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Study of combining ability effect of parents and crosses [*Vigna radiata* (L.) Wilczek]

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Abstract

The present investigation on “Combining Ability Studies in Mungbean (*Vigna radiata* L. Wilczek)” was conducted during *Kharif* 2016-17 with an objective to estimate the general combining ability (GCA) effects of parents, specific combining ability (SCA) of crosses for seed yield and it’s components. The tester BM 2011-1 was a good general combiners for seed yield per plant and most of the traits. Among line BPMR 145 recorded significant GCA effect for four characters and found good general combiner in GCA status. Among the cross combination AKM 8802 x BM 2011-1 recorded the highest SCA effect for seed yield per plant, VAIBHAV x TBM 9 recorded highest SCA effect for the Number of pods per plant.

Keywords: Mungbean, general combining ability, specific combining ability

Introduction

Pulses, best known as “poor man’s meat”, constitute the major source of dietary protein of the large section of vegetarian population of the world. On an average, pulses contain 20 to 30 per cent protein, which is almost 2.5 to 3.0 times the value normally found in cereals. Pulses also play an important role by fixing biological nitrogen and thus enhance the soil fertility. It is also useful to cattle as it is a fodder and concentrate (Rahim *et al*., 2010). Pulses occupy 68.32 million hectares and contribute 57.51 million tonnes to the world food basket (Chaturvedi and Ali, M., 2002). India is the largest producer and consumer of pulses in the world accounting for 33 per cent of world area and 22 per cent of world production. Among the pulses, mungbean is a well known crop among Asian countries. The dietary or nutritional value of mungbean has been very popular from ancient times as it plays a vital role in meeting the requirements of easily digestable protein. Mungbean is an economically important short duration pulse crop characterized by relatively more palatable, nutritive, cheap source of high quality and easily digestable protein, non flatulent than other pulses and constitute an important source of cereal based diets in Asia (Kamleshwar *et al*., 2014). It is mainly utilized in making dhal, curries, soup, sweets and snacks. The germinated seed have nutritional value compared with Asparagus or mushroom. During sprouting, there is an increase in thiamine, niacin and ascorbic acid concentration. The food values of mungbean lie in its high and easily digestible protein. Saleem *et al*. (1998) reported that seed contains the following components namely total protein (22.88-24.65%), total aminoacid (20.98-25.61%), crude fibre (4.30-4.80 %) and lipids (1.53-2.63%). Like other pulses, the protein of mungbean is rich in lysine, an essential amino acid that is absent in cereal grains. In India, greengram covers an area of 3.53 million hectare with a total production of 1.49 million tonnes and the average productivity of 532 kg/ha (Iranna and Kajjidoni, 2008). Important green gram growing states in India are Orissa, Andhra Pradesh, Maharashtra, Karnataka and Bihar. The area under green gram in Maharashtra is 5.11 lakh ha with production of 2.89 lakh tonnes and productivity of 187 Kg/ha. during 2016-17 (Anonymous 2017). This is less than half of the national productivity there by indicating the scope to improve its productivity potential. Green gram belongs to family leguminaceae and sub family Papilionaceae. It's chromosome number is 2n=22. Over 2000 different types have been reported. Green gram is rapidly growing, erect or sub-erect, annual, usually 30 to 90 cm in height and showing considerable variation in form and adaptation. Inspite of high demand, the yield of greengram worldwide is very low (384 Kg/ha) and limited success have been achieved so far in augmenting its yield. To enhance the present

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yield levels, it is essential for a systemic varietal improvement through hybridization and exploitation of generated variability through recombination breeding. To breed a genotype with high yielding potential, the information on the genetic mechanism controlling various traits in the material being handled, is a pre-requisite. In order to accomplish this task, combining ability analysis has to be performed which furnishes the information to identify desirable parents and genetic architecture of the crosses. The estimates of combining ability along with per se performance of genotypes in crop improvement programme have a direct bearing upon choice of breeding methodology to be followed and to identify the parent and crosses (Khattak *et al*., 2004), which could be exploited in future breeding programme. Study of GCA effects helps in selection of superior parents and SCA effects for superior hybrids.

