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RESEARCH PAPER

General and specific combining ability effects for yield and its component in okra [*Abelmoschus esculentus*(L.) Moench]

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Abstract : The present investigation was conducted to magnitude the combining ability in Okra [*Abelmoschus esculentus* (L.) Moench] for identifying desirable parents. The experiment comprised of 36 hybrids obtained by crossing 15 parents (12 lines and 3 tasters) for line x taster analysis. All the hybrids and their parents were sown in a randomized block design with three replications at department of Horticulture, Institute of Agricultural Science, Bundelkhand University, and Jhansi (U.P.). The parents and hybrids were sown in single row and 5 plants were selected randomly for recording observation for all the characters. Combining ability analysis of variances for general and specific combining ability was highly significant for all the characters under study. The study revealed that presents KS-440, KS-448, KS-427and KS-455 were significantly superior general combiners for yield and its contributing characters. However, the cross combinations KS-448 x KS -404, KS-440 x KS-404, KS-427 x KS-404 and KS-453 x P.K. were found to be significantly superior specific combinations for yield and yield contributing characters. It indicated that both additive as well as non-additive gene actions were responsible for controlling these characters.

Key Words : Combining ability, Okra, Characters, Yield

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INTRODUCTION

Okra [*Abelmoschus esculentus* (L.) Moench] is an important vegetable crop of India and it is believed to have originated in Hindustan . It is belong to Malvacea family. It was earlier known as *Hibiscus esculentus* (L.) Since in Bhindi 5 -10 epi –calyx ,5 calyx 5 corolla and a stamina column on are fused together at the base and fall together after anthesis. It has been renamed as [*Abelmoschus esculentus* (L.) Moench] distinguishing it from hibiscus in which calyx is present. Okra is an important fruit vegetable crop of the tropical and sub-tropical regions of the world. It is grown successfully in plain as well as hills. The okra is an often cross pollinated crop where natural cross pollination occurs up to extant of 8.75 to 9.61 per cent. It has been mentioned by Purewal and Randhawa (1947). At edible stage okra is good source of calcium, iron, vitamins protein, fibres, carbohydrate, minerals *viz.*, magnesium, potassium, sodium copper and sulphur. The success of breeding programme depends mainly upon the promising parents from the gene pool. A clear understanding general and specific combining ability of the trait under consideration will help the breeding in deciding the appropriate breeding methods to improve the genetic makeup as well as to make a dense in productivity.

MATERIALS AND METHODS

The material for the present investigation comprised of 12 line (female) and 3 tester (male) of okra selected on the basis of variability for different characters and maintained by selfing for several generation in the Department of Horticulture, Institute of Agricultural Science, Bundelkhand

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University, Jhansi (U.P.). All possible 36 F_1s (hybrids) excluding reciprocals were made among their 15 parents *viz.*,12 lines as KS-423,KS-440,KS-447,KS-441,KS -453,KS-455,KS-420,BO-2 ,KS-437,KS-448,KS-439 and KS-427 and 3 testers as Prbhani Kranti (P.K.),KS-410 and KS-404, through line x testers technique (Kampthorne,1957). The material consisted of 15 parents and 36 F_1s were sown in Randomized Block Design with three replications. The plant to plant and row to row spacing was maintained 45 cm apart. The observation were recorded on five randomly selected plant of each treatment in parents and crosses in each replication and following observations were recorded such as days to flowering, height of plant (cm), number of branches per plant, number of first fruiting node, length of first fruiting node (cm), number of node per plant, length of inter node(cm), length of fruit (cm), width of fruit (cm), tapering length of fruit (cm), number of fruit per plant and yield per plant (g).

RESULTS AND DISCUSSION

The present study was under taken in respect of 15 parents (12 lines and 3 testers) in okra [*Abelmoschus esculentus* (L.) Moench], three parents were subsequently utilized in making 36 hybrids from lime x tester design. The estimate of general and specific combining ability effects of 15 parents and 36 crosses for different characters were presented in Table 1a and 1b. Analysis of variance for days to flowering,4 lines have significant and positive general combining ability effect with magnitude varied from -1.59 to 3.41. Estimates of specific combining ability effect were observed in 8 crosses showed positive significant and it's ranged from -1.20 to 1.69. The range of variation of gca effects was -8.14 to 6.14, one tester and six lines were found highly significant and positive gca effects. The range of variation of sca effects was observed from -10.01 to 11.17,18 crosses exhibited significant and positive sca effect for height of plant. The gca effect varied from -0.92 to 0.59, only one testers and 5 lines exhibited significant were positive gca effects. The range of variation of sca effect was observed from -0.71 to 0.59, 9 crosses exhibited significant and positive

