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COMBINING ABILITY ANALYSIS FOR YIELD AND ITS ATTRIBUTING TRAITS IN BLACKGRAM THROUGH DIALLEL ANALYSIS

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Abstract

The present study was undertaken to evaluate seven parents and forty two hybrids through diallel mating system, to study the general and specific combining ability effects and genetic analysis for various yields and yield attributing traits. Observations were recorded on single pant basis for traits *viz.,* days to 50 per cent flowering (days), while under metric trait include plant height at maturity (cm), number of branches per plant, and number of pods per plant, seed yield per plant (g) were recorded. Data was subjected to statistical and biometrical analysis given by Hayman and Jinks (1953). For the improvement of seed yield the cross combination ADT 5 x VBN 8, ADT 5 x VBN 6, VBN 8 x TU 68, VBN6 x TU 68 was best for the basis of *sca* effects, *per se* performance.

***Keywords*:** Diallel analysis, combining ability effects, *gca* and *sca* effects, biometrical analysis.

Introduction

Pulses are the important commodity group of crops that provide high quality protein, also known as grain legumes. India is one of the largest producer (25 per cent), consumer (27 per cent) and importer (14 per cent) of pulses which is suitable for growing in all three seasons (*kharif, rabi, summer*). Among all other pulses, Black gram (*Phaseolus mungo.* Linn / *Vigna mungo.*(L.) Hepper) is one of the important *kharif* pulse crop grown in India, which belongs to family fabaceae (leguminoceae). It is otherwise known as urd bean, black maple, mash, black lentil, mungbean etc. Though black gram is a very popular crop in the developing world, there is a massive gap in productivity because of the non-availability of high yielding varieties and lack of the quality seeds reported by (Vasanthakumar, 2016). To overcome these limitations breeders should take crucial step to improve the yield and its attributing traits of black gram by means of varietal improvement or hybridization programs. The efficiency of hybridization programme highly depends on selection of elite parents to be used. Therefore, the present investigation on diallel analysis in black gram done to get superior segragants and better recombinants.

Materials and Methods

The present investigation on the "Studies on genetic analysis through diallel mating system in black gram (*Vigna mungo* (L.) Hepper)" was carried out at experimental farm, department of Genetics and plant breeding, faculty of agriculture, Annamalai University, during season *kharif* 2019-2020, with an altitude of 5.79m above mean sea level, at 11 º 24' N latitude and 79 º 44' E longitude. Experiment includes 7 parental genotypes ADT-3, ADT-5. VBN-8, NANDI, VBN-5, VBN-6, TU-68, along with 42 F_1 hybrids was planted in a randomized block design with three replications fulfilling all recommended agronomical requirements.

Observations recorded

In order to record the observations, five plants are randomly selected in each treatment in all the three replications. For six characters include plant height, number of branch per plant, number of cluster per plant, number of pods per plant, were recorded on each plant basis, except for days to 50 per cent flowering for which data recorded on plot basis.

Biometrical analysis

The experimental data were compiled by taking the mean of each treatment separately for all the three replications. It was then subjected to the following biometrical procedures i.e. Analysis of variance, Combining ability analysis(diallel analysis Hayman and Jinks, 1953).

Results and Discussion

The results obtained from this investigation were presented and discussed under the following topics i.e., Analysis of variance, *Per se* performance of genotypes, Combining ability analysis. The analysis of variance for all characters were highly significant indicates the presence of genetic variability in selected genetic material chosen for this experiment (table.1).Among the parents ADT-5, VBN-8, VBN-6, TU-68 recorded significantly high value for most of the traits. Among cross combination ADT 5 x VBN 8, VBN 8 x TU 68, VBN 6 x TU 68, ADT 5 x VBN 6 show significantly high values for yield and yield attributing traits (table.2). Analysis of variance due to general and specific combining ability was significant for all the traits (table.3) indicating the presence of adequate amount of variability and there is possibility for selection of desirable plants fortraits of interest. (Selvam and Elangaimannan, 2010),(Upendra Kumar Sahu, 2016).

The estimates of combining ability effects, on the basis of *gca* effects (Table.4) indicated that ADT-5 show significant superior effect for days to 50 per cent flowering, number of branches per plant, number of clusters per plant, number of pods per plant. TU-68 show superior effect for earliness, number of clusters per plant. VBN-8 exhibit significant effect towards number of branches per plant, number of pods per plant. VBN-6 show significant effect towards number of pods per plant.

On basis of *sca* effects shows that VBN-6 x TU-68 and VBN-8 x TU-68 exhibit superior and highly significant effect towards seed yield per plant and attributing traits like number of branches per plant, number of clusters per plant, number of pods per plant,. Some other cross combination like ADT-5 x VBN-8 and ADT-5 x VBN-6 also exhibit superior effects towards earliness, plant height, number of clusters per plant, number of branches per plant. These chosen best hybrids also having high *per se* performance (Table 5).

