Plant Archives Vol. 19 No.2, 2019 pp. 2964-2966 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

STUDIES ON GENE ACTION AND COMBINING ABILITY FOR EARLINESS, FRUIT YIELD AND YIELD CONTRIBUTING CHARACTERS IN BHENDI (*ABELMOSCHUS ESCULENTUS* L. MOENCH.)

J.L. Joshi, G. Jayalakshmi, R. Ebenezer Babu Rajan and Ajish Muralidharan*

Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalai nagar - 608002, Tamilnadu, India.
Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai nagar - 608002, Tamilnadu, India.

Abstract

A study was conducted to estimate the magnitude of combining ability and gene action on eighteen hybrids generated by crossing six lines with three testers. The results revealed that seven hybrids showed significant negative value for days to 50 percent flowering. Among the hybrids, maximum positive *sca* effect was recorded by the hybrid $L_5 \times T_2$ followed by $L_6 \times T_1$ The predominance of non-additive gene action was found in days to 50 percent flowering, number of branches per plant, internodal length, fruit girth, fruit weight, number of seeds per fruit, hundred seed weight and fruit yield.

Key words: gene action, combining ability, *Abelmoschus esculentus* L. Moench., fruit yield

Introduction

Bhendi is an important member of family Malvaceae and commonly known as Okra/Ladies finger. Bhendi is originated from tropical Africa. In recent years, we are experiencing a surplus production in cereals and oil seeds leading to self-sufficiency through green revolution and yellow revolution. However, shortage in the production of vegetable has drawn the attention for increasing the cultivation of vegetables to provide food and nutritional security. Vegetables are cultivated all over an area of 49 million hectares with the production potential of 487 million tonnes in the world. India is the largest production of okra in the world and shares nearly 12 percent of the total world output. According to horticulture statistics the total area under cultivation of okra during the year 2016 –2017 is 5,28,000 ha and the production is 61,46,000 MT. In India, Andhra Pradesh ranks first in okra productivity followed by Jammu and Kashmir, Assam. The genetic potential of the parents is expressed in terms of combining ability. Among the parents involved in large number of crosses only few exhibits superiority and such parents producing good hybrids are considered as good general combiners. Sprague and Tatum (1942) gave the concept of combining ability as genetic variation. The line × tester analysis is one of the most useful techniques for preliminary evaluation of genotypes in-order to identify good combiners. Therefore an attempt has made to study the combining ability for eleven characters by adopting line × tester mating design as suggested by Kempthorne (1957).

***Author for correspondence :**

Materials and Methods

An investigation was carried out at Plant Breeding Farm, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University during 2017 –2018. The six Lines Annamalai Nagar Local, Trichy Local, Muthur, Ae Tuticorin, Hyveg 155, Local Bhuvanagiri and three Testers, Arka Anamika, Mdu-1, Arka Mini were crossed in line × tester manner resulting in eighteen F_1 hybrids. Eighteen F_1 hybrids along with nine parents (6 lines and 3 testers) were raised in a

Randomized Block Design (RBD) with three replications. Recommended cultural operations and regular plant protection measures were carried out to maintain crop healthy. The observations were made on randomly selected five plants for parents and hybrids to record all the traits. The observations recorded for hybrids and the parents were subjected to line × tester analysis and the general combing ability effects of parents and the *sca* effects of different crosses were worked out. The combining ability variance analysis was based on the method developed by Kempthrone (1957).

Results and Discussion

In the Analysis of variance, the mean sum of squares due to lines was significant for all the characters and among the testers all characters except for fruit girth. This indicated existence of significant difference among the parents studied. Gene action refers to the behavior or mode of expression of genes in a genetic population. Knowledge of gene action helps in the selection parents for use in the hybridization programme and also in the choice of appropriate breeding procedure for the genetic improvement of various quantitative characters. The SCA variance was higher than GCA variance indicating predominance of non-additive gene action for all the characters except plant height at maturity, fruit length and number of fruits per plant.

Based on *per se* performance the line L_2, followed by L_3 and L_5 and among the testers T_1 and T_3 were superior and high yielder for all the characters. The *gca* is a measure of additive genetic factor, while the *sca* is due to non-additive genetic factors (Sprague and Tatum, 1942). The lines and testers with negative and significant *gca* were considered as superior for the trait days to 50 percent flowering. Among the nine parents, three lines L_2 (-2.53) followed by L_3 (-1.21) and L_5 (-1.43) and the

