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Short communication

Generation means analysis for fruit yield and its component traits in okra

S.K. Dhankhar*, M.S. Dahiya and Chandanshive A.V.

Department of Vegetable Science, CCS Haryana Agricultural University, Hisar 125004

ABSTRACT

Experimental material comprised of five generations (P_1, P_2, F_1, F_2 and F_3) of Pusa Sawani × HBT-36, JNDOL-05 × HB-25-2 and HB-25-2 × HBT-36 okra crosses. Five generations of these crosses were raised in randomized block design with three replications in rainy season of 2011-12. The observation for fruit yield per plant and its five component traits, *viz*., plant height, fruit length, fruits per plant, inter-nodal length and weight per fruit in five generations were recorded. The mean values of the five generations were subjected to C-scaling test (I) and five parameter method to find out the gene effects and interactions. The C-scaling test showed the evidence of epistasis for all six characters in all three crosses. All three types of gene effects namely additive, dominance and epistasis were found involved in the inheritance of the characters studied. The additive gene effects were relatively more important than the dominance gene effects for fruits per plant and inter-nodal length however, for fruit yield the dominance gene effects were observed important. Out of 18 cases, 13 cases designated preponderance of complementary type of epistasis.

Key words: Epistasis, generation means, gene effects, okra.

Okra, *Abelmoschus esculentus* (L.) Moench, belongs to the family Malvaceae and is an important vegetable crop grown mainly for its tender green fruits throughout the world in tropical and subtropical regions and also in the warmer parts of temperate regions. Okra occupies prominent position among the vegetable crops due to its wider adaptability and round the year cultivation. The genetic research carried out on okra in the recent past has made known that fruit yield in this crop is mainly determined by three component traits, *viz*., fruits per plant, fruit length and plant height. So the knowledge about nature and magnitude of gene effects of these traits may assist the okra breeder to great extent in devising an effective breeding plan to achieve desired genetic improvement in this important vegetable crop. The study of gene effects not only tells about the relative importance of various kinds of gene effects in the control of characters but also provides the information about the causes of heterosis. Therefore, the objective of this study was to find out the nature and magnitude of different kinds of gene effects and to get the information regarding the relative importance of these gene effects in the inheritance of fruit yield and its main component traits in okra.

The experimental material consist of three crosses, *viz*., Pusa Sawani × HBT-36, JNDOL-05 × HB-25-2 and HB-25-2 × HBT-36 using two commercial okra varieties. Five generations (P_1, P_2, F_1, F_2 and F_3) of each of these cross combinations were sown in randomised block design with three replications at spacing of 60 cm between row to row and 30 cm between plants to plant during rainy season of 2010-11 at Vegetable research farm, CCS Haryana Agricultural University, Hisar. Each non segregating generations, *i.e*., P_1, P_2 and F_1 were represented by two rows and non segregating generations, *i.e*., F_2 and F_3 by twenty rows accommodating ten plants in each row in each replication. Five competitive plants were randomly selected in each row to record the data for six traits namely plant height (cm), fruit length (cm), fruits per plant and fruit yield per plant (g), inter-nodal length (cm) and fruit weight (g). To know the presence or absence of gene interaction, the data were first subjected to the C-scaling test of Mather (7) and then five generation model (Hayman, 5) was applied to the data for getting the estimates of (m), (d'), (h), (i) and (l) parameters since the generations produced in this case allowed to only the fitting of five-parameter model.

The values of C-scaling test and the estimates of (m), (d'), (h), (i) and (l) parameters for six characters in three crosses are presented in the Table 1. The estimated values of C-scaling test were found significant for all six characters in all three crosses showed the inadequacy of the additive dominance model, which indicated the presence of gene interactions (additive × additive, additive × dominance and dominance × dominance) in all the eighteen cases. The fitting of five parameters model to the data revealed that the estimates of all the five parameters were significant for fruit yield as well as its three components traits (plant height, fruit length,

*Corresponding author's E-mail: dhankharsk@gmail.com

Table 1. Values of C-scaling test, estimates of gene effects and type of epsitasis for six traits in three crosses of okra.

Trait	Cross	C-scaling test	Gene effect					Type of epistasis
			m	(d')	(h)	(i)	(l)	
Plant height (cm)	Pusa Sawani x HBT-36	-16.64**	82.22**	14.29*	8.6*	40.20*	20.09*	C
	HB-25-2 x HBT-36	-17.47*	88.71**	11.65*	7.15*	18.98*	12.41*	C
	JNDOL-05 x HB-25-2	31.67*	91.26**	12.51*	-16.4*	9.36*	28.91*	D
Fruit length (cm)	Pusa Sawani x HBT-36	-0.79*	6.61**	1.79*	2.95*	9.11*	-8.11*	D
	HB-25-2 x HBT-36	-0.56*	7.76**	2.75*	1.75*	4.49*	3.75*	C
	JNDOL-05 x HB-25-2	-0.64*	8.21**	-2.34*	2.10*	3.76*	2.32*	C
No. of fruits/ plant	Pusa Sawani x HBT-36	-4.84*	28.43**	6.02*	3.12*	2.35*	1.11*	C
	HB-25-2 x HBT-36	-7.07*	22.04**	12.06*	3.42*	6.75*	3.74*	C
	JNDOL-05 x HB-25-2	-2.01*	25.69**	5.09*	2.31*	9.99*	6.32*	C
Fruit yield/ plant (g)	Pusa Sawani x HBT-36	-59.61*	198.92**	20.45*	24.36*	17.60*	16.08*	C
	HB-25-2 x HBT-36	-65.25*	186.53**	28.69*	30.97*	38.91*	29.17*	C
	JNDOL-05 x HB-25-2	-21.41*	174.76**	21.50*	25.94*	29.06*	30.16*	C
Internodal length (cm)	Pusa Sawani x BT-36	-3.9**	5.41**	0.70**	0.36*	1.73**	-0.73**	D
	HB-25-2 x HBT-36	-1.75**	5.76**	0.41**	-0.39**	0.13**	-2.36**	C
	JNDOL-05 x HB-25-2	2.30**	5.21**	0.75**	-0.34	1.32	-3.72**	C
Fruit wt. (g)	Pusa Sawani x HBT-36	3.32**	9.71**	1.07**	-1.49**	14.01**	7.11**	D
	HB-25-2 x HBT-36	-2.13**	8.32**	0.91**	6.10**	6.50**	10.40**	D
	JNDOL-05 x HB-25-2	-4.79**	10.10**	-0.91**	0.25**	2.27	12.50**	C

