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COMBINING ABILITY STUDIES FOR GROWTH AND YIELD CHARACTERS OF BHENDI *ABELMOSCHUS ESCULENTUS* (L.) MOENCH)

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ABSTRACT

The present investigation consisted of 9 lines, 3 testers with their 27 F_1 hybrids developed through line x tester mating fashion in randomized block design with three replications. Parents and hybrids differed significantly for gca and sca effects, respectively. Among the parents, maximum gca effect was found in EC 112241 and Aruna for inter node distance, EC 112241 and Arka Anamika for single fruit weight, EC 109454, EC 169344 and Arka Anamika for number of branches per plant, EC 169331 and Arka Anamika for number of fruits per plant, EC 109454 and Aruna for plant height at final harvest. The crosses exhibited maximum positive significant sca effect was observed in EC 112241 x Aruna, EC 109454 x Kashi Kranti and EC 112264 x Aruna were found as good specific combiners for single fruit weight, number of branches per plant and number of fruits per plant respectively. The hybrid EC 112264 x Aruna exhibited maximum significant negative sca effects for inter node distance and plant height at final harvest.

Keywords: Line x Tester, gca, sca, Bhendi

INTRODUCTION

Bhendi [*Abelmoschus esculentus* (L.) Moench] popularly known as Ladies finger or Okra or Bhindi comes under the family of Malvaceae with chromosome no: $2n=2x=130$. It is an important vegetable grown in tropical and sub-tropical regions of the world and believed to have originated in Tropical Africa. Bhendi is an annual vegetable crop grown upto 3-6 feet height and have a deep taproot system, often cross pollinated crop due to protogynous in nature and propagated through seeds. Bhendi is used for treating genitor-urinary disorder, chronic dysentery and spermatorrhoea. Drinking of "okra water" is one of the method of reducing diabetes symptoms. The roots and stems of okra are used for clarification of sugarcane juice before it is converted into jaggery and brown sugar (Fageria *et al.*, 2012).

Bhendi is known as powerhouse of valuable nutrients because it is having low calories and is fat-free. It also has considerable medicinal and industrial value (Kirtikar and Basu, 1984). The okra seeds are crushed and fed to cattle for increasing milk production. Dry seeds of okra contain 13-22 % of edible oil and 20-24 % of protein. The oil is used in soap and cosmetic industry and the protein is used for fortified feed preparations. The crude fibre in okra is used in the jute, textile and paper industry. The concept of combining ability plays an important role in selection of parents and production of superior hybrids. The general combining ability (gca) and specific combining ability (sca) is a foundation for any breeding programme. This method is used for the selection of desirable parents for hybridization programme. Hence, the current study was

undertaken with a view to assess the combining ability of parents and hybrids.

MATERIALS AND METHODS

The experimental materials comprised of twelve parents which involved nine lines and three testers with their twenty seven F_1 hybrids, were raised at spacing of 45 x 30 cm in Randomized Block Design (RBD) with three replications during December to February, 2020 was carried out at Vegetable Unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai Nagar. Many biometrical procedures were used for studying the combining ability, Line x Tester is one of the efficient method was developed by Kempthorne (1957), which is good method for evaluating the large number of genotypes at a time for combining ability variances and effects. Recommended cultural practices were followed to raise a successful crop. Five plants of each entry in each replication were randomly selected for recording the observations on inter node distance, single fruit weight, number of branches per plant, number of fruits per plant and plant height at final harvest.

RESULT AND DISCUSSION

The analysis of variance (Table 1.) showed all the lines and testers were significant for all the characters. The variance due to lines x testers interaction was significant for all the characters, there by showing high specific combining ability. The variance due to hybrids was significant for all the characters.

Table 1. Analysis of variance for biometric characters in bhendi

Source	DF	Inter node distance (cm)	Single fruit weight (g)	Number of branches per plant	Number of fruits per plant	Plant height (cm)
Replication	2	0.06	0.09	0.006	0.01	0.003
Lines	8	1.90**	15.44**	0.52**	13.43**	938.25**
Testers	2	8.50**	73.60**	0.11**	23.28**	3096.33**
Lines x testers	16	2.40**	23.57**	0.14**	8.68**	304.20**
Hybrids	26	2.71**	24.92**	0.26**	11.27**	714.07**
Error	76	0.01	0.02	0.007	0.02	0.02

*significant at 5% level, **significant at 1% level.