Table 1: Combining ability for *gca* effects

Parents	Days to 50% flowering	Plant height at maturity	Number of branches per plant	Inter-nodal length	Fruit length	Fruit girth	Fruit weight	Number of fruits per plant	Number of seeds per fruit	100 seed weight	Fruit yield per plant
L_1	1.54**	10.21**	-0.25**	-0.36**	-0.19**	-0.41**	-1.08**	-0.03	-1.97**	-0.62**	-5.42**
L_2	-2.53**	-15.21**	0.56**	0.59**	0.75**	0.51**	1.89**	2.50**	4.31**	0.90**	66.64**
L_3	-1.21**	-8.72**	0.25**	0.36**	0.44**	0.79**	0.64**	1.50**	2.15**	0.76**	34.03**
L_4	1.77**	13.15**	-0.24**	-0.66**	-0.68**	-0.59**	-0.58**	-2.62**	-2.45**	-0.70**	-53.00**
L_5	-1.43	-8.08**	0.01*	0.34**	0.34**	0.15**	0.14**	1.31**	1.50**	0.62**	19.66**
L_6	1.87	8.65**	-0.33**	-0.26**	-0.65**	-0.45**	-1.02**	-2.66**	-3.54**	-0.96**	-61.90**
T_1	0.09	-1.85**	0.19**	0.30**	0.26**	-0.08**	0.30**	0.74**	1.14**	0.27**	26.54**
T_2	-0.30**	1.43**	-0.19**	-0.19**	-0.20**	0.09**	-0.43**	-0.76**	-1.23**	-0.23**	-23.82**
T_3	0.21**	0.42**	0..00	-0.11**	-0.06**	-0.01	0.13	0.02	0.08**	-0.04	-2.72**
Combining ability for *sca* effects											
$L_1 \times T_1$	1.13**	-0.20**	-0.12**	-0.07	-0.05**	0.08**	-0.07	-0.27**	-1.06**	-0.15**	-12.82**
$L_1 \times T\text{-}_2$	-1.74**	0.65**	0.08***	-0.16**	0.20**	-0.00	0.16*	0.52**	1.16**	0.07	-3.62**
$L_1 \times T_3$	0.61**	-0.45**	0.04**	0.23**	-0.15**	-0.08**	-0.10	-0.25**	-0.10	0.08	16.44**
$L_2 \times T_1$	-1.22**	-2.66**	-0.03**	-0.12**	0.01	0.23**	0.16*	-0.00	0.62**	-0.19**	2.92**
$L_2 \times T_2$	2.47**	4.69**	-0.03**	-0.14**	-0.15**	0.06**	-0.10	-0.21*	-1.47**	0.06	-13.51**
$L_2 \times T_3$	-1.25**	-2.03**	0.06**	0.26**	0.13**	-0.30**	-0.05	0.21*	0.85**	0.13*	10.59**
$L_3 \times T_1$	-1.27**	0.94**	0.10**	-0.08	0.10**	-0.30**	0.82**	0.20*	0.18**	-0.20**	3.34**
$L_3 \times T_2$	0.54**	-0.64**	-0.14**	0.04	-0.03	-0.00	1.03**	-0.20**	-0.51**	0.30**	-2.11**
$L_3 \times T_3$	0.73**	-0.30**	0.04**	0.04	-0.07**	0.30**	-1.85**	0.00	0.33**	-0.10	-1.24*
$L_4 \times T_1$	1.01**	2.82**	-0.16**	0.33**	-0.18**	-0.16**	-1.59**	0.00	-0.68**	0.23**	-11.45**
$L_4 \times T_2$	-0.82**	-2.30**	0.08**	0.01	0.12**	-0.13**	-0.50**	-0.22**	0.61**	-0.27**	5.63*
$L_4 \times T_3$	-0.19	-0.51**	0.08**	-0.35**	0.06**	0.29**	2.09**	0.22**	0.07	0.04	5.82**
$L_5 \times T_1$	-0.73**	0.63**	0.24**	-0.19**	-0.12**	0.11**	0.92**	-0.21*	0.71**	-0.18**	-3.40**
$L_5 \times T_2$	0.49**	0.09	-0.06**	0.03	0.09**	-0.14**	-0.88**	0.28**	0.14**	0.13*	22.34**
$L_5 \times T_3$	0.24	-0.72**	-0.17**	0.16**	0.03	0.03*	-0.04	-0.08	-0.85**	0.05	-18.94**
$L_6 \times T_1$	1.08**	-1.52**	-0.03**	0.13*	0.23**	0.03	-0.24**	0.28**	0.23**	0.49**	21.40**
$L_6 \times T_2$	-0.94**	-2.48**	0.08**	0.22**	-0.24**	0.22**	0.29**	-0.17	0.07	-0.29**	-8.73**
$L_6 \times T_3$	-0.14	4.01**	-0.04**	-0.35**	0.01	-0.25**	-0.05	-0.11	-0.30**	-0.19**	-12.67**

*Significant at 5% level ** Significant at 1% level tester T_3 (-0.30) have negative and significant *gca* effects. These results of current investigation were in agreement with Wammanda *et al.,* (2010), who have also reported favorable *gca* effects for earliness. Among the eighteen hybrids seven cross combinations such as $L_2 \times T_1$ (-1.22), $L_3 \times T_1$ (-1.27), $L_5 \times T_1$ (-0.73), $L_1 \times T_2$ (-1.74), $L_4 \times T_2$ (-0.82), $L_6 \times T_2$ (-0.94), $L_2 \times T_3$ (-1.25) recorded negative significant *sca* effects for this character.