The estimates of variance due to the of GCA were higher than the SCA for most of the traits includes plant height, number of branches, number of clusters per plant, number of pods per plant, seed yield per plant which indicate the presence of additive gene action in the expression of these traits. It also reveals that predominance of dominance gene action in the expression of days to 50 per cent flowering. Which was concordance with findings of Vijay Kumar *et al.,* (2017), Gill *et al.,* (2014)

Table 1: Analysis of variance for yield and yield attributing traits in black gram

SOURCE	Df	Days to 50 per cent flowering	Plant height at maturity	Number of branches per plant	Number of clusters per plant	Seed yield per plant
Replication	2	0.5217	1.4670	0.3537	0.1090	0.1726
Genotype	48	39.4262**	32.7209**	3.7494**	17.1806**	24.8029**
Error	96	0.3919	0.3796	0.3051	0.3102	0.0384
CD±5		1.012074	0.9961	0.8930	0.9005	0.3169
CD±1		1.344321	1.3230	1.1862	1.1961	0.4210
SE		0.3614	0.3557	0.3189	0.3216	0.1132

Table 2 : Mean performance of parents and hybrids for various traits.

Parents/ Crosses	Days to 50% flowering	Plant height at maturity	No. of branches per plant	No. of clusters /plant	Seed yield/ plant (g)
ADT3	35.33	45.8	3.33	7.33	4.77
ADT5	38.33	32.5	4	11.33	8.3
VBN 8	40.33	35.67	4.67	10.67	5.48
NANDI	38.67	49.8	3	7.67	6.77
VBN5	37.67	39.2	3.33	9.67	6.33
VBN6	37.33	35.83	3.33	8.67	7.63
TU 68	33.67	35	3.33	7.33	6.33
ADT3 x ADT5	40.33	40.6	2.33	5.33	1.78
ADT3 x VBN 8	42.67	40.87	2.67	4.33	1.53
ADT3 x NANDI	38.67**	37.87**	1.67	5.33	2.5
ADT3 x VBN5	40.33	35.40**	2	5	2.23
ADT 3 x VBN 6	41.33	40.77	2.67	7.33	2.67
ADT3 x TU 68	38.33**	42.47	3	5.33	3.14
ADT5 x ADT3	41.33	41.93	2.33	7.67	2.8
ADT5 x VBN8	30.33**	32.57**	6.67**	13.67**	11.23**
ADT5 x NANDI	40.67	41.83	3.33*	9.33**	4.1
ADT5 x VBN5	37.33**	42.93	3.67*	6.67	2.81
ADT5 x VBN6	35.33**	33.80**	6.33**	14.67**	12.27**
ADT5 x TU 68	39.33*	41.73	2.33	8.67	2.57
VBN8 x ADT5	35.33**	40.13	2	6	3.23
VBN8 x NANDI	36.67**	40.1	2.33	8.33	4.2
VBN8 x VBN 5	40.67	41.5	2.67	5.33	2.13
VBN8 x VBN6	41.67	41.8	1.67	5.33	1.84
VBN8 x TU 68	38.33**	32.07**	6.00**	13.33**	12.20**
NANDI x ADT3	46.67	40.93	1.67	7.33	2.5
NANDI x ADT5	45.33	41.83	2.33	6	2.13
NANDI x VBN8	46.33	40.63	3.67*	7.67	7.30**
NANDI x VBN 5	42.67	41.93	2.33	6.33	2.23
NANDI x VBN6	44.33	42.57	2.67	6	2.5
NANDI x TU 68	42.67	41.67	2.67	8.67	3.2
VBN5 x ADT 3	44.33	39.23	2.67	7	3.43
VBN5 x ADT 5	44.33	40.83	2.67	9.67**	3.2
VBN5 x VBN 8	40.67	42.23	2.33	6.67	2.37

Table 2 : Mean performance of parents and hybrids for various traits.

