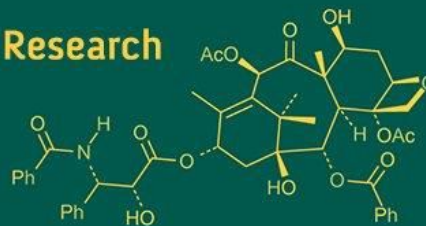


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(12): 25-28
www.biochemjournal.com
Received: 22-09-2024
Accepted: 30-10-2024

Naik SV
M.Sc. Agri., Department of
Agriculture Botany, College of
Agriculture, Dapoli,
Maharashtra, India

Desai SS
Senior Scientist, AICRP on
Agroforestry, College of
Forestry, Dapoli, Maharashtra,
India

Palshetkar MG
Assistant Professor,
Department of Agriculture
Botany, College of Agriculture,
Dapoli, Maharashtra, India

Mahadik SG
Vegetable breeder, CES
Wakavali, DBSKKV, Dapoli,
Maharashtra, India

Chavan VG
Associate Professor,
Department of Agronomy,
College of Agriculture, Dapoli,
Maharashtra, India

Patil SS
M.Sc. Agri., Department of
Agriculture Botany, College of
Agriculture, Dapoli,
Maharashtra, India

Bone SS
M.Sc. Agri., Department of
Agriculture Biotechnology,
College of Agriculture, Dapoli,
Maharashtra, India

Corresponding Author:
Naik SV
M.Sc. Agri., Department of
Agriculture Botany, College of
Agriculture, Dapoli,
Maharashtra, India

Studies on combining ability for yield and its attributes in blackgram (*Vigna mungo* (L.) Hepper)

Naik SV, Desai SS, Palshetkar MG, Mahadik SG, Chavan VG, Patil SS and Bone SS

DOI: <https://doi.org/10.33545/26174693.2024.v8.i12Sa.3062>

Abstract

A diallel set of 6 parents and their 15 F1 were studied fourteen characters to determine combining ability analysis. The analysis of variance revealed significant variation among the genotypes for all the characters. Based on general combining ability effects, the parents KKVVM-18 and KKVVM-20 were identified as good general combiners. The most promising specific combiners for yield and yield components were KKVVM-13 X KKVVM-20, KKVVM-9 X KKVVM-20 and KKVVM-10 X KKVVM-13.

Keywords: Combining ability, diallel, cross, variance, yield

Introduction

Blackgram (*Vigna mungo* (L.) Hepper) ($2n=2x=22$) is an important pulse crop of the tropics and semi-arid tropics. Blackgram is commonly called "urdbean," "udid" or "mash." It is one of India's most important pulse crops, grown during both the *kharif* and *rabi* seasons. Nutritionally, black gram is an excellent source of protein (25-26%), carbohydrates (60%), fats (1.5%), minerals and vitamins (Malik, 1994) ^[1]. It also contains important vitamins like vitamin A, B1 (thiamine), B3 (niacin) and vitamin C along with high levels of phosphorus and nitrogen. Black gram is highly nutritious and provides 347 calories per 100 grams. (Tharanathan and Mahadevamma, 2003) ^[2].

Blackgram is an important for nutritional security in developing countries due to its high nutritional value but it has a narrow genetic base with limited variation in its gene pool. This limits the availability of new varieties adapted to local conditions, which is a challenge for production. One of the main reasons for low productivity in blackgram farming is the low yield potential of existing varieties. Hybridization in blackgram helps to develop genotypes which are adaptable to local condition and having high yield with stress tolerance and disease resistance. For good result research efforts would need to concentrate on efficient hybridization procedures.

The knowledge of combining ability and gene action becomes a prerequisite in any plant breeding program, guiding the selection of superior parents and the creation of improved cross combinations. The present investigation was conducted to estimate the effects of general combining ability and specific combining ability for various traits in blackgram of superior parents and the development of enhanced cross combinations in blackgram breeding programs.

