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STUDIES ON RELATIVE HETEROSIS, HETEROBELTIOSIS AND INBREEDING DEPRESSION ON FRUIT YIELD AND IT'S ATTRIBUTES IN OKRA [*Abelmoschus Esculentus* (L.) MOENCH]

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ABSTRACT

The present investigation on okra [*Abelmoschus esculentus* (L.) Moench] was carried out with a view to know extent of heterosis and inbreeding depression of fruit yield and its attributes through generation mean analysis. Ample amount of heterosis over mid and better parent was observed for all the traits. The relative heterosis was found significantly positive in cross KS-404 x HRB-108-2 for number of nodes per plant, number of fruits per plant, fruit length and in cross VRO-5 x GO-2 for number of fruits per plant and fruit yield per plant. The significantly positive heterobeltiosis was observed for fruit length and fruit yield per plant in cross KS-404 x HRB-108-2 and cross VRO-5 x GO-2 and moderate to high amount of inbreeding depression was observed for all the traits. Likewise heterosis and inbreeding depression were also varied in degree and direction from cross to cross.

Key words: *Hybrid vigour, okra, Heterobeltiosis.*

Okra one of the important summer and rainy season vegetable and crops is extensively grown throughout India. Exploitation of hybrid vigour in crop plant for quantum jump in yield and other quantitative characters is one of the approaches in crop improvement. The estimates of heterosis and inbreeding depression also provide the information about nature of gene actions involved in the expression of yield and its component characters. The information of such estimates is also essential to formulate efficient breeding programme for improvement of crop. Present study was, therefore, undertaken using four basic generation of six cross in okra to estimate extent of heterosis and inbreeding depression for yield and its component traits.

MATERIALS AND METHODS

The experimental material consisting P_1, P_2, F_1 and F_2 generations of six cross involving ten promising genotype of okra was evaluated in a randomized block design with three replications. Six F_1 hybrids and their F_2 generation and ten parents were grown in kharif 2005 season at Vegetable Research Station, Junagadh Agricultural University, Junagadh. Each replication was divided into four compact blocks and each block had a single cross of P_1, P_2, F_1 and F_2 generations. Each block comprised seven rows consisting of single row each of P_1, P_2 and F_1 and four rows of F_2. Each row was 3.0 m long with a spacing 60 cm. x 30 cm. The observations were recorded on eight traits from 5 plants selected randomly from each P_1, P_2 and F_1 and 20 plants from F_2 generation in each replication. The data were subjected to statistical analysis for estimation of heterosis and inbreeding depression.

RESULTS AND DISCUSSION

The estimate of Heterosis, heterobeltiosis and inbreeding depression for eight characters in okra are presented in Table1. Significantly negative value of heterosis was considered desirable for days to flowering and days to first picking in okra. The relative heterosis ranged from –7.34% (KS-404 × HRB-108-2) to –1.88% (Arka Anamika × Parbhani Kranti). Out of six cross, four cross viz, VRO-5 × GO-2, KS-404 × HRB-108-2, D-1-87-5 × KS-404 and HRB-55 × Arka Abhay expressed significantly negative relative heterosis, suggesting the presence of dominance gene effect in these crosses. The heterosis over better parent ranged from –2.86% (KS-404 × HRB-108-2) to –0.57 (VRO-3 × VRO-5). None of the cross combinations showed significant negative hetero-beltiosis for days to flowering and these findings are in agreement with the finding of (1). Inbreeding depression varied from –6.99% (HRB-55 × Arka Abhay) to –1.55% (Arka Anamika × Parbhani Kranti). Out of six cross, only one cross viz, HRB-55 × Arka Abhay showed significantly negative inbreeding

Table-1: Relative heterosis (H_1), heterobeltiosis (H_2) and inbreeding depression (ID) for different characters in okra