Parents/ Crosses	Days to 50% flowering	Plant height at maturity	No. of branches per plant	No. of clusters /plant	Seed yield/ plant (g)
VBN5 x NANDI	39.67	41.17	1.67	5.33	2.7
VBN5 x VBN6	45.33	39.73	2.67	7.67	2.73
VBN5 x TU 68	43.33	40.2	2.67	9.33**	4.49
VBN6 x ADT3	42.33	38.33**	2.33	7.33	2.17
VBN6 x ADT5	46	39.07	2.67	6.67	2.4
VBN6 x VBN 8	41.67	41.47	3.33*	8.33	4
VBN6 x NANDI	39.33*	39.63	2.67	7.33	3.17
VBN6 x VBN5	44.67	41.5	3	6.33	3.3
VBN6 x TU 68	33.67**	35.47**	5.33**	13.33**	12.37**
TU 68 x ADT 3	39.33*	39.37	2.33	8	2.33
TU 68 x ADT 5	41	38.33**	2.33	9.33**	2.87
TU 68 x VBN 8	43	41.67	2.67	9.00*	7.03**
TU 68 x NANDI	45.67	38.67*	2.33	8.33	2.67
TU 68 x VBN5	43.33	40.2	3.33*	5.67	2.63
TU 68 x VBN6	42.33	41.13	2.67	4.67	2.52

Table 3 : Analysis of variance for combining ability effects for yield and yield attributing characters.

SOURCES	Df	Days to 50 per cent flowering	Plant height at maturity	Number of branches per plant	Number of clusters per plant	Seed yield per plant
GCA	6	11.0833	20.21	2.145	10.72	11.42
SCA	21	14.25	11.06	0.762	3.097	7.894
RECIPROCAL	21	12.6217	7.223	1.482	6.931	7.742
ERROR	96	0.1306	0.0875	0.103	0.103	0.013
GCA/SCA		0.7777	1.827	2.814	3.461	1.446

Table 4 : Estimation of *gca*effects for yield and yield attributing traits

Parents	DFF	PH	NOB	NOC	SYP
ADT3	-0.03ns	0.80 **	-0.49 **	-1.31**	-1.30**
ADT5	-1.08**	-0.75**	0.37 **	1.21**	0.57 **
VBN8	-0.63**	-0.78 **	0.44 **	0.45 **	0.94 **
NANDI	1.25**	2.11**	-0.46 **	-0.57**	-0.53**
VBN5	0.97**	0.61 **	-0.25 **	-0.64**	-0.94**
VBN6	0.29**	-0.85 **	0.20 *	0.21**	0.50 **
TU 68	-0.77**	-1.13 **	0.18 *	0.64 **	0.76 **

Table 5 : Estimation of *sca* effects for yield and yield attributing traits.

CROSSES	DFF	PH	NOB	NOC	SYP
ADT3 x ADT5	1.34**	1.31 **	-0.54**	-1.21 **	-1.26 **
ADT3 x VBN 8	2.23**	0.81 **	-0.28 ns	-1.62**	-0.55 **
ADT3 x NANDI	0.84**	-3.43 **	-0.37 ns	0.41 *	0.04 ns
ADT3 x VBN5	0.80**	-4.01 **	0.08ns	0.14 ns	0.78 **
ADT 3 x VBN 6	0.96**	-0.31ns	-0.20 ns	0.62 **	-1.08 **
ADT3 x TU 68	-0.97**	1.34**	-0.01 ns	-0.48 *	-1.01 **
ADT5 x VBN8	-6.06**	-2.04**	0.53 **	0.36 ns	1.44 **
ADT5 x NANDI	2.23**	0.56**	-0.06 ns	-0.79**	-1.21 **
ADT5 x VBN5	0.34ns	3.19**	0.06ns	-0.21ns	-0.91 **
ADT5 x VBN6	0.84**	-1.88 **	0.94 **	1.43 **	1.97 **
ADT5 x TU 68	1.42**	2.00 **	-1.20 **	-0.67**	-2.90 **
VBN8 x NANDI	0.27ns	-0.88**	0.03 ns	0.31 ns	1.04 **
VBN8 x VBN 5	-0.28ns	2.11**	-0.68 **	-1.62**	-2.04 **
VBN8 x VBN6	1.39**	3.34**	-1.13 **	-1.64 **	-2.82 **
VBN8 x TU 68	1.46**	-1.14**	0.72 **	2.26 **	3.63 **
NANDI x VBN 5	-1.66**	-1.09 **	-0.28ns	-0.76**	-0.36 **
NANDI x VBN6	-0.32ns	-0.08ns	-0.06 ns	-0.79 **	-1.44 **
NANDI x TU 68	3.08**	-0.73 **	-0.20 ns	0.62 **	-1.59 **
VBN5 x VBN6	3.13**	0.94 **	-0.11 ns	-0.38ns	-0.84 **
VBN5 x TU 68	2.53**	0.81 **	0.08 ns	-0.31ns	-0.54 **
VBN6 x TU 68	-2.13**	0.37 *	0.63 **	0.33 ns	4.92 **

