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Short communication

Diallel analysis of quantitative characters in cucumber (*Cucumis sativus* L.)

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Cucumber (*Cucumis sativus* L.) is one of the most important cucurbitaceous vegetables grown throughout the world in subtropical and tropical climatic conditions. Its tender fruits are consumed in several ways like in the form of salad and are in great demand throughout the world. It is one of the important crops grown in glasshouse or plastic house. However, in spite of its importance the knowledge of the genetic basis, which influences the expression of different quantitative characters, is still insignificant in cucumber. Knowledge of gene action of yield and its contributing characters are helpful to formulate an appropriate breeding procedure for achieving the desired objectives for the improvement of the fruit characters in the crop. In view of its commercial importance and existence of large genetic variability in cucumber, the present investigation was carried out to study the inheritance of quantitative characters in cucumber genotypes.

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The present investigation was carried out at the Division of Vegetable Crops, I.A.R.I, New Delhi. Ten promising and distinct lines/varieties of cucumber collected from different parts of the country, namely, P_1 (DC-1), P_2 (CHC-1), P_3 (DC-2), P_4 (CH-20), P_5 (CHC-2), P_6 (Himangi), P_7 (PCUC-28), P_8 (VRC-11-1), P_9 (Poona Khira) and P_{10} (DARL-81) were selected for the present study. These lines were crossed in a half-diallel fashion and 45 F_1 hybrids were obtained. All the crosses and their parents were sown in randomized block design with three replications. The crop was grown in rows at 2 m apart with a spacing of 0.60 m between the plants. All the recommended practices for irrigated conditions were followed to raise the crop. Five fruits in each replication per treatment were randomly selected for observations of ten important quantitative characters namely vine length, days to first male flower opening, days to first female flower opening, node number of first flower opening, days to first fruit harvest, fruit weight, fruit diameter, fruit length, number of fruits per plant and total yield per plant. The diallel analysis was carried out to study the gene action of above said characters by the method given by Jinks and Hayman (1953) and Hayman (1954).

The estimates of component of variation and various statistics of all the characters studied are presented in Table 1. The diallel analysis revealed over-dominance effect for seven characters studied, namely, days to first male flower opening, node number of first female flower, fruit weight, fruit diameter, fruit length, number of fruits per plant and total yield per plant. Dominance effect was shown by vine length, days to first female flower opening and days to first fruit harvest. In all these characters, the dominance component of genetic variance (H_1) was higher than additive component of genetic variance (D). Narrow sense heritability was found to

Table 1: Estimate of components of variation and various statistical parameters for different characters

Statistics	Vine length (m)	Days to first male flower opening	Days to first female flower opening	Node number of first female flower	Days to first fruit harvest
D	0.05**	13.40**	25.00**	0.64**	26.97**
	± 0.01	± 1.41	± 2.10	± 0.16	± 1.64
H_1	0.06**	27.68**	27.58**	1.80**	28.21**
	± 0.01	± 2.99	± 4.47	± 0.35	± 3.49
H_2	0.05**	20.22**	22.34**	1.10**	21.60**
	± 0.01	± 2.54	± 3.80	± 0.30	± 2.97
F	0.03	13.02**	17.47**	0.93*	19.98**
	± 0.02	± 3.24	± 4.84	± 0.38	± 3.78
h^2	0.00	23.68**	25.39**	0.18	12.86**
	± 0.01	± 1.70	± 2.54	± 0.20	± 1.99
E	0.00	0.18	0.20	0.06	0.37
	± 0.01	± 0.42	± 0.63	± 0.05	± 0.49
$(H_1/D)^{1/2}$	1.07	1.44	1.05	1.68	1.02
$(H_2/4H_1)$	0.21	0.18	0.20	0.15	0.19
$[(4\ DH_1)^{1/2} + F/(4\ DH_1)^{1/2} - F]$	1.82	2.02	2.00	2.54	2.14
(h^2/H_2)	0.01	1.17	1.14	0.16	0.60
Heritability % (narrow sense)	54.01	46.54	69.59	36.85	73.53

*Significant at 5% level; ** Significant at 1% level.

Table 1 continued :

Statistics	Fruit weight (g)	Fruit diameter (cm)	Fruit length (cm)	Number of fruits per plant	Total yield per plant (g)
D	1160.79*	0.18*	3.33**	2.58**	107698.23*
	± 306.50	± 0.09	± 0.78	± 0.68	± 54273.62
H_1	4521.03**	0.92**	10.54**	11.56**	830595.29**
	± 652.41	± 0.20	± 1.65	± 1.44	± 115526.45
H_2	3467.11**	0.59**	7.41**	10.13**	701354.50
	± 554.48	± 0.17	± 1.40	± 1.22	± 98184.67
F	1212.62	0.35	4.69**	-1.27	-59974.42
	± 707.18	± 0.22	± 1.79	± 1.56	± 125225.55
h^2	192.96	0.01	7.83**	1.48	147325.32*
	± 371.14	± 0.11	± 0.94	± 0.82	± 65721.01
E	38.41	0.02	0.31	0.27	823.66
	± 92.41	± 0.03	± 0.23	± 0.20	± 16364.11
$(H_1/D)^{1/2}$	1.97	2.26	1.78	2.12	2.78
$(H_2/4H_1)$	0.19	0.16	0.18	0.22	0.21
$[(4\ DH_1)^{1/2} + F/(4\ DH_1)^{1/2} - F]$	1.72	2.55	2.31	0.79	0.82
(h^2/H_2)	0.06	0.02	1.06	0.15	0.21
Heritability % (narrow sense)	25.11	21.86	31.99	15.66	10.75

*Significant at 5% level; ** Significant at 1% level

be less than 0.5 for all these characters except vine length, days to first female flower opening and days to first fruit harvest indicating predominance of dominance gene action over additive ones. The positive sign of 'F' value in most of these characters showed an excess of dominant genes in the parents except total yield per plant. The negative 'F' value for number of fruits per plant and total yield per plant indicated predominance of

recessive genes for these characters. The proportion of genes with positive and negative effects in the parents was found to be less than 0.25 for all these characters denoting asymmetry at loci showing dominance. The mean degree of dominance $(H_1/D)^{1/2}$ which was also found to be more than one (1.0) confirmed the presence of over-dominance. Similar results were obtained by Ananthan and Pappiah (1997) in cucumber and Munshi and Verma (1998) in muskmelon. Complete dominance for days to first fruit harvest was reported by El-Shawaf (1980) in cucumber, and Munshi and Verma (1998) in muskmelon.

The results of the present investigation showed over-dominance gene action for all the characters studied except vine length, days to first female flower opening and days to first fruit harvest. The predominance of non-additive gene action and low to moderate narrow sense heritability for most of the characters studied, suggest that heterosis breeding is worthwhile to get higher gain in cucumber and the cultivation of promising F_1 hybrids will be useful to give a quantum jump in the production of this vegetable in our country.

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