For plant height at maturity, maximum positive significant *gca* effects was observed in the lines such as L_4 (13.15) followed by L_1 (10.21) and in tester T_2 (1.43). Among the hybrids, $L_2 \times T_2$ (4.69) followed by $L_6 \times T_3$ (4.01) and $L_4 \times T_1$ (2.82) showed positive and significant *sca* effects. Similar results were reported by Rewale *et al.,* (2003), Manivannan *et al.,* (2007) and Srivastava *et al.,* (2008).

Lines, L_2 (0.56) and L_3 (0.25) and the tester, T_1 (0.19) showed maximum positive significant *gca* effects for the trait number of branches per plant and nine hybrids showed significant positive effects. In these nine hybrids, $L_5 \times T_1$ (0.24), $L_3 \times T_1$ (0.10) showed highly positive significant effects.

Among the lines, line L_4 (-0.66), L_1 (-0.36) and L_6 (-0.26) followed by L_3 and L_5 and in testers T_2 (-0.19) followed by T_3 (-0.11) recorded maximum significant negative *gca* effects for internode length. Among eighteen hybrids, $L_4 \times T_3$ (-0.35) followed by $L_6 \times T_3$ showed higher negative significant *sca* effects.

For fruit length, Lines L_2 (0.75) and testers T_1 (0.26) registered positive significant *gca* effects and fourteen crosses showed significant *sca* effects. The hybrids $L_6 \times T_1$ (0.23) followed by $L_1 \times T_2$ (0.20) and $L_2 \times T_3$ (0.13) recorded maximum positive significant *sca* effects.

Four lines had positive significant *gca* effects for fruit girth. It was maximum in L_3 (0.79) followed by L_2 (0.51) and among testers T_2 (0.09) registered significant positive *gca* effects for fruit girth. Whereas *sca* effects were positive significant for eight combinations with maximum for $L_3 \times T_3$ (0.30).

Among parents, lines L_2 (1.89) and tester T_1 (0.30) have recorded positive significant *gca* effects for fruit weight. Among the crosses twelve crosses showed significant *sca* effects. The cross $L_5 \times T_1$ (0.92) followed by $L_3 \times T_1$ (0.82) had significant positive *sca* effects.

The number of fruits per plant was found to be positive and significant *gca* effects for lines L_2 (2.50) followed by L_3 (1.50) and for testers T_1 (0.74). Whereas six hybrids had positive significant *sca* effects with maximum $L_1 \times T_2$ (0.52) followed by $L_5 \times T_2$ (0.28).

For number of seeds per fruit, lines L_2 (4.31) followed by L_3 and L_5 (2.15 and 1.50) and tester T_1 (1.14) and T_3 (0.08) recorded positive significant *gca* effects. Nine crosses showed maximum positive significant *sca* effects. It is maximum for $L_1 \times T_2$ (1.16) followed by $L_2 \times T_3$ (0.85) and $L_5 \times T_1$ (0.71).

Among the parents the lines L_2 (0.90) followed by L_3 (0.76) and L_5 (0.62) and tester T_1 (0.27) recorded positive significant *gca* effects for 100 seed weight. The hybrid $L_6 \times T_1$ (0.49) and $L_3 \times T_2$ (0.30) recorded positive significant *sca* effects for this trait.

The fruit yield per plant was found to be positive significant *gca* effects for lines L_2 and L_3 (66.64 and 34.03) and tester T_1 (26.54) and T_3. Eight hybrids have positive significant *sca* effects with maximum recorded in $L_5 \times T_2$ (22.34) followed by $L_6 \times T_1$ (21.40). Similar results were obtained by Rawal *et. al.,* (2003) and Sanjeev Kumar and Pathania (2011).

References

Kempthrone, 0. (1957). An Introduction to Genetical Statistics. John Wiley and sons, New York. 545.

Kumar Sanjeev and N.K. Pathania (2011). Combining ability and gene action studies in okra (*Abelmoschus esculentus* L. Moench). *J. Res. Punjab Agriuniversity*, **48(1&2):** 43-47.

Manivannan, M.T., J. Rajangam and P. Aruna (2007). Studies on combining ability in okra (*Abelmoschus esculentus* L. Moench). *Asian J. Hort.*, **2(2):** 13-18.

Rewale, V.S., V.W. Bendale, S.G. Bhave, R.R. Madav and B.B. Jadhav (2003). Heterosis for yield and yield components in okra. *J. Maharastra Agri. University*, **28(3):** 247-249.

Sprague, G.F. and L.A. Tatum (1942). General vs specific combining ability in single crosses of corn. *J. Americansoc. Agron.*, **34:** 823-832.

Srivastava, M.K., S. kumar and A.K. pal (2008). Studies on combining ability in okra through diallel analysis. *Indian J. Hort.*, **65(1):** 48-51.

Wammanda, D.T., A.M. Kadams and P.M. Jonah (2010). Combining ability analysis and heterosis in a diallel cross of okra (*Abelmoschus esculentus* L. Moench). *African J. of Agrl. res.*, **5(16):** 408 -2115.