Table 2. Estimates of general combining ability effects of parents for different characters of okra

Parents	Inter node distance (cm)	Single fruit weight (g)	Number of branches per plant	Number of fruits per plant	Plant height at final harvest (cm)
Lines					
Ec 102605	0.13**	0.13**	-0.20**	-0.54**	6.44**
Ec 112112	1.02**	-0.47**	-0.40**	-1.21**	18.11**
Ec 112264	0.35**	0.16**	-0.31**	-1.08**	10.11**
Ec 109454	-0.34**	-0.73**	0.25**	-1.01**	-11.89**
Ec 112241	-0.45**	2.26**	0.06*	0.06	-5.22**
Ec 169329	-0.33**	1.90**	0.11**	-0.81**	-10.89**
Ec 169344	-0.01	-1.72**	0.25**	1.32**	-5.22**
Ec 169331	-0.16**	-0.98**	0.14**	1.96**	-4.11**
Ec 169335	-0.22**	-0.55**	0.09**	1.32**	-5.56**
SE for lines	0.03	0.05	0.02	0.05	0.06
Testers					
Arka Anamika	0.62**	1.14**	0.07**	1.04**	11.89**
Kashi Kranti	-0.14**	0.75**	-0.04**	-0.31**	-3.00**
Aruna	-0.48**	-1.89**	-0.04**	-0.73**	-8.89**
SE for testers	0.02	0.03	0.01	0.03	0.03

*significant at 5% level, **significant at 1% level.

The estimates of gca effects (Table 2) showed the range of gca effects of lines varied from -0.45 to 1.02 whereas in the testers -0.48 to 0.62. Among the lines EC 112241 (-0.45) followed by EC 109454 (-0.34) and EC169329 (-0.33) exhibited maximum negative significant gca effect for inter node distance whereas, among the testers Aruna (-0.48) and Kashi Kranti (-0.14) exhibited negative gca effect for this character. The results are in conformation with earlier findings of Jagan *et al.*, (2013), Joshi *et al.*, (2015) and Shwetha *et al.*, (2018).

In respect to single fruit weight, the range of gca effects of lines varied from -1.72 to 2.26 whereas in the testers -1.89 to 1.14. Highest positive significant gca effect was recorded among the lines EC 112241 (2.26) followed by EC 169329 (1.90), EC 112264 (0.16) and EC 102605 (0.13) whereas, the testers Arka Anamika (1.14) and Kashi Kranti (0.13) for this character. The results are in agreement with the findings of More *et al.*, (2015), Gowda *et al.*, (2018).

Table 3. Estimates of specific combining ability effects of crosses for different characters of okra

Crosses	Inter node distance (cm)	Single fruit weight (g)	Number of branches per plant	Number of fruits per plant	Plant height at final harvest (cm)
Ec 102605 x AA	-0.24**	-2.53**	-0.08*	-1.18**	-5.56**
Ec 102605 x KK	0.04	3.79**	0.04	-0.42**	2.33**
Ec 102605 x A	0.20**	-1.26**	0.05	1.60**	3.22**
Ec 112112 x AA	-0.85**	-1.09**	-0.08*	0.89**	0.78**
Ec 112112 x KK	0.26**	-0.56**	0.04	-0.56**	-3.33**
Ec 112112 x A	0.60**	1.65**	0.05	-0.33**	2.56**
Ec 112264 x AA	1.11**	0.52**	-0.17**	-1.04**	13.78**
Ec 112264 x KK	0.84**	0.03	0.03	-1.69**	10.67**
Ec 112264 x A	-1.94**	-0.55**	0.14**	2.73**	-24.44**
Ec 109454 x AA	0.60**	0.05	0.05	-1.11**	-3.22**
Ec 109454 x KK	0.18**	-0.70**	0.36**	0.84**	7.67**
Ec 109454 x A	-0.78**	0.65**	-0.42**	0.27**	-4.44**
Ec 112241 x AA	1.02**	-2.60**	0.06	-0.28**	7.11**
Ec 112241 x KK	-0.54**	-2.36**	-0.21**	1.28**	-6.00**
Ec 112241 x A	-0.48**	4.96**	0.16**	-1.00**	-1.11**
Ec 169329 x AA	-0.22**	2.94**	-0.01	-0.51**	-8.22**
Ec 169329 x KK	-0.82**	-0.81**	-0.10*	0.84**	-6.33**
Ec 169329 x A	1.05**	-2.13**	0.10*	-0.33**	14.56**
Ec 169344 x AA	-0.67**	3.71**	0.26**	1.96**	-5.89**
Ec 169344 x KK	0.17**	-2.99**	-0.23**	1.71**	4.00**
Ec 169344 x A	0.49**	-0.72**	-0.03	-3.67**	1.89**
Ec 169331 x AA	-0.31**	-1.47**	-0.24**	0.92**	2.78**
Ec 169331 x KK	0.02	3.90**	0.11**	-0.92**	-3.33**
Ec 169331 x A	0.30**	-2.43**	0.12**	0.00	0.56**
Ec 169335 x AA	-0.44**	0.47**	0.21**	0.36**	-1.56**
Ec 169335 x KK	-0.13**	-0.30**	-0.05	-1.09**	-5.67**
Ec 169335 x A	0.58**	-0.17*	-0.17**	0.73**	7.22**
SE for crosses	0.1	0.10	0.04	0.10	0.10