Table 1a: Estimates of general combining ability (gca) effects for different characters in okra [*Abelmoschus esculentus* (L.) Moench]

Lines	Day to flowering	Height of plant	Number of branches per plant	Number of first fruiting node	Length of first fruiting node	Number of nodes per plant	Length of internode	Length of fruit	Width of fruit	Tapering length of fruit	Number of fruits per plant	Yield per plant
KS 423	1.53**	-6.21**	-0.75**	0.27**	-0.93**	-2.59**	0.00	-0.67**	-0.16**	-0.15**	-3.20**	-14.90**
KS 440	2.50**	5.58**	0.44**	0.35**	-0.42**	2.65**	0.99**	0.62**	0.11**	0.11**	2.74**	17.24**
KS447	2.94**	-2.15**	-0.24*	-0.07	-0.75**	-0.19	-0.08	-0.04	0.08*	0.07	-0.50**	-2.90**
KS441	3.41**	2.72**	0.24*	-0.15	1.18**	0.91**	-0.21*	0.68**	0.10**	0.08*	0.95**	13.37**
KS 453	-1.59**	-6.60**	-0.12	0.15	-0.75**	-2.05**	0.19*	-0.34**	-0.14**	-0.15**	-2.18**	-10.80**
KS 455	-1.52**	4.95**	0.59**	-0.01	0.52**	2.02**	0.14	0.80**	0.13**	0.13**	2.20**	21.08**
KS420	-1.39**	-2.13**	-0.18	-0.07	-0.63**	-0.48**	-0.36**	-0.52**	-0.13**	-0.14**	-0.54**	-13.21**
BO-2	-1.55**	3.50**	0.24*	-0.46**	0.73**	0.21	-0.27**	0.49**	0.09*	0.06	0.73**	11.50**
KS 437	-1.35**	-8.14**	-0.92**	0.04	-0.81**	-4.24**	-0.21	-0.56**	-0.13**	-0.12**	-0.75**	-13.71**
KS 448	-0.88**	6.14**	0.60**	0.05	0.44**	2.74**	0.10	0.74**	0.14**	0.10**	3.31**	19.99**
KS 439	-1.01**	-2.38**	-0.07	-0.22**	0.59**	-0.19	-0.14	-1.34**	-0.18**	-0.11**	-0.32**	-30.65**
KS 427	-1.08**	4.71**	0.18	0.11	0.82**	1.19**	-0.16	0.14**	0.11**	0.11**	1.54**	2.97**
Testers												
Prabhani kranti (P.K.)	0.12	3.57**	0.22*	0.02	0.70**	0.58**	-0.02	0.46**	0.05	0.06	0.67**	12.46**
KS 410	0.15	-0.53**	0.06	-0.15	-0.07	0.37**	-0.28**	-0.13**	-0.03	-0.04	0.54**	-2.61**
KS 404	-0.27	-3.03**	-0.28*	0.14	-0.63**	-0.95**	0.31**	-0.33**	-0.02	-0.02	-1.21**	-9.85**
S.E.giO (±)	0.18	0.16	0.11	0.08	0.15	0.13	0.09	0.05	0.04	0.04	0.10	0.18
S.E.giO (±)	0.08	0.07	0.05	0.03	0.06	0.05	0.04	0.02	0.02	0.02	0.04	0.08

* and ** Indicate significance of value at P=0.05 and 0.01, respectively

Table 1b: Estimates of specific combining ability (sca) effects for different characters in okra [*Abelmoschus esculentus* (L.) Moench]