Materials and Methods

The experimental material for present investigation was carried out during *rabi*, 2024 at Experimental Research farm, Department of Agricultural Botany, Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli (MS). Six genotypes KKVVM-9, KKVVM-10, KKVVM-13, KKVVM-18, KKVVM-20 and KKVVM-6 were used as parents and crosses were made in diallel fashion. The fifteen hybrids, six parents and one check (TAU-1) evaluated in RBD with two replications adopting a spacing of 30 cm x 30 cm during *rabi* 2024. Recommended agronomical practices were adopted to raise the crop. Observations were recorded for fourteen characters namely Days to 50 percent flowering, Days to maturity, Plant height (cm), Number of clusters per plant, Number of pods per cluster,

Number of pods per plant, Number of branches per plant, Pod length (cm), Number of seeds per pod, Seed index (g), Grain yield per plant (g), Harvest index (%), Protein content (%) and Dry matter per plant (g). The general combining ability (GCA) effects of parents and specific combining ability (SCA) effects of hybrids were worked out as suggested by Griffing (1956) [3].

Results and Discussion

The analysis of variance showed significant differences for all the traits studied among the parents which indicated wide genetic variability among parents (Table 1). Similar results were reported by Indrani Dana and T. Dasgupta (2001) [4], Debbarma *et al.* (2022) [5] and Prasad and Murugan (2015) [6].

The GCA effect is a good estimate of additive gene action (Sprague and Tatum, 1942) [7]. The general combining ability effects of parents for different traits are presented in Table 2. Among the genotypes studied, no entry had manifested good general combining ability for all the quantitative traits. Among the six genotypes, KKVVM-18 emerged as a commendable general combiner for earliness-contributing characters, displaying a desirable significant negative performance for days to 50% flowering and days to maturity. The parents KKVVM-10, KKVVM-20 and KKVVM-6 were also found to be best general combiner for short plant stature. Among parents, KKVVM-18 demonstrated a desirable significant GCA effect for the traits number of clusters per plant, number of pods per plant, pod length, seed index, grain yield per plant, number of branches per plant and dry matter per plant. Parent KKVVM-9 and KKVVM-10 showing good general combining ability for the trait protein content. Hence, involvement of these genotypes in the crossing programme would result in the identification of superior segregants with favorable genes for seed yield and its attributes. These results are in agreement with Debbarma *et al.* (2021) [5], Shalini *et al.* (2019) [8], Vijay *et al.* (2017) [9], Panigrahi *et al.* (2015) [10] and Venkateswarlu *et al.* (2020) [11].

The results obtained in specific combining ability effect (Table 3) indicated that among 15 F1 cross combinations the highest magnitude of negative SCA effect for days to 50% flowering was exhibited for cross KKVVM-10 X KKVVM-18. The negative SCA effect is desirable because early maturity than the parents is advantageous. The assessments of the SCA effect indicated that none of the hybrids consistently demonstrated superiority across all traits.

The cross combinations KKVVM-13 X KKVVM-20, KKVVM-9 X KKVVM-20, KKVVM-10 X KKVVM-13 were identified as the most promising specific combiners for most of the yield and yield contributing characters. The cross KKVVM-13 X KKVVM-20 had been identified as the

best specific combiner for the number of clusters per plant, number of pods per cluster, number of pods per plant, number of branches per plant, grain yield per plant. Subsequently, the cross KKVVM-9 X KKVVM-20 was observed to be a promising specific combiner with respect to traits such as the number of clusters per plant, number of pods per plant, number of branches per plant, seed index, grain yield per plant and dry matter per plant.

