Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP2: 436-439

Dr. Shiba Supriya Demta
Department of Horticulture and Genetics, Birsa Agricultural University, Ranchi, Jharkhand, India

Dr. Supriya Supal Surin
Department of Plant Breeding and Genetics, Birsa Agricultural University, Ranchi, Jharkhand, India

Correspondence
Dr. Shiba Supriya Demta
Department of Horticulture and Genetics, Birsa Agricultural University, Ranchi, Jharkhand, India

Combining ability analysis for yield and its traits of okra crosses (*Abelmoschus esculentus* L. Moench)

Dr. Shiba Supriya Demta and Dr. Supriya Supal Surin

Abstract
Crop improvement depends upon the magnitude of genetic variability present in the base population. The concept of combining ability analysis has been very useful in hybrid development. Exploitation of hybrid vigour is one of the important tools for increasing productivity. A field experiment was conducted at the Department of Horticulture BAU, Ranchi, using line x tester method of analysis (Kempthrone 1957). Experimental material was grown in Randomized Block Design (RBD) with three replications. Ten lines (female) and four testers (males) of Okra crop were crossed to estimate the combining ability and variance effects. The different characters considered were fruit yield Q/ha, plant height, height of internode, fruit per plant, fruit length and fruit weight. The results indicated that combining ability and variance effects for various traits showed a preponderance of non-additive gene action for all the characters. The lines KS-410, HRB 9-2, Parbhani Kranti, Punjab Padminiand and the testers VRO-5 and 156 Red were the superior performers for yield and its component traits with respect to general combining ability. The crosses IIVR -for fruits per plant responded significantly for specific combining ability. The crosses 155 Red X 315, HRB 9-2 X VRO-5, Parbhani Kranti X IIVR-10 were found to be superior when specific combining ability effects were considered for yield and its component traits.

Keywords: Line X tester, combining ability, GCA, SCA Okra.

Introduction
Okra (*Abelmoschus esculentus* L. Monech) is a member of the malvaceae family. Popular for its immature fruits used as vegetable. Apart from this it is used in paper industry and jaggery preparation. India is the largest producer of okra in the world, still there is a consistent pressure on higher yield. Crop improvement depends upon the magnitude of genetic variability present in the base population. Exploitation of hybrid vigour is one of the most important tools for increasing productivity. Breeding in okra has a high scope for hybrid development due to easy emasculation and high fruit setting. The concept of combining ability analysis has been very useful in hybrid development. It helps in identifying potential parental lines for producing better hybrids. It also provides information about the nature and relative magnitude of gene action involved in the expression of a character helpful in formulating suitable breeding methodology. Line X tester crossing technique is one among them which is widely used to study combining ability of the parents to be chosen for heterosis breeding.

Materials and Methods
The material for the present study comprised of 10 lines of okra viz. Parbhani Kranti, Punjab Padmini, Sel-10, HRB-9-2, IIVR-11, DOV-914, KS-410, 155 Red, Larm-1, HRB-55 and Four testers, VRO-5, 156 Red, 315 and IIVR-10. The lines and testers were crossed to generate forty cross combinations. These hybrids were grown in a randomized block design (RBD) with three replications in the Department of Horticulture, Birsa Agriculture University, Ranchi. Each Cross was raised in two rows of 4.0 m long with inter and intra row spacing of 50 and 25 cm respectively. Observations were recorded on five randomly selected plants. In each entry, for every replication observations were recorded with respect to fruit yield (q/ha), fruit length, fruit weight, fruits per plant, plant height and height of internode. The recommended cultural practices and plant protection measures were adopted. The data recorded were subjected to biometrical analysis as per the method suggested by Kempthorne (1957) [2].

Result and Discussion

The selection of potential parental line to combine well in hybridization is very crucial to the plant breeder. To supplement this problem, combining ability analysis is of special importance as it helps in identifying potential inbred line for producing synthetics and line showing superior performance in specific combinations would be useful for hybrid production. The results indicated SCA varience were greater than GCA varience for all the character studied, indication the predominant role of dominance gene action in governing these characters under study (Table 1). However the ratio GCA/SCA being, < 1 revealed preponderance of non-additive gene effects for all the characters. Similar observations were made earlier by Sharma and Mahajan (1978) and Sivagamasundhari *et al.* (1992) [4, 5].