Heterosis and inbreeding depression	VRO-5 GO-2	VRO-3 VRO-5	KS-404 HRB-108-2	D-1-87-5 KS-404	Arka Anamika Parbhani Kranti	HRB-55 Arka Abhay
Days to flowering						
H_1	-4.70*	-3.23	7.34*	7.27*	-1.88	-7.33*
H_2	-2.52	-0.57	-2.86	-0.79	-1.02	-2.50
ID	-2.31	-2.34	-4.98*	-5.40*	—1.55	-6.99*
Days to first picking						
H_1	-3.85	-1.97	-7.99**	-6.29*	0.64	-6.88*
H_2	-2.35	0.76	-4.29*	-0.28	1.16	-1.25
ID	-4.57*	-5.39*	-10.99**	1.99	1.27	-3.87
Plant height						
H_1	8.88*	-2.56	3.55	5.09*	4.47	3.13
H_2	2.14	-11.92**	-2.91	-4.42*	-0.22	14. 96**
ID	8.47*	-3.87	2.25	-1.92	3.44	-8.73*
Number of branches per plant						
H_1	14.71*	-16.00	7.46	8.82	16.13*	16.67*
H_2	8.33	-40.00**	-10.00	0.01	0.01	6.06
ID	0.64	10.71	5.57	16.22*	11.11	12.86
Number of nodes per plant						
H_1	2.86	6.78*	13.43**	1.25	6.72*	5.36*
H_2	-5.27*	-15.34**	2.70	-9.73**	1.26	-3.47
ID	2.78	-1.72	5.15*	5.12*	-1.50	2.25
Number of fruits per plant						
H_1	10.26*	-10.65*	15.70**	8.46*	-0.15	5.45*
H_2	2.62	-27.92**	7.83*	-0.24	-4.34	-7.03*
ID	6.11	-4.72	0.69	12.18**	-2.27	-3.01
Fruit length						
H_1	0.73	-5.28	12.68**	-0.48	0.38	0.99
H_2	-5.32	-16.22*	6.94*	-7.16*	-2.66	2.52
ID	-0.16	-3.71	2.64	-2.89	-3.05	-5.71
Fruit yield per plant						
H_1	19.26*	-15.34*	31.73**	9.94*	-0.48	7.40
H_2	8.37*	-35.86**	19.44*	-2.01	-1.89	-7.44
ID	6.91	-5.29	5.73	12.75*	-7.35	-1.45

*,** = Significant at P = 0.05 and 0.01, respectively

depression indicating that F_2 decreased over F_1 generation. Similar findings were also reported by (2) for this trait.

The extent of relative heterosis for days to first picking ranged from –7.99% (KS-404 × HRB-108-2) to 0.64% (Arka Anamika × Parbhani Kranti). Among six cross, three cross viz, KS-404 × HRB-108-2, D-1-87-5 × KS-404 and HRB-55 × Arka Abhay expressed significantly negative relative heterosis. The heterobetiosis ranged from –4.29% (KS-404 × HRB-108-2) to 1.76 % (Arka Anamika × Parbhani Kranti). Only one cross viz, KS-404 × HRB-108-2 showed significantly negative heterbeltiosis. Similar

findings were also reported by (3) and Singh et al. (2004). Inbreeding depression ranged from –10.99% (KS-404 × HRB-108-2) to 1.99% (D-1-87-5 × KS-404). Three cross viz., KS-404 × HRB-108-2, VRO-5 × GO-2 and VRO-3 × VRO-5 exhibited significantly negative inbreeding depression and similar reports were also made by (4).

The range of relative heterosis for plant height varied from 8.88% (VRO-5 × GO-2) to –3.13% (HRB-55 × Arka Abhay). Two cross viz., VRO-5 × GO-2 and D-1-87-5 × KS-404 expressed significantly positive relative heterosis for this trait. The heterobeltiosis ranged from -11.92% (VRO-3 × VRO-5) to 14.96 (HRB-55 × Arka Abhay). Only one cross viz, HRB-55 × Arka Abhay expressed significantly positive heterobeltiosis for plant height and these results are in close agreement with finding of (3) for this trait. The estimates of inbreeding depression ranged from 8.47% (VRO-5 × GO-2) to –8.73% (HRB-55 × Arka Abhay). The cross viz, VRO-5 × GO-2 had significantly positive, while cross HRB-55 × Arka Abhay had significantly negative inbreeding depression for this trait, which indicated the transgressive segregations. Significant and positive inbreeding depression was reported by (2).

The estimates on relative heterosis for number of branches per plant ranged from 16.67% (HRB-55 × Arka Abhay) to –16.00 % (VRO-3 × VRO-5). Three cross viz., VRO-5 × GO-2, Arka Anamika × Parbhani Kranti and HRB-55 × Arka Abhay showed significantly positive heterosis. None of the cross combinations showed significantly positive heterobeltiosis for this trait. The finding of (5) supported the above results. Inbreeding depression varied from 16.22% (D-1-87-5 × KS-404) to 0.64 % (VRO-5 × GO-2). Out of six cross, only one cross D-1-87-5 × KS-404 had significantly positive inbreeding depression, indicating that effective number of branches per plant was reduced in F_2 over F_1. Significantly positive inbreeding depression for this trait was also reported by (4).

