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Studies on Gene Action and Combining Ability for Yield and Other Quantitative Traits in Brinjal (*Solanum melongena* L.)

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ABSTRACT

A set of 30 genotypes including 5 females, 4 males, their 20 F_1 hybrids and one standard check (Surti Ravaiya) were sown at Vegetable Research Scheme, Regional Horticulture Research Station, Navsari Agricultural University, Navsari to study the gene action and combining ability in brinjal (*Solanum melongena* L.) for 14 characters including fruit yield and its component characters following line x tester mating design. Combining ability analysis revealed that both additive as well as non-additive effects were important in the inheritance of all the traits studied. However, magnitude of variances due to *sca* was comparatively larger than those of *gca* for most of the economic traits indicated preponderance of additive component of genetic variance. Four crosses had desirable sca effects in addition to high per se performance for the trait.Among the parents, AB-8/5 and GJB-2 were good general combiners for majority of the traits, including fruit yield. The crosses *viz.,* AB-8/5 x GJB-2, JBR-6/7 x GJB-2, AB-7/2 x JDNB-19, JBR-8/7 x GOB-1 and AB-9/1 x GOB-1 showed higher order *sca* effects for fruit yield and its component characters.

Key words : combining ability, brinjal,

Brinjal (*Solanum melongena* L.) of the family Solanaceae is one of the important and popular vegetable crops grown in India and other parts of the world and is probably a native of India and has been in cultivation since prehistoric times. The productivity of F_1 hybrid has been reported to be high compared to varieties. Line × Tester is a useful tool for preliminary evaluation of genetic stock for use in hybridization to identify good combiners.

Information on combining ability and the types of gene action that governs the inheritance of economically important quantitative characters have an immense value in the development of an efficient breeding programme. It not only helps to identify parents and crosses which are likely to give maximum improvement for the characters under consideration, but also provides means of understanding the genetic architecture of metric traits.

In this context, the present investigation was under taken to elucidate information on the nature of gene action and combining ability of brinjal genotypes for fruit yield and yield component characters in addition to identification of hybrid for commercial exploitation.

MATERIALS AND METHODS

The experiment was conducted at Vegetable Research Scheme, Regional Horticulture Research Station (R.H.R.S.), Navsari Agricultural University, Navsari Gujarat. The experimental material for the present investigation was crossed in L X T fashion using 5 females (AB-7/2, AB-8/5, AB-9/1, JBR-6/7 and JBR-8/7) and 4 males (JDNB-19, GOB-1, GBL-1 and GJB-2). These 20 F_1s, 9 parents (5 females, 4 males) and a commercial check variety (Surti Ravaiya) composed the material for the present investigation. The experiment was laid out in Randomized Block Design (RBD) with three replication during *rabi* 2012. In each replication, parents and hybrids were planted in single row of 10 plants per entry. Row to row & plant to plant distance was 90 and 60 cm, respectively. The recommended agronomic practices and plant protection measures were adopted for raising a good crop. Five competitive plants were randomly selected from the middle of each row in each replication to record the observations on fourteen plant characters viz., seedling height (cm), plant height (cm), number of branches per plant, days to 1st flowering, days to 50 per cent flowering, number of flowers per inflorescence, number of fruits per inflorescence, fruit length (cm), fruit diameter (cm), fruit length : fruit diameter, average fruit weight (g), number of fruits per plant, fruit yield per plant (kg) and phenol content (mg/100g fresh weight).

RESULTS AND DISCUSSION

Analysis of variance (Table 1) revealed that variance due to female parents was highly significant for all traits, similarly, the male parents showed significant difference for all traits except seedling height and days to 50 per cent flowering, thus revealing the presence of sufficient genetic variability among them for majority of the characters studied.