For grain yield per plant, five cross combinations viz., KKVVM-13 X KKVVM-20, KKVVM-10 X KKVVM-13, KKVVM-9 X KKVVM-20, KKVVM-13 X KKVVM-6, KKVVM-10 X KKVVM-18 were observed as best specific combiners. SCA is the deviation from the performance predicted on the basis of general combining ability (Allard, 1956) [12]. High SCA effect alone may not be the appropriate choice of the hybrid for heterosis exploitation because the hybrids with low mean value may also possess high SCA effects, even if the GCA effects of the parents were very low or even negative (Grakh and Chaudhary, 1985) [13]. Being a self-pollinated crop, it is not possible to exploit heterosis, however it may be utilized if any new method or male sterility is identified in blackgram in future. The presence of highly significant GCA and non-significant SCA may be due to additive and additive x additive interaction. Hence, these crosses may be utilized for recombination breeding for further exploitation as these hybrids would throw segregants for high seed yield (kg/ha) in combination with early maturity. However the ratio of GCA/SCA variance indicated the preponderance of non-additive gene action and hence, selection could be postponed to later generations. Similar outcome was found in Debbarma *et al.* (2021) [5], Indrani Dana and T. Dasgupta (2001) [4], Vijay *et al.* (2017) [9], Panigrahi *et al.* (2015) [10], Reddy *et al.* (2021) [14], Prasad and Murugan (2015) [6] and Vaithiyalingam (2004) [14].

Table 1: Analysis of variance for combining ability for different characters in half diallel analysis of Blackgram genotypes.

Sr. No.	Characters	Mean sum of squares		
		GCA	SCA	Error
1.	Days to 50% flowering	35.605**	9.969	6.535
2.	Days to maturity	33.656**	18.590*	7.156
3.	Plant height (cm)	123.356**	32.329**	1.088
4.	Number of clusters per plant	4.994**	1.150**	0.058
5.	Number of pods per cluster	0.084**	0.025**	0.002
6.	Number of pods per plant	43.069**	12.904**	0.783
7.	Number of branches per plant	0.331**	0.085**	0
8.	Pod length (cm)	0.103*	0.032	0.025
9.	Number of seeds per pod	0.550**	0.171**	0.36
10.	Seed index (g)	0.423**	0.156**	0.026
11.	Grain yield per plant (g)	0.695**	0.021**	0.033
12.	Harvest index (%)	7.341**	6.005**	1.318
13.	Protein content (%)	3.595**	1.117	0.562
14.	Dry matter per plant (g)	3.598**	1.123**	0.103

Table 2: Estimation of general combining ability

Sr. No.	Parents	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of clusters per plant	Number of pods per cluster	Number of pods per plant	Number of branches per plant
1	KKVVM-9	-0.646	-0.906	-0.256	0.049	0.065 **	0.301	0.078 **
2	KKVVM-10	1.104	-0.844	-5.020 **	-0.828 **	0.132 **	-1.566 **	-0.241 **
3	KKVVM-13	2.292 *	2.000 *	3.735 **	-0.387 **	-0.173 **	-2.085 **	0.045 **
4	KKVVM-18	-3.177 **	-2.906 **	5.482 **	1.490 **	-0.027	4.344 **	0.307 **
5	KKVVM-20	-1.396	0.000	-2.132 **	-0.086	0.016	0.08	0.025 **
6	KKVVM-6	1.823 *	2.656 **	-1.810 **	-0.239 **	-0.013	-1.074 **	-0.214 **

* Significant at 5% LS and ** Significant at 1% LS

Sr. No.	Parents	Pod length (cm)	Number of seeds per pod	Seed index (g)	Grain yield per plant (g)	Harvest index (%)	Protein content (%)	Dry matter per plant (g)
1	KKVVM-9	-0.076	0.004	-0.187 **	-0.065	0.668	0.523 *	-0.255 *
2	KKVVM-10	-0.128 *	0.144 *	-0.306 **	-0.285 **	-0.725	1.004 **	-0.597 **
3	KKVVM-13	0.017	0.005	-0.019	-0.254 **	0.646	-0.504	-0.678 **
4	KKVVM-18	0.204 **	-0.388 **	0.115 *	0.444 **	0.295	0.115	1.028 **
5	KKVVM-20	0	0.386 **	0.346 **	0.273 **	0.725	-0.731 **	0.555 **
6	KKVVM-6	-0.017	-0.153 *	0.05	-0.113	-1.609 **	-0.406	-0.053