Estimates of the general combing ability effects of fourteen parents have been given in (Table 2). The Line KS-410 exhibited high GCA estimates and was a good combiner for fruit yield, fruits per plant, height of internode and plant height. Line Parbhanikranti for fruit length, fruit weight and fruit yield. Line Pubjab padmini for fruit length and fruit weight. Line HRB-9-2 for plant height, height of internodes and yield characters by having significant GCA effects, proved good combiners. However Testers VRO-5 and 156 Red exhibited high GCA estimates and were good combiners for yield and its attributing characters. High GCA effects are related to additive gene effects or additive x additive effects Griffing (1956) [1], which represent the fixable genetic components of variance. It may therefore, be suggested that these parents with high GCA effects may be extensively used in hybridization programme for the improvement of these characters. Specific combining ability effects (SCA) of the forty cross combinations have been given in (Table 3). The SCA effect is an important criterion for the evaluation of hybrids. The cross combinations DOV-91-4 X 156 Red, Parbhani Kranti X IIVR -10, 155 Red X 315 showed the maximum, positive and significant SCA effect for the traits plant height. The crosses Parbhani Kranti X IIVR -10, DOV-91-4 X VRO –5, Punjab Padmini X VRO – 5 exhibited high positive significant SCA effects for height of internode.155 Red X IIVR-10, Parbhani Kranti X 156 Red, KS-410XVRO-5 showed positive significant SCA results with respect to fruits per plant. The SCA effects for fruit length were observed significant for SEL -10 X 156 Red, IIVR-11 X VRO -5, KS-410 X VRO-5.Crosses155 Red x 315, KS-410 X VRO-5, IIVR-11 X VRO -5 resulted positive SCA effect for fruit weight. The crosses 155 Red x 315, Larm-1 X IIVR-10 and HRB-9-2 X VRO -5, Parbhani Kranti X IIVR -10 resulted maximum positive significant results for fruit yield(Q/ha) (Table 3). Based on the SCA effect, the hybrids KS-410 X VRO-5 and 155 Red x 315 were found to be superior for commercial exploitation Shukla *et al* (1989) [6], Rani and Arora (2002) [7]. The cross IIVR-11 X IIVR-10 resulted from one parent with poor and another parent with good combining ability effects. This was due to involvement of non-allelic interaction of fixable as well as non-fixable genetic variables for yields Sarsar *et al*. [3].

The present study showed that both additive and non additive gene actions were important in the expression of the characters studied. However, the magnitude of non additive effects was greater than that of additive effects. These crosses having significant GCA effect and SCA effect could be exploited for further improvement for yield and yield attributing characters.

Table 1: Analysis of combining ability variance for different characters in okra.

Sl. No.	Source of variation	GCA	SCA	GCA/SCA
1	Plant Height cm	12.43	181.25***	0.07
2	Height of Internode cm	1.95***	4.69***	0.15
3	No. of Fruits/Plant	0.01	0.05	0.00
4	Fruits length cm	16.92***	108.17***	0.16
5	Fruit weight gm	0.47	1.83***	0.87
6	Estimated yield q/ha	64.0*	280.48***	0.23

Significant at 5% probability level *** significant at 15% probability level.

Table 2: Estimates of General combining ability effect of the parental lines for yield and its attributing traits of okra.

Parent	**Lines**										**Testers**			
Character	Punjab Padmini	Parbhani Kranti	Hrb-9-2	Iivr-11	Sel-10	Dov-91-4	Ks-410	155 Red	Larm-1	Hrb-55	Vro-5	156 Red	315	Iivr-10
Plant Height cm	-0.825***	-0.688***	3.754***	-9.938	3.087***	8.529***	4.637***	0.542	0.190	-9.288***	-2.693***	1.959***	1.044***	-0.300***
Height of Internode cm	-0.905***	-1.980***	2.098***	0.747	-2.322***	1.410**	2.710***	1.575***	-1.952***	-1.381***	0.462**	1.370***	-0.466***	-1.366***
No. of furits per plant	-0.162	-1.162***	-0.412**	0.347	-1.237**	0.813***	1.913***	0.422**	0.755***	-1.278***	0.455***	0.762***	-1.728***	0.522***
Fruit length cm	5.614**	8.084***	3.644**	1.197	-4.177***	-3.256	-3.091	-0.892***	3.838**	-10.960	3.925***	0.921*	-4.172***	-0.675
Fruit weight gm	0.597	1.048***	0.433*	-1.342	-0.198***	-0.543***	0.329*	-0.438***	0.239	-0.125***	0.635***	-0.001***	0.393	-1.027***
Furit yield q/ha	0.345	3.637**	4.979**	-2.773	1.196	-0.275***	13.503***	-11.829***	-9.464***	0.680	5.012***	9.099***	-5.731	-8.381***

Table 3: Estimates of Specific combining ability effect of the crosses for yield and its attributing traits of okra.