The interaction between females x males was significant for all the characters studied except plant height and fruit weight. Parent vs. hybrids showed highly

Table 1: Analysis of variance for line X tester analysis for fruit yield and its component characters

Source of variation	d.f.	Seedling height (cm)	Plant height (cm)	Number of branches per plant	Days to first flowering	Days to 50 per cent flowering	Number of flowers per inflorescence	Number of fruits per inflorescence	Fruit length (cm)	Fruit diameter (cm)	Fruit length : Fruit diameter ratio	Average fruit weight (g)	Number of fruits per plant	Fruit yield per plant (kg)
Replications	2	0.25	72.05	1.49	5.45	15.20	0.12	0.008	0.038	0.185	0.061	30.350	2.418	0.023
Females	4	6.83**	742.82**	30.61**	67.52**	100.56**	11.73**	13.18**	60.468**	7.877**	7.002**	2140.683**	1716.91**	1.710**
Males	3	18.37**	410.51**	16.53**	22.90**	16.89	1.64**	2.77**	11.313**	1.64**	1.163**	87.244	463.435	0.784**
Females x Males	12	5.19**	87.52*	8.47**	12.06*	18.18*	0.27**	0.82**	0.924**	0.242	0.055	194.550**	386.232**	1.006**
Error	38	1.48	36.13	2.20	4.80	6.81	0.07	0.06	0.337	0.161	0.052	69.700	8.643	0.040
σ^2_{gca}		0.549*	36.233**	1.118**	2.456**	3.003**	0.475**	0.530**	2.590**	0.051	0.043**	68.105**	52.143**	0.017
σ^2_{sca}		1.291**	18.067*	2.155**	1.918	3.375*	0.068**	0.256**	0.103	0.89**	0.768**	42.292**	126.162**	0.323**
σ^2_{gca} / σ^2_{sca}		0.425	2.005	0.519	1.280	0.889	6.985	2.070	25.145	0.057	0.056	1.610	0.413	0.052

significant differences for all the characters except fruit length : fruit diameter ratio and fruit weight, which indicates that heterosis was reflected in hybrids.

In the present study, contribution of female for variability was found to be higher than that of males for all characters studied.

In the present study, both *gca* and *sca* variances were highly significant for seedling height, plant height, number of branches per plant, days to 50 per cent flowering, number of flowers per inflorescence, number of fruits per inflorescence, fruit length : fruit diameter ratio, fruit weight, number of fruits per plant and phenol content. This suggested that both additive and non-additive variances were important in the expression of these traits. Significance of both the variances have been reported by Das and Barua (2001), Baig and Patil (2002),Singh *et al.* (2003), Aswani and Khandelwal (2005), Suneetha *et al.* (2008) and Sao and Mehta (2011). The gca/ sca variance ratio being less than unity for most of the characters revealed predominance of non-additive components of variance (Table 2).

It was observed that none of the parent was showing simultaneously significant *gca* effects favourably for all the characters. These findings are supported by Patel *et al.* (1994), Kumar *et al.* (1996), Varshney *et al.* (1999), Das and Barua (2001), Singh *et al.* (2003), Aswani and Khandelwal (2005), Suneetha *et al.* (2005) and Sao and Mehta (2010). Among the parents AB-8/5, GJB-2 and JDNB-19 were found to be good general combiners for majority of the characters.

The parents with good general combining ability for a trait also exhibited well *per se* performance. This is true with the parents AB-8/5, AB-7/2, JBR-6/7 and GJB-2 for most of the characters. Therefore, these parents were noted as good source of favourable genes for increasing fruit yield per plant through various yield contributing characters and use of these parental lines would be more rewardaring for boosting fruit yield in brinjal. It was further noted that improvement of these parents had resulted in to crosses expressing useful heterosis for various traits.

As regard to specific combining ability (sca) effects the cross, AB-8/5 x GJB-2 significantly scored for total fruit yield and three other characters viz., number of flowers per inflorescence, number of fruits per inflorescence, number of fruits per plant and phenol content. Other cross combinations viz., JBR-6/7 x GJB-2, AB-7/2 x JDNB-19, JBR-8/7 x GOB-1 and AB-9/1 x GOB-1 were also significant for yield and most of the yield related traits. These crosses exhibited significant sca effects indicating the presence of dominance and epistatic (non-additive) type of gene action (Table 3). Similar results were reported by Kele *et al.* (1992) and Singh *et al.* (2003).

The superior crosses attempted through line X tester mating design utilizing local germplasm of brinjal on the basis of significant heterosis over better parent and sca effects can be further exploited for commercial cultivation after multilocation testing.

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