95**	0.840**	723.43**	1.022**	10.85**	0.85 **	679.30**	1.152**	10.86**	0.81 **	621.10**	1.145**
	(0.09)	(0.02)	(37.00)	(0.05)	(0.15)	(0.01)	(2.89)	(0.042)	(0.15)	(0.006)	(27.85)	(0.065)
d	1.41**	- 0.017 (0.02	25.367	0.107	- 2.05**	0.030	-110.73* (46.24)	-0.172	- 2.31**	- 0.037	99.96**	0.024
	(0.15)	)	(24.29)	(0.10)	(0.11)	(0.02)		(0.152)	(0.17)	(0.03)	(33.45)	(0.036)
h	0.12	0.157	-290.90	0.749*	1.80	0.123	332.93**	1.971**	0.38	0.265 **	273.28*	-0.745**
	(0.85)	(0.10)	(157.36)	(0.30)	(1.82)	(0.07)	(97.47)	(0.354)	(0.34)	(0.065)	(129.55)	(0.273)
I	-0.033	0.140	-722.47**	0.080*	-1.78**	0.073	-127.20	0.917*	0.51	0.247 **	-221.13	-0.053
	(0.83)	(0.10)	(155.80)	(0.29)	(0.63)	(0.07)	(93.21)	(0.348)	(0.41)	(0.065)	(129.39)	(0.270)
J	0.61**	-0.003	(-25.40	-0.136*	- 1.71	- 0.003	-88.60	-0.078	- 1.10**	- 0.008	66.72	-0.049
	(0.21)	0.02)	(29.27)	(0.10)	(1.71)	(0.02)	(53.54)	(0.159)	(0.21)	(0.030)	(33.72)	(0.041)
l	-1.55	-0.260*	1444.20**	1.304**	- 0.94 (3.49)	- 0.260*	505.06*	-0.365	- 2.39**	- 0.303*	930.50**	1.796**
	(1.04)	(0.13)	(182.53)	(0.47)		(0.10)	(193.91)	(0.643)	(0.77)	(0.123)	(174.20)	(0.306)
Type of epistasis	Duplicate	Duplicate	Duplicate	Complementary	Duplicate	Duplicate	Complementary	Duplicate	Duplicate	Duplicate	Complementary	Duplicate

Cross: P_2 x P_3

The significant values of either of three parameters of ABC scaling tests for fruit length, fruit width, fruit number and green fruit yield, indicated presence of all three type of non-allelic interactions for this characters (Table 2). The traits fruit length and fruit numbers exhibited significant values for additivity. Similar observations were made by Singh et al. (1983) for fruit number. In addition to additive gene effects, the character fruit number and green fruit yield exhibited predominance of gene effects also. Among the interaction components, additive x additive for fruit length, green fruit yield and dominance x dominance gene effects for fruit width and fruit number. Singh and Singh, (1976 a) reported significant additive x additive gene effects with duplicate type of epistasis for fruit length. Awasthi et al. (1976) found more of additive components and Muthukrishnan et al. (1983) observed more of dominant component to be involved in the inheritance of fruit length. Such contrasting results of different workers for same trait could be due to the difference in genetic background of parents used and their interaction on different cross combinations (Table 2).

Cross P_1xP_7

Mathers scaling test revealed, the presence of either of ABC scaling test indicated significancy and presence of all three types of non-allelic interactions for characters under studied. Fruit number displayed significant values for both additive and dominance component. However, for green fruit yield and fruit width, dominant component was predominant among the interaction components, dominance x dominance type of non-allelic epistasis were observed for all the tratits. In addition to this for fruit width highly significant additive x additive interaction was present and for fruit length additive x dominance component was significant. This indicated that, additive x additive component was found to be influence fruit width, whereas additive x dominance component was influenced fruit length (Table 2). Significant values and opposite signs for the component (h) and (l) indicaterd presence of duplicate type of epistasis except fruit number. Similar results have been reported by singh and Singh (1976 b) and found that both types of epistasis operating for fruit length, fruit breadth and fruit yield.

Based on the above results heterosis and pedigree method of breeding could be adopted for varietal improvement. Pedigree selection method can be followed after intermating the desirable plants in F_2 for yield.

सारांश

ग्रीष्म 2008 के दौरान 6 वंशों के संकर की जाँच फल संख्या, फल लम्बाई, फल चौड़ाई और हरी फल उपज के लिए की गई आँकड़ो को एपीस्टैबीस एवं 6 वंश माध्यम विश्लेषण के लिए इकट्ठा किया। यह पाया गया कि सभी जीन कार्य जैसे योगशील, प्रभावी और यन्त्र क्रिया तत्व उसके पैतृक वंशानुगत में अहम भूमिका अदा करता है लेकिन संकरो के साथ कोटी विभिन्न थी। यह अभिवावक के वंशानुगत पिछली पीढ़ी और जीन प्रभाव के गुरूतत्व (आकार) में विभिन्नता के कारण था। इस परिणाम के आधार पर संकर ओज प्रजनन और ट्रासगेसिव अलगाव के एच्छिक चुनाव को किस्मों की उन्नति के लिए यह प्रजनन विधि को सलाह दे सकते है।

Referances

Awasthi DN, Joshi S, Ghidiyal PC (1976) Studies on genetic variability, heritability and genetic advance in chilli (*Capsicum annuum* L.). Prog Hort 8:37-40

Hayman BI (1958) The separation of epistatic from additive and dominance variance in generation means. Heridity 12:371-390

Mather K (1949) Biometrical genetics. Methuen and Co Ltd London

Muthukrishnan CR, Thangaraj T, Muthuswamy S (1983) Genetic attributes in chilli. Proc National Seminar Prod Tech on chilli and Tomato TNAU, Coimbature pp 111

Singh J, Ahmed N, Virk DS (1983) Inheritance of quantitative characters in chilli pepper (Capsicum annuum L.) Proc V Eucarpia Meeting on capsicum and egg plant 4-7 July1983, Bulgeria Pp 187-189

Singh A, Singh H N (1976 a) Combining ability in chilli. J Genet Pl Breed 36 (2): 201-208

Singh A, Singh H N (1976 b) Inheritance of quantitative characters in chilli. Ind J Genet 36 : 420-424