* Significant at 5% LS and ** Significant at 1% LS

Table 3: Estimation of specific combining ability

Sr. No.	Hybrids	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of clusters per plant	Number of pods per cluster	Number of pods per plant	Number of branches per plant
1	KKVVM-9 X KKVVM-10	1.05	-1.25	-1.93	-0.18	0.099 *	-0.28	-0.071 **
2	KKVVM-9 X KKVVM-13	4.62	6.906 *	-6.783 **	-1.750 **	0.123 **	-5.337 **	-0.403 **
3	KKVVM-9 X KKVVM-18	2.34	5.813 *	6.525 **	0.16	-0.212 **	-1.686 *	0.080 **
4	KKVVM-9 X KKVVM-20	-1.2	0.41	1.71	1.088 **	0.03	4.533 **	0.088 **
5	KKVVM-9 X KKVVM-6	2.59	-0.5	-4.748 **	-0.549 *	-0.161 **	-2.568 **	-0.224 **
6	KKVVM-10 X KKVVM-13	-1.88	-4.16	7.837 **	1.296 **	0.04	3.705 **	0.191 **
7	KKVVM-10 X KKVVM-18	-3.67	-3.75	4.395 **	0.534 *	-0.194 **	0.93	0.434 **
8	KKVVM-10 X KKVVM-20	0.8	2.34	6.024 **	0.940 **	-0.097 *	2.450 **	0.271 **
9	KKVVM-10 X KKVVM-6	-1.42	4.94	5.247 **	0.618 *	-0.108 *	1.24	0.180 **
10	KKVVM-13 X KKVVM-18	1.4	1.66	-5.276 **	-0.482 *	0.170 **	0.07	-0.198 **
11	KKVVM-13 X KKVVM-20	-3.63	0.5	1.62	0.929 **	0.238 **	4.779 **	0.135 **
12	KKVVM-13 X KKVVM-6	-1.35	-1.41	-4.104 **	0.747 **	0.01	2.852 **	-0.02
13	KKVVM-18 X KKVVM-20	5.335 *	3.91	-1.05	-1.253 **	0.02	-4.465 **	-0.367 **
14	KKVVM-18 X KKVVM-6	0.87	3.75	0.19	-0.42	0.111 *	-1.09	0.03
15	KKVVM-20 X KKVVM-6	2.09	0.84	2.334 *	0.751 **	0.03	0.97	0.324 **

Sr. No.	Hybrids	Pod length (cm)	Number of seeds per pod	Seed index (g)	Grain yield per plant (g)	Harvest index (%)	Protein content (%)	Dry matter per plant (g)
1	KKVVM-9 X KKVVM-10	-0.03	0.07	-0.23	-0.18	-0.88	1.15	-0.32
2	KKVVM-9 X KKVVM-13	-0.27	0.648 **	-0.527 **	-0.601 **	1.34	0.15	-1.536 **
3	KKVVM-9 X KKVVM-18	0.1	-0.33	0.15	-0.13	1.01	-0.48	-0.5
4	KKVVM-9 X KKVVM-20	0.17	-0.02	0.498 **	0.437 *	-0.57	-0.75	1.086 **
5	KKVVM-9 X KKVVM-6	0.1	0.601 **	0.494 **	0.08	-0.96	-1.637 *	0.35
6	KKVVM-10 X KKVVM-13	0.18	-0.467 *	0.3	0.468 *	-0.64	-0.92	1.202 **
7	KKVVM-10 X KKVVM-18	0.11	0.04	0.468 **	0.385 *	0.22	-1.16	0.985 **
8	KKVVM-10 X KKVVM-20	0.14	-0.413 *	0.13	0.31	-1.1	-0.79	1.053 **
9	KKVVM-10 X KKVVM-6	0.18	-0.23	0.468 **	0.3	2.829 *	-0.32	0.32
10	KKVVM-13 X KKVVM-18	0.07	0.375 *	0.01	-0.16	-3.589 **	0.3	0.17
11	KKVVM-13 X KKVVM-20	0.25	-0.36	0.16	0.576 **	0.8	1.25	1.220 **
12	KKVVM-13 X KKVVM-6	-0.09	0.22	0.356 *	0.437 *	1.08	0.92	0.867 **
13	KKVVM-18 X KKVVM-20	-0.22	-0.02	-0.29	-0.757 **	-3.644 **	0.19	-1.252 **
14	KKVVM-18 X KKVVM-6	0.03	0.19	-0.1	0.03	3.705 **	-0.48	-0.41
15	KKVVM-20 X KKVVM-6	0.04	-0.12	-0.314 *	0.11	2.934 *	1.621 *	-0.19

