



COMBINING ABILITY STUDIES IN BHENDI [*ABELMOSCHUS ESCULENTUS* (L.) MOENCH]

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Abstract

Combining ability effects were estimated for different characters of bhendi in a line \times tester mating design comprising 6 lines and 3 testers and 18 F_1 hybrids. Parents and hybrids differed significantly for *gca* and *sca* effects, respectively. Among the lines, Trichy local, Muthir and HyVeg 155 and among the testers Arkaanamika and arka mini were found to be the best general combiners. Three cross combiners Trichy local \times Arkaanamika, Trichy local \times Arkamini and Muthir \times Arkaanamika were found to be the best specific combiners.

Key words : Line \times Tester, *gca*, *sca*, bhendi.

Introduction

Bhendi [*Abelmoschus esculentus* (L.) Moench] is an important member of family Malvaceae and commonly known as okra or ladyfinger in India. It is one of the most ancient and traditional vegetable crops grown in tropical and subtropical regions of the world (Martin and Ruberte, 1978). The general combining ability is the measure of additive genetic factor whereas the specific combining ability is due to non-additive genetic factor. The genetic potential of the parents is expressed in terms of combining ability. Among the parents involved in a large number of crosses, only few exhibit 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. Therefore, an attempt has been made to study the combining ability for 13 characters by line \times tester mating design as suggested by Kempthorne (1957).

Materials and Methods

The experimental materials for the present investigation consisted of six lines. Annamalai Nagar local, Tirchy local, Muthir, AE-Tuticorin, HyVeg 155, Local bhuvnagiri and three testers, *viz.*, Arkaanamika, MDU-1, Arka mini crossed to develop 18 F_1 hybrids. All the 18 F_1 cross-combinations along with 9 parents were laid out

in a randomized block design with three replications at Experimental Farm of Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalai Nagar (Tamil Nadu), India. All the parents or hybrids were raised in a spacing of 45 \times 30 cm. The observations were made on five randomly selected plants in each replication. The characters studied were, days to fifty per cent flower (days), plant height at maturity (cm), number of branches per plant, internodal length (cm), fruit length (cm), fruit girth (cm), fruit weight (g), number of fruits per plant, number of seeds per plant, 100 seed weight (g), fruit yield per plant (g). The combining ability analysis was calculated as suggested by Kempthorne (1957).

Results and Discussion

The analysis of variance showed significant differences among the crosses for all the traits (table 1). The mean sum of squares due to lines and testers were significant for all the traits except for fruit girth. Variance due to line and tester interaction were also significant for all the traits.

The estimates of general combining ability effects of 6 female lines and 3 male testers for eleven characters (table 2) indicated that the line Tirchy local exhibited significant and *gca* effects for days to 50% flower, plant

Table 1 : Analysis of variance for combining ability.

Source of variance	Replication	Line	Tester	L × T	Error
D.F	2	5	2	10	52
Days to 50 % flowering	0.0446	33.9715**	1.2917**	6.2829**	0.0698
Plant height at maturity	-0.0752	1304.229**	50.7986**	22.2900**	0.0144
Number of branches per plant	0.0008	1.1014**	0.6254**	0.0590**	0.0004
Intrnodal length	0.0038	2.2163**	1.2847**	0.2012**	0.0079
Fruit length	-0.0002	3.2224**	0.9765**	0.0898**	0.0008
Fruit girth	0.0010	2.9154**	0.1343	0.1815**	0.0007
Fruit weight	0.0355	11.7852**	2.6101**	4.2354**	0.0128
Number of fruits per plant	0.0135	43.4438**	10.1895**	0.2764**	0.0251
Number seeds per fruits	0.0214	86.2365**	25.3776**	2.5143**	0.0077
100 Seed weight	0.0198	6.4474**	1.1599**	0.2319**	0.0104
Fruit yield per plant	1.3889	22780.9111**	11515.7778**	758.6514**	1.0680

Table 2 : Estimates of general combining ability effects of parents.

Parents	Days to 50 % flowering	Plant height at maturity	Number of branches per plant	Intrno-dal length	Fruit length	Fruit girth	Fruit weight	Number of fruits per plant	Number seeds per fruits	100 seed weight	Fruit yield per plant
Line											
Annamalainagar	1.54**	10.21**	-0.25**	-0.36**	-0.19**	-0.41**	-1.08**	-0.03	-1.97**	-0.62**	-5.42**
Tirchy local	-2.53**	-15.21**	0.56**	0.59**	0.75**	0.51**	1.89**	2.50**	4.31**	0.90**	66.64**
Muthir	-1.21**	-8.72**	0.25**	0.36**	0.44**	0.79**	0.64**	1.50**	2.15**	0.76**	34.03**
AE-Tuticorin	1.77**	13.15**	-0.24**	-0.66**	-0.68**	-0.59**	-0.58**	-2.62**	-2.45**	-0.70**	-53.00**
HyVeg 155	-1.43**	-8.08**	0.01*	0.34**	0.34**	0.15**	0.14**	1.31**	1.50**	0.62**	19.66**
Local bhuvnagiri	1.87**	8.65**	-0.33**	-0.26**	-0.65**	-0.45**	-1.02**	-2.66**	-3.54**	-0.96**	-61.90**
SE for line	0.0881	0.0400	0.0070	0.0296	0.0092	0.0090	0.0377	0.00528	0.0293	0.0340	0.3445
Testers											
ArkaAnamika	0.09	-1.85**	0.19**	0.30**	0.26**	-0.08**	0.30**	0.74**	1.14**	0.27**	26.54**
MDU-I	-0.30**	1.43**	-0.19**	-0.19**	-0.20**	0.09**	-0.43**	-0.76**	-1.23**	-0.23**	-23.82**
Arka mini	0.21**	0.42**	0.00	-0.11**	-0.06**	-0.01	0.13**	0.02	0.08**	-0.04	-2.72**
SE for tester	0.0623	0.0283	0.0050	0.0209	0.0065	0.0064	0.0266	0.0373	0.0207	0.0240	0.2436