AA – Arka Anamika, KK – Kashi Kranti, A – Aruna.

*significant at 5% level, **significant at 1% level.

The gca effects of lines varied from -0.40 to 0.25 whereas in the testers ranging varied from -0.04 to 0.07. The lines EC 109454 (0.25) followed by EC 169344 (0.25), EC 169331 (0.14) and EC 169329 (0.11) and the tester Arka Anamika (0.07) expressed maximum significant positive gca effect for number of branches per plant. However, this is the conformity with the findings by Sharma and Singh (2012) and Devi *et al.*, (2017).

The range of gca effects of lines varied from -1.21 to 1.96 whereas in the testers -0.73 to 1.04. Among the parents EC169331 (1.96), EC 169344 (1.32), EC 169335 (1.32) and Arka Anamika (1.04) exhibited highest significant

positive gca effect for number of fruits per plant. This is in consonance with the results of Raju and Selvam (2017) and Sapavadiya *et al.*, (2019).

The range of gca effects varied from -11.89 to 18.11 and -8.89 to 11.89 for lines and testers respectively. Highest significant negative gca effect were found among the lines EC 109454 (-11.89) followed by EC 169329 (-10.89), EC 169335 (-5.56), EC 112241 (-5.22) and EC 169344 (-5.22) whereas the testers Aruna (-8.89) and Kashi Kranti (-3.00) for plant height at final harvest. The results are in agreement with Balakrishnan *et al.*, (2009), Jagan *et al.*, (2013) and Joshi *et al.*, (2015).

The estimates of sca effects (Table 3) showed the range of sca effects of crosses varied from -1.94 to 1.11. The hybrids showed maximum negative significant sca effect was observed in EC 112264 x Aruna (-1.94) followed by EC 112112 x Arka Anamika (-0.85) and EC 169329 x Kashi Kranti (-0.83) for inter node distance. The results are in conformation with earlier findings of Weerasekara *et al.*, (2008) and Tiwari *et al.*, (2016).

The range of sca effects of hybrids varied from -2.60 to 4.96. The hybrids expressed highest significant positive sca effect was reported on EC112241 x Aruna (4.96) followed by EC 169331 x Kashi Kranti (3.90), EC 102605 x Kashi Kranti (3.79) for single fruit weight. The results are in agreement with Adiger *et al.*, (2013) and Bhatt *et al.*, (2015).

The range of sca effects of crosses varied from -0.42 to 0.36. The crosses exhibited maximum positive significant sca effect was recorded in EC 109454 x Kashi Kranti (0.36) followed by EC 169344 x Arka Anamika (0.26) and EC 169335 x Arka Anamika (0.21) for number of branches per plant. Similar results were observed by Reddy and Sridevi (2018) and Punia and Garg (2019) in Bhendi.

The range of sca effects of hybrids varied from -3.67 to 2.73. The crosses exhibited maximum positive significant sca effect was noticed in EC 112264 x Aruna (2.73) followed by EC 169344 x Arka Anamika (1.96) and EC 169344 x Kashi Kranti (1.71) for number of fruits per plant. This is in consonance with the results of Dabhi *et al.*, (2010) and Eswaran and Anbanandan (2018).

The range of sca effects of crosses varied from -24.4 to 14.56. The cross combination exhibited highest significant negative sca effect was found in EC 112264 x Aruna (-24.44) followed by EC 169329 x Arka Anamika (-8.22) and EC 169329 x Kashi Kranti (-6.33) for plant height at final harvest. The results are in agreement with the findings of More *et al.*, (2017) and Satish *et al.*, (2017).

CONCLUSION

From the above discussion that could be concluded with the first top ranking hybrids had either one of the parents as good general combiner for all the characters except number of fruits per plant. Hence, these cross combinations will be used in future hybridization programme for further improvement.

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