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Short communication

Triple test-cross analysis for fruit yield and some component characters in cucumber

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Cucumber (*Cucumis sativus* L.) is an important cucurbitaceous vegetable crop cultivated widely for consumption as fresh salad or pickles in many countries of the world. The available open-pollinated cultivars have low yield potential while hybrid varieties exhibit narrow adaptation. The precise knowledge of additive, dominance and epistatic components of genetic variance for important metric traits is essential for achieving success in breeding programmes. The available reports on analysis genetic variation for quantitative traits in cucumber are invariably based on approaches that lack ability for through detection of epistasis to allow precise estimation of additive and dominance variance components using larger sample of crosses. Therefore, an attempt was made to detect epistasis and estimate additive and dominance genetic variance for ten important traits in cucumber during rainy season using modified triple test-cross (TTC) analysis.

Two cucumber inbred lines, NDCU-36 and NDCU-13 and their hybrid (NDCU-36 x NDCU-13) were crossed as testers with 12 diverse inbreds of cucumber, namely, NDCU-39, EC-363927, Bihar-9, EC-442891, DARL-81, VRC-19, DC-1, VRC-7, DARL-103, VRC-33, DVRC-81-2 and NDCU-23. The experimental material comprising 3 testers, 12 lines, 24 single crosses and 12 three-way crosses was evaluated in randomized block design with three replications during rainy season at Kumarganj, Faizabad. Each entry was grown in 2 m long two row plot with 40 cm plant to plant spacing within the row and 2m distance between the rows. Observations were recorded on five competitive plants in each plots for ten important quantitative traits. The data were subjected to modified triple test-cross analysis of Ketata *et al.* (3).

The analysis of variance of triple test-cross for test of epistasis revealed presence of significant epistasis for all the ten characters under study (Table 1). The partitioning of total epistasis in to 'i' and 'j & l' types showed that additive x additive (i) type epistasis was non-significant for all the characters. The additive × dominance (j) and dominance x dominance (l) type epistatic component was highly significant for all the ten traits. Existence of significant epistasis in inheritance of fruit yield and some other important quantitative traits in cucumber has also been reported by Ghaderi and Lower (2), Lower *et al.* (4), Solanki *et al.* (9), Owens (7), and Prasad and Singh (8). On contrary to the lack of importance of additive x additive (i) interaction observed in case of all the characters in the present study, Lower *et al.* (4), Solanki *et al.* (9), and Prasad and Singh (8) reported significance 'i' type epistasis for fruit yield and some other components traits.

The additive (D) as well as dominance (H) components of genetic variance was highly significant for all the characters except non-significant additive component recorded for nodal position of first female flower (Table 2). Nienhius and Lower (6) recorded significance of additive and dominance gene effects for fruit weight per plant, vine length, fruit diameter and fruit length. The important role of additive as well as dominance gene effect in inheritance of fruit yield and its component characters in cucumber has also been reported earlier by Solanki *et al.* (10), Dogra *et al.* (1), and Navazio and Simon (5). The lesser than one values of degree of dominance resulting due to higher estimates of D than H, suggested existence of partial dominance for all the characters except nodal position of first female flower, primary branches per plant and average fruit diameter. These three traits showed over dominance as indicated by getter than one values of degree of dominance due to higher estimates of H than D. The non-significant values of directional element of dominance (F) for all the characters indicated presence of ambidirectional dominance and alleles with increasing and decreasing effects appear to be dominant and recessive to the same extent.

The significant of fixable additive genetic component for fruit yield and its component characters except nodal position of first female flower, indicated that substantial improvement in yield status of cucumber can still be achieved by developing open-pollinated variety through conventional breeding procedures. Being a cross pollinated and monoecious crop having large number of seeds per fruit and very low inbreeding depression, cucumber offers ample scope for exploitation of fixable

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Table 1. Analysis of variance (mean squares) of triple test-cross analysis to test epistasis for ten characters in cucumber.

Source of variation	Days to anthesis of first female flower	Nodal position of first female flower	Days to first harvest	Vine length	Primary branches per plant	Average fruit weight	Average fruit length	Average fruit diameter	Number of fruits per plant	Fruit yield per plant
'i'	1.11	17.78	2.15	29.77	0.28	6.24	54.26	1.03	35.60	4.01
'j + l' type epistsis	9.74**	24.86**	16.84*	7.12**	7.55**	9.06**	107.53**	7.70**	219.95**	5.93**
Total epistasis	8.93**	24.27**	15.61*	9.01**	6.75**	8.30*	103.09**	7.15**	204.59**	5.77**
'i' type epistsis × replication	2.77**	4.44*	0.54	7.44**	7.11**	1.56	13.56**	0.26	8.90**	1.00*
'J+l' type epistsis × replication	2.90	0.13**	5.96	0.11	0.26	3.00	1.60	0.38	0.19	0.19
Total epistasis × replication	2.66	0.49	5.51	0.72	0.25	2.75	2.60	0.37	0.92	0.26

*,** Significant at 5 and 1% levels, respectively.

Table 2. Estimates of additive (D) and dominance (H) components of genetic variance, average degree of dominance $(H/D)^{0.5}$ and parameter F for ten characters in cucumber.

Source of variation	Days anthesis of first female flower	Nodal position of first female flower	Days to first harvest	Vine length	Primary branches per plant	Average fruit weight	Average fruit length	Average fruit diameter	Number of fruits per plant	Fruit yield per plant
D	17.71**	4.92	21.71**	2.16**	3.84**	0.005**	79.28**	3.61**	184.21**	8.15**
H	3.27**	11.30**	8.66**	2.00**	9.38**	0.004**	29.06**	11.08**	60.35**	2.51**
F	-0.13	-0.17	0.31	0.14	0.17	0.15	0.43	0.05	0.23	0.08
$(H/D)^{0.5}$	0.43	1.51	0.63	0.96	1.56	0.96	0.61	1.75	0.57	0.55

*,** Significant at 5 and 1% levels, respectively.

and non-fixable components of genetic variance through development inbred lines or hybrid varieties, respectively. The results also revealed importance of dominance variance and additive x dominance (j) and dominance x dominance (l) type epistasis in expression of all the characters. Due to their non-fixable nature, the dominance and 'j & l' type epistatic components can be utilized for developing high yielding hybrid varieties. For exploitation of such non-fixable variance components, the intermating of selected individuals in early generations followed by selection in later generations and recurrent selection procedures may also be considered.

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