Variance	**Plant Height cm**	**Height of Internode cm**	**No. of Fruits Per Plant**	**Fruit Length cm**	**Fruit Weigthgm**	**Fruit Yield Q/Ha**
Punjab Padmini x Vro-5	6.972***	2.5536***	1.4883**	-1.3922	-0.8891	11.145***
Punjab Padmini x 156 Red	-11.1527***	1.4762*	-0.195	4.8744***	0.4139	6.581***
Punjab Padmini x 315	-10.6647***	-1.7447*	-0.038	2.7741*	-0.4907	-11.701***
Punjab Padmini x Iivr-10	14.8453***	-2.2851**	-1.255*	-6.2563***	0.9659	-6.025***
Parbhani Kranti x Vro-5	-4.1988***	-2.4048**	-2.0117***	-7.1497***	-2.5107***	-21.497***
Parbhani Kranti x 156 Red	-19.1402***	-2.4421**	2.605***	-0.8198	0.3689	13.220***
Parbhani Kranti x 315	0.1645	1-8003*	0.7283	-0.6334	1.5876	-7.300***
Parbhani Kranti x Iivr-10	23.1745***	3.0466***	-1.3217**	8.6029***	0.5543	15.576***
Hrb-9-2 x VRO-5	19.7928***	0.0469	-2.895***	5.7378***	0.0876	26.581***
Hrb-9-2 x 156 Red	-6.2485***	0.8196	2.0217***	1.6511	-0.4394	5.844***
Hrb-9-2 X 315	-12.1438***	-0.1881	-0.121	-6.8526***	0.5793	0.921***
Hrb-9-2 x Iivr-10	-1.4005	-0.6784	0.995*	-0.5362	-0.2274	-33.346***
Iivr-11 Xvro-5	0.2512	-0.6814	-2.0533***	17.6744***	2.0234***	7.537***
Iivr-11 X 156 Red	-5.3902***	-1.2721	0.4967	-16.6889***	-2.4736***	-22.287***
Iivr-11 X 315	-0.1522	2.1003**	0.6533	-7.5859***	0.5717	12.987***
Iivr-11 x Iivr-10	5.2912***	-0.1467	0.9033	6.6004***	-0.1216	1.763***
Sel-10 x Vro-5	-10.7405***	-1.9456**	1.63**	-10.5781***	-0.2807	-6.156***
Sel-10 x 156 Red	18.2848***	2.0037**	-1.02*	19.5919***	1-4089	10.624***
Sel-10 x 315	-0.1438	-1.8439*	0.7367	-2.8551***	-0.7091	12.101***
Sel-10 x Iivr-10	-7.4005***	1.7858*	-1.346**	-6.1588***	-04191	-16.569***
Dov-91-4 x Vro-5	-1.8488	2.5852***	0.4467	-3.7023***	-0.1191	4.562***
Dov-91-4 x 156 Red	28.4765***	0.3713	1.2633*	6.5078***	-0.5128	-9.972***

References

1. Griffings B. Concept of general and specific combining ability in relation to diallel crossing systems. Aust. J. Biol. Sci, 1956; 9:463-93.
2. Kempthorne O. An introduction to Genetics Statistics. John Willey and Sons, New York & London, 1957.
3. Sarsar SM, Patil RA, Bhatola SS. Heterosis, combining ability in upland cotton. Indian J. Agric. Sci, 1986; 56:567-73.
4. Sharma BR, Mahajan YP. Line X tester analysis for combining ability and heterosis for some economic characters in okra. Scientia Hort, 1978; 9:111-118.
5. Sivagamasundhari S, Irulappan I, Arumugam R, Jayasankar S. Heterosis in bhindi. South Ind. Hort., 1992; 40(2):79-82.
6. Shukla AK, Gautam NC, Tiwari AK, Chaturvedi AK. Heterosis and combining ability in okra (*Abelmoschus esculentus* L. Moench). Veg. Sci., 1989; 16(2):191-196.
7. Rani M, Arora SK. Combining ability studies in okra (*Abelmoschus esculentus* L. Moench). Res. Punj. Agri. Univ, 2002; 40(2):196-200.