With respect to number of nodes per plant, relative heterosis ranged from 13.43% (KS-404 × HRB-108-2) to 1.25 % (D-1-87-5 × KS-404). Out of six cross, four cross viz., VRO-3 × VRO-5, KS-404 × HRB-108-2, Arka Anamika × Parbhani Kranti and HRB-55 × Arka Abhay showed significantly positive relative heterosis. The heterobeltiosis ranged from 2.70% (KS-404 × HRB-108-2) to –15.34% (VRO-3 × VRO-5). Out of six crosses, none of the cross combinations expressed significantly positive heterobeltiosis. These results are in agreement with the report of (5). Inbreeding depression varied from 5.15% (KS-404 × HRB-108-2) to -1.72 (VRO-3 × VRO-5). Two cross viz., D-1-87-5 × KS-404 and KS-404 × HRB-108-2 showed significantly positive inbreeding depression. More or less, similar observations were also reported by (4).

In case of number of fruits per plant, the relative heterosis ranged from 15.70% (KS-404 × HRB-108-2) to –10.65% (VRO-3 × VRO-5). Out of six cross, four cross viz., VRO-5 × GO-2, KS-404 × HRB-108-2, D-1-87-5 × KS-404 and HRB-55 × Arka Abhay had significantly positive relative heterosis. The maximum heterobeltiosis was observed in KS-404 × HRB-108-2 (7.83%) and minimum in VRO-3 × VRO-5 (-27.92%). Out of six cross, only one cross viz, KS-404 × HRB-108-2 expressed significantly positive heterobeltiosis. Similar results were also reported by Singh et al. (2004). Inbreeding depression varied from –4.72% (VRO-3 × VRO-5) to 12.18% (D-1-87-5 × KS-404). Only one cross viz, D-1-87-5 × KS-404 expressed significantly positive Inbreeding depression. This result is in close conformity with the finding of (2).

Regarding fruit length, heterosis in respect to mid-parental value varied from –5.28% (VRO-3 × VRO-5) to 12.68% (KS-404 × HRB-108-2). Only one cross, combination viz, KS-404 × HRB-108-2 manifested significantly positive relative heterosis. Heterobeltiosis ranged from –16.22% (VRO-3 × VRO-5) to 6.94% (KS-404 × HRB-108-2). Only one hybrid viz, KS-404 × HRB-108-2 exhibited significantly positive heterobeltiosis due to the presence of dominance gene effects in this cross. These results are in accordance with the finding of (1, 6). Inbreeding depression ranged from –5.71% (HRB-55 × Arka Abhay) to 2.64% (KS-404 × HRB-108-2). Out of six cross, none of the cross combinations showed significant inbreeding depression for fruit length. However, (4, 7) reported significantly positive inbreeding depression for this trait.

The estimates of relative heterosis and

heterobeltiosis for fruit yield per plant ranged from -15.34% to 31.73% and –35.86% to 19.44% in cross of VRO-3 × VRO-5 and (KS-404 × HRB-108-2), respectively. The top heterotic crosses displayed higher and positive estimate of relative heterosis were KS-404 × HRB-108-2 (31.73 %) VRO-5 × GO-2 (19.26 %) and D-1-87-5 × KS-404 (9.94%). On contrary the top heterotic crosses showing higher and positive estimate for heterobeltiosis in cross of KS-404 × HRB-108-2 (19.44%) followed by VRO-5 × GO-2 (8.37%) and similar results were also reported by Singh et al. (2004). Inbreeding depression ranged from –7.35% (Arka Anamika × Parbhani Kranti) to 12.75% (D-1-87-5 × KS-404). Only one cross of D-1-87-5 × KS-404 showed significantly positive inbreeding depression. This might be due to either dominance or dominance × dominance interaction effect in F_1 hybrid dissipate in F_2 and subsequent generation due to reduction in heterozygocity. Thus, selection would be effective in F_2 and subsequent generation for this trait. These results are in accordance with the finding of. Based on the results of present study, it can be concluded that the fruit yield and yield contributing characters in okra showed all three type of gene effects i.e. additive, dominance and epistatis. Thus, improvement population through progeny selection, which may first exploit additive gene effect and the intermating in F_2 and backcross generation, can increase the frequency of desirable recombinants.

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