*P ≤ 0.05 and **P ≤ 0.01, Type of epistasis, C = Compementary, D = Duplicate

fruits per plant, inter-nodal length and weight per fruit), which indicated involvement of all three kinds of gene effects (additive, dominance and epistasis) in the inheritance of all the six characters. The presence of both additive and non-additive gene effects were also observed for plant height and fruit length by Akhtar *et al*. (3), for fruits per plant and fruit yield by Akhtar *et al.* (3) and Kharnorkar and Kathiria (6) and for inter-nodal length and weight per fruit Akotkar and De (1) in okra. With relation to the comparative magnitude of additive and dominance gene effects, the higher values of additive gene effects (d') than those of dominance gene effects (h) for plant height in cross Pusa Sawani × HBT-36 and HB-25-2 × HBT-36, fruit length in crosses HB-25-2 × HBT-36 and JNDOL-05 × HB-25-2, weight per fruit in cross Pusa Sawani × HBT-36 and for fruits per plant and inter-nodal length all three crosses indicated that additive gene effects were relatively more important in these cases. Whereas, dominance gene effects was more prominent in the cross JNDOL-03 × HB-25-2, for fruit length in cross Pusa Sawani × HB-36, for fruit weight in crosses HB-25-2 × HBT-36 and JNDOL-05 × HB-25-2 while for fruit yield in all the three crosses.

Amid the interaction components, additive × additive component was more important than dominance × dominance component in all the cases except plant height and fruit yield per plant in cross JNDOL-05 × HB-25-2 for which magnitude of dominance x dominance component was higher than additive x additive type of epistasis. The classification of epistasis, largely depend on the signs of (h) and (l). Similar signs of the (h) and (l) parameters indicate the predominance of complementary epistasis and opposite signs indicate duplicate interaction. Duplicate type of interaction was observed predominantly for plant height in cross JNDOL-05 × HB-25-2 and fruit length in cross Pusa Sawani × HBT-36. Whereas, a preponderance of complementary type of epistasis was observed for rest of crosses for all the traits studied. Adeniji and Kehinde (2) and Alake *et al*. (4) also observed predominance of complementary epistasis for seed yield. Kharnorkar and Kathiria (6) reported predominance of duplicate epistasis fruit length, plant height and fruit number per plant. The negative value of (h) observed for plant height in cross JNDOL-05 × HB-25-2 indicated that alleles responsible for less height were dominant over the alleles controlling more height of plants.

Thus, the results of the present study showed relatively greater significance of additive and additive × additive gene effects in the control of component traits of fruit yield, especially for fruits per plant. Therefore, genetic improvement in fruit yield per plant would be easier through indirect selection for component like fruits per plant than through direct selection for fruit yield itself.

REFERENCES

1. Akotkar, P.K. and De, D.K. 2014. Genetic analysis for fruit yield and yield attributes in okra (*Abelmoschus esculentus* L. Moench). *Elec. J. Pl. Breed.* **5**: 735-42.
2. Adeniji, O.T. and Kehinde, O.B. 2003. Inheritance of pod and seed yield characters in West Afrian okra (*Abelmoschus caillei* (A. Chev.) Stevels): Generation mean analysis. *Nigerian J. Genet*. **18**: 1-4.
3. Akhtar, M., Singh, J.N., Shahi, J.P. and Srivastava, K. 2010. Generation mean analysis for fruit traits in okra. *Indian J. Hort.* (Special Issue), **67**: 203-07.
4. Alake, C.O., Ariyo, O.J. and Kehinde, O.B. 2012. A quantitative analysis of the genetics of yield and yield components in West African okra, *Abelmoschus caillei* (A. Chev) Stevels. *Int. J. Pl. Breed. Genet*. **6**: 94-104.
5. Hayman, B.I. 1958. The separation of epistatic from additive and dominance variation in generation means. *Heredity*, **12**: 371-90.
6. Kharnorkar, S.M. and Kathiria, K.B. 2010. Genetic architecture of fruit yield and its contributing quantitative traits in *Abelmoschus esculentus* (L.) Moench. *Elec. J. Pl. Breed*. **1**: 716-30.
7. Mather, K. 1949. *Biometrical Genetics* (1st Ed.), Methuen, London.

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