Cross combinations	Day to flowering	Height of plant	Number of branches per plant	Number of first fruiting node	Length of first fruiting node	Number of nodes per plant	Length of internode	Length of fruit	Width of fruit	Tapering length of fruit	Number of fruits per plant	Yield per plant
KS 423 XP.K	1.69**	11.17**	0.59	3.29**	0.14	-0.18	-0.09	0.87**	0.16**	0.14*	2.62**	27.61**
K S 440XP.K	-0.45	-10.01**	-0.71**	-2.39**	-0.09	0.41	1.37*	-1.32**	-0.28**	-0.28**	-2.76**	-38.37**
KS447XP.K	-0.46	2.62**	0.32*	-0.19	0.21	1.32**	-0.11	0.84**	0.00	-0.02	0.18	22.41**
KS 441XP.K	-0.07	-2.25**	-0.35*	-1.15**	0.29**	-0.69**	-0.09	0.20	-0.08	-0.08	-1.00**	6.32**
KS453XP.K	0.34	10.06**	0.57**	4.71**	0.40**	0.17	O.29*	1.47**	0.12*	0.11	5.30**	35.50**
KS-455X P.K	0.03	-8.86**	-0.09	-1.26**	-0.48**	-0.59**	-0.43**	-1.69**	-0.06	-0.07	-0.92**	-37.50**
KS-420X P.K	0.57*	3.73**	0.16	0.59**	0.03	1.10**	0.07	1.24**	0.20**	0.21**	0.48**	30.80**
BO-2 X P.K	-0.39	-3.57**	0.01	-0.82**	0.21	-0.50*	0.10	-0.84**	-0.01	0.01	-0.93**	-23.70**
KS-437X P.K	-0.12	7.76**	-0.24	0.37*	0.35**	-0.45*	-0.40**	0.47**	0.28**	0.27**	0.06	8.44**
KS-448X P.K	0.16	10.14**	-0.29	-1.96**	-0.65**	0.67**	-0.42**	-1.20**	-0.35**	0.40**	-1.96**	-30.91**
KS439XP.K	-0.55*	3.47**	0.24	0.28	0.18	-0.25	0.00	0.82**	0.20**	0.31**	0.55**	17.33**
KS427XP.K	0.74**	-3.99**	-0.21	-1.47**	0.10	-0.18	-0.28*	-0.88**	-0.19**	-0.22**	-1.61**	-17.93**
KS423XKS410	-1.20**	-3.41**	-0.49**	-1.03**	-0.08	0.33	-0.50**	-0.33**	-0.05	-0.05	-1.08**	-9.45**
KS440 XKS410	0.77**	3.76**	0.13	0.42*	0.40**	-0.37	0.22	0.16	0.08	0.08	0.60**	10.61**
KS447 XKS410	-0.02	1.69**	0.24	1.44**	-0.22*	-1.30**	0.12	0.58**	0.11	0.11	1.69**	11.72**
KS441 XKS410	-0.69**	-2.24**	0.00	0.21	-0.22*	-0.02	0.38**	0.02	0.06	0.07	0.66**	-3.04**
KS453 XKS410	-1.02	-2.91**	0.10	-1.63**	-0.12	0.30	-0.88**	-0.54**	-0.03	-0.02	-2.24**	-12.25**
KS455 XKS410	0.48	1.72**	-0.38*	-1.77**	0.08	1.03**	-0.03	0.73**	0.06	0.06	-2.24**	12.65**
KS420 XKS410	0.15	-1.32**	0.38*	1.44**	-0.04	-1.33**	0.69**	-0.42**	-0.09	-0.11	1.55**	-8.97**
BO2 XKS410	0.34	-1.05**	-0.12	0.22	-0.19	-0.31	0.41**	-0.17	-0.03	-0.02	0.53**	-6.62**
KS437 XKS410	0.33	-1.32**	0.10	0.84**	0.70**	0.55**	-0.69	0.62**	-0.10	-0.07	0.38**	15.72**
KS448 XKS410	0.43	2.69**	-0.08	-0.27**	0.34**	-0.47*	0.54**	0.08	0.07	0.09	-0.06	7.62**
KS 439 X KS 410	0.52*	4.54**	0.32*	1.02**	-0.36**	1.15**	0.01	0.23	-0.01	-0.08	1.87**	7.23**
KS 427 XKS 410	-0.10	-2.10**	-0.20	-0.87**	-0.28*	0.46*	0.16	-0.96**	-0.08	-0.06	-1.66**	-25.22**
KS 423XKS 404	-0.49	-7.76**	-0.10	-2.27**	-0.06	-0.15	0.58**	-0.54**	-0.11	-0.09	-1.54**	-18.16**
KS440 XKS 404	-0.32	6.25**	0.58**	1.97**	-0.31**	0.79**	-1.15**	1.16**	0.20**	0.19**	2.16**	27.76**
KS447 XKS 404	0.48	-4.31**	-0.56**	-1.25**	0.00	-0.02	0.00	-1.42**	-0.11	-0.10	-1.87**	-34.13**
KS441 XKS 404	0.76**	4.50**	0.35*	0.95**	-0.07	0.71**	-0.29*	-0.22	0.02	0.00	0.34*	-3.28**
KS 453 XKS 404	0.68**	-7.16**	-0.67**	-3.07**	-0.28*	-0.46*	0.59**	0.93**	-0.10	-0.09	-3.06**	-23.25**
KS 455 XKS 404	0.51*	7.14**	0.48**	3.03**	0.40**	-0.43*	0.46**	0.96**	0.00	0.01	3.16**	24.85**
KS 420 XKS 404	-0.72**	-2.36**	-0.54**	-2.03**	0.01	0.23	-0.77**	-0.82**	-0.12*	-0.10	-2.03**	-21.83**
BO 2 XKS 404	0.06	4.62**	0.10	0.60**	-0.02	0.82**	-0.51**	1.01**	0.03	0.01	0.40**	30.33**
KS 437 XKS 404	-0.21	-6.44	0.14	-1.21**	-0.35**	-0.10	1.09**	-1.10**	-0.18**	-0.20**	-0.44**	-24.16**
KS 448 XKS 404	0.59*	7.44**	0.36*	2.23**	0.31*	-0.20	-0.12	1.12**	0.27**	0.30**	2.02**	23.29**
KS 439 XKS 404	0.03	-8.01**	-0.56**	-1.29**	0.18	-0.90**	-0.01	-1.05**	-0.19**	-0.23**	-2.42**	-24.56**
KS 427 XKS 404	0.84**	6.09**	0.41*	2.35**	0.18	-0.28	0.12	1.83**	0.27**	0.29**	3.27**	43.15**
SE(S_{ij})±	0.26	0.22	0.16	0.18	0.11	0.21	0.12	0.12	0.06	0.06	0.14	0.25