height at maturity, number of branches per plant, internodal length, fruit length, fruit girth, fruit weight, number of fruits per plant, number of seeds per plant, 100 seed weight, and fruit yield per plant. Muthir also exhibited significant and positive desirable *gca* effects for number of branches per plant, internodal length, fruit girth, fruit weight, number of fruits per plant, number of seeds per plant, 100 seed weight. HyVeg 155 revealed significant and positive *gca* effects for internodal length, fruit weight, number of seeds per plant, 100 seed weight. Among the testers, Arkaanamika showed significant *gca* effects for plant height at maturity, number of branches per plant, internodal length, fruit length, fruit weight, number of fruits per plant, number of seeds per plant, 100 seed weight and fruit yield per plant. This was followed by MDL-I, which -

showed significant *gca* effects for days to 50 per cent flower for fruit girth. Similar reports were presented by Singh and Sanwal (2010), Sanjeev and Pathania (2011), Amaranatha Reddy *et al.* (2013). Varnmunda *et al.* (2011), Senthilkumar and Kannan (2010), Praveen *et al.* (2012), Jagan *et al.* (2013) and Sibsankar Das *et al.* (2013).

Annamalainagar local × MDU-I was a promising cross combination which exhibited significant and *sca* effects for days to 50 per cent flower and number of seeds per fruit. HyVeg 155 × Arkaanamika exhibited significant and positive *sca* effects for number of branches per plant and fruit weight. Local bhuvnagiri × ArkaAnamika expressed significant and positive *sca* effects for fruit length and 100 seed weight. HyVeg 155

Table 3 : Estimates of general combining ability effects of parents.

Parents	Days to 50% flowering	Plant height at maturity	Number of branches/plant	Intrnodal length	Fruit length	Fruit girth	Fruit weight	Number of fruits per plant	Number seeds /fruits	100 seed weight	Fruit yield per plant
Line											
Annamalainagar x ArkaAnamika	1.13**	-0.20**	-0.12**	-0.07	-0.05**	0.08**	-0.07	-0.27**	-1.06**	-0.15*	-12.82**
Annamalainagar x MDU-1	-1.74**	0.65**	0.08**	-0.16**	0.20**	-0.00	0.16*	0.52**	1.16**	0.07	-3.62**
Annamalainagar x Arka mini	0.61**	-0.45**	0.04**	0.23**	-0.15**	-0.08**	-0.10	-0.25**	-0.10	0.08	16.44**
Tirchy local x ArkaAnamika	-1.22**	-2.66**	-0.03*	-0.12*	0.01	0.23**	0.16*	-0.00	0.62**	-0.19**	2.92**
Tirchy local x MDU-1	2.47**	4.69**	-0.03**	-0.14*	-0.15**	0.06**	-0.10	-0.21*	-1.47**	0.06	-13.51**
Tirchy local x Arka mini	-1.25**	-2.03**	0.06**	0.26**	0.13**	-0.30**	-0.05	0.21*	0.85**	0.13*	10.59**
Muthir x ArkaAnamika	-1.27**	0.94**	0.10**	-0.08	0.10**	-0.30**	0.82**	0.20*	0.18**	-0.20**	3.34**
Muthir x MDU-1	0.54**	-0.64**	-0.14**	0.04	-0.03	-0.00	1.03**	-0.20*	-0.51**	0.30**	-2.11**
Muthir x Arka mini	0.73**	-0.30**	0.04**	0.04	-0.07**	0.30**	-1.85**	0.00	0.33**	-0.10	-1.24*
AE-Tuticorin x ArkaAnamika	1.01**	2.82**	-0.16**	0.33**	-0.18**	-0.16**	-1.59**	0.00	-0.68**	0.23**	-11.45**
AE-Tuticorin x MDU-1	-0.82**	-2.30**	0.08**	0.01	0.12**	-0.13**	-0.50**	-0.22*	0.61**	-0.27**	5.63**
AE-Tuticorin x Arka mini	-0.19	-0.51**	0.08**	-0.35**	0.06**	0.29**	2.09**	0.22*	0.07	0.04	5.82**
HyVeg 155 x ArkaAnamika	-0.73**	0.63**	0.24**	-0.19**	-0.12**	0.11**	0.92**	-0.21*	0.71**	-0.18**	-3.40**
HyVeg 155 x MDU-1	0.49**	0.09	-0.06**	0.03	0.09**	-0.14**	-0.88**	0.28**	0.14**	0.13*	22.34**
HyVeg 155 x	0.24	-0.72**	-0.17**	0.16**	0.03	0.03*	-0.04	-0.08	-0.85**	0.05	-18.94
Arka mini Local bhuvnagiri x ArkaAnamika	1.08**	-1.52**	-0.03**	0.13*	0.23**	0.03	-0.24**	0.28**	0.23**	0.49**	21.40**
Local bhuvnagiri x MDU-1	-0.94**	-2.48**	0.08**	0.22**	-0.24**	0.22**	0.29**	-0.17	0.07	-0.29**	-8.73**
Local bhuvnagiri x Arka mini	-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 per cent level.

** - Significant at 1 per cent level.

× MDU-1 showed significant and positive *sca* effect for number of fruits per plant and fruit yield per plant. Similar results were also reported by Jagan *et al.* (2013) and Patel (2014), Pal and Sabeson (2009, 2012), Akotkar *et al.* (2014) Ranjithrajaram and Senthilkumar (2011) and Adhi Shankar *et al.* (2013).

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