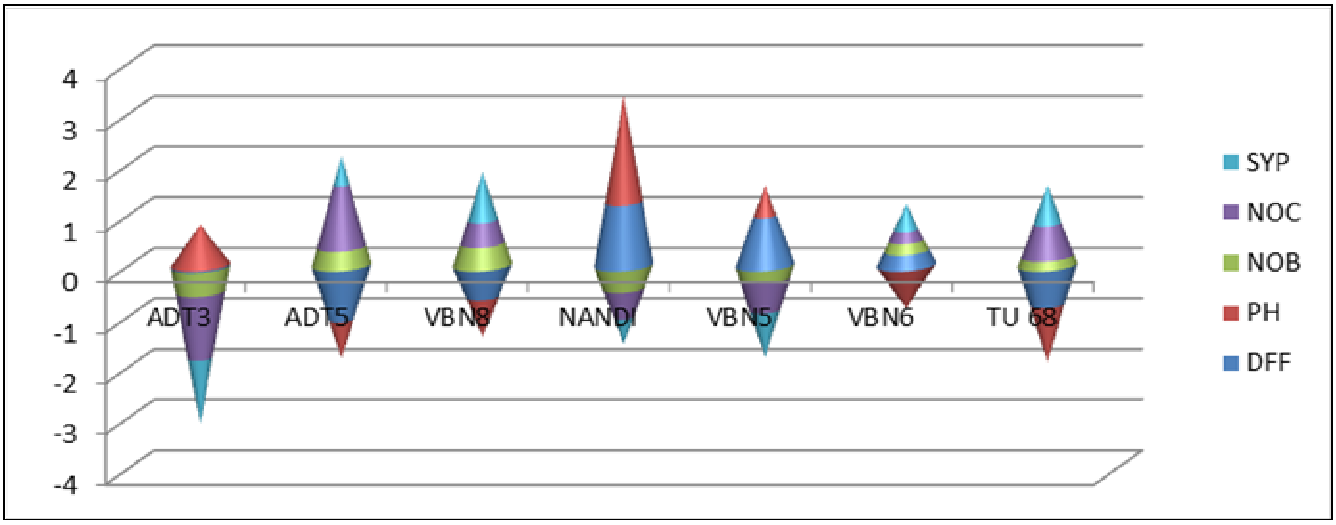

Chart 1 : Estimation of *gca* effects for yield and yield attributing traits

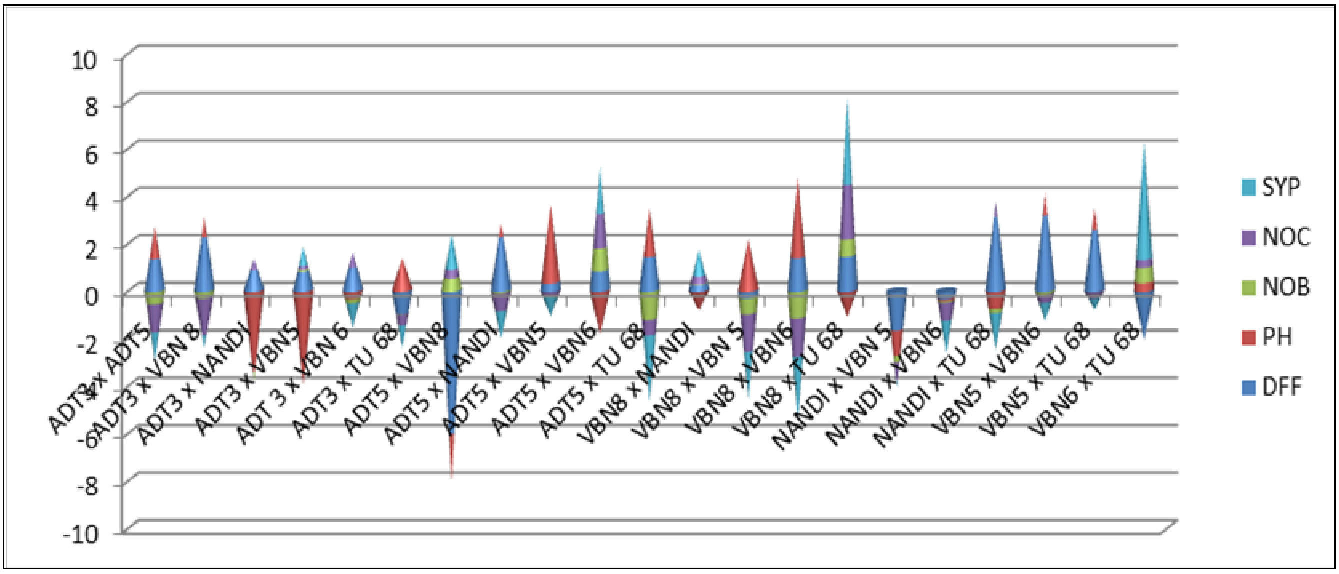

Chart 2 : Estimation of *sca*effects for yield and yield attributing traits

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