Conclusion

The present investigation showed that there was significant variation among all genotypes studied. Parent KKVVM-18 was good general combiner for earliness. Among parents, KKVVM-9 and KKVVM-10 were good general combiners for the trait protein content. Considering the improvement in yield and yield contributing characters KKVVM-18 and KKVVM-20 were found to be good general combiners.

References

- Allard RW. The analysis of genetic-environmental interactions by means of diallel crosses. Genetics. 1956 May;41(3):305.
- Dana I, Dasgupta T. Combining ability in blackgram. Indian J Genet Plant Breed. 2001;61(2):170-171.
- Debbarma P, Kant R, Mishra SB, Bharti LJ, Rojaria V, Barman M. Combining ability and heterosis studies in blackgram [*Vigna mungo* (L.) Hepper]. Legume Res Int J. 2022;45(6):676-682.
- Grakh SS, Chaudhary MS. Heterosis for early maturing and high yield in *Gossypium arboreum*. Indian J Agric Sci. 1985;55:10-13.
- Griffing B. Concepts of general and specific combining ability in relation to diallel hybridizing system. Aust J Biol Sci. 1956;9:463-493.
- Kumar GV, Vanaja M, Abraham B, Lakshmi NJ, Sarkar B. Heterosis and combining ability studies in blackgram (*Vigna mungo* L. Hepper) under alfisols of SAT region, India. Electron J Plant Breed. 2017;8(2):541-547.
- Malik BA. Grain legumes. In: Bashir E, Bantel R, editors. Crop Production. Islamabad: National Book Foundation; 1994. p. 277-328.
- Panigrahi KK, Mohanty A, Pradhan J, Das TR, Baisakh B. Estimation of combining ability in black gram

- (*Vigna mungo* (L.) Hepper) for yield and its attributing traits using the diallel crossing method. Electron J Plant Breed. 2015;6(3):651-657.
9. Prasad AD, Murugan E. Combining ability analysis for yield and its attributes in blackgram (*Vigna mungo* (L.) Hepper). Electron J Plant Breed. 2015;6(2):417-423.
 10. Reddy AK, Reddy DM, Vemireddy LR, Sudhakar P, Reddy BB. Studies on heterotic trends in blackgram [*Vigna mungo* (L.) Hepper] for yield and earliness. Legume Res Int J. 2020;1:6.
 11. Shalini CH, Lal GM. Heterosis and combining ability studies for yield and yield components in blackgram (*Vigna mungo* L. Hepper) under different environmental conditions of Prayagraj region, India. J Pharmacogn Phytochem. 2019;8(3):3512-3516.
 12. Sprague GF, Tatum LA. General vs. specific combining ability in single crosses of corn. J Am Soc Agron. 1942;34:923-932.
 13. Tharanathan RN, Mahadevamma S. Grain legumes, a boon to human nutrition. Trends Food Sci Technol. 2003;14:507-551.
 14. Venkateswarlu O, Naik BSK. Studies on combining ability for yield and its attributes in black gram (*Vigna mungo* L. Hepper). J Pharmacogn Phytochem. 2020;9(1):1547-1549.