* and ** Indicate significance of value at P=0.05 and 0.01, respectively

sca effects for number of branches per plant. The gca effect varied from -0.46 to 0.35, only two lines showed significant positive value of the gca effects. The range of variance of sca effects was observed from -3.07 to 4.71, 15 crosses noted significant and positive sca effects for number of first fruiting node. Length of first fruiting node range of variation for gca and sca were observed from -0.93 to 1.18 and 1.33 to 1.32, only one tester, 6 lines and 8 crosses revealed significant and gca and sca effects were noted. Number of node per plant range of variation of gca and sca effects between -4.24 to 2.74 and -1.33 to 1.32 .The significant positive gca and sca effects were noted for two tester, 5 linens and 10 crosses. Length of internodes magnitude of gca and sca effects varied from -0.30 to 0.99 and -1.15 to 1.37, only one tester, two lines and 10 crosses revealed positive significant gca and sca effect were noted .Length of fruit,range of variation for gca and sca effect were observed from -1.34 to 0.80 and 1.69 to 1.83, one tester, six lines and 15 crosses were recorded significant and positive gca and sca effect. Width of fruit range variation from -0.18 to 0.14 and -0.35 to -0.28 for gca and sca effects were observed.The significant and positive gca and sca effects were recorded for 7 lines and 8 crosses combination. Tapering length of fruit range varied from-0.15 to 0.13 and -0.28 to 0.40 for gca and sca effects were noted, 5 lines and 8 crosses were observed significant and positive gca and sca effects. Number of fruits per plant range varied from -4.75 to 3.31 and -2.76 to 5.30 for gca and sca effects. The significant and positive gca and sca effects were recorded for two tester, six lines and 17 crosses, respectively. Yield per plant range varied from -30.65 to 21.08 and -38.37 to 43.15 for gca and sca effects. The significant and positive gca and sca effects were recorded for one tester , 6 lines and 18 crosses, respectively .The preponderance of general combining ability (gca) and specific combining ability (sca) for yield and yield contributing characters in okra or other crops were also reported by Indu *at al*.(2002), Poshiya and Vashi (1995), Singh *at al.* (1996), Singh *at al.* (2001), Vijay and Manoher (1986), Banu *at al.* (2006) and Gupta *at al.* (2007). The combining ability also elucidates the nature of gene action involved in the inheritance of the nature of gene action for yield and its component characters has a bearing on the development of efficient breeding procedures.The general combining ability is attributed to additive, additive x additive and higher degree of additive x additive interaction and is fixable in nature. The other hand specific combining ability is attributed to non additive gene action and such is non fixable in nature. The present study parents KS-440, KS-448, KS-427and KS-455 were superior general combiners for yield and its contributing characters. However, the cross combination KS-448 x KS404, KS-440 x KS-404, KS-427 x KS-404 and KS-453 x PK were found to be superior specific combination for yield and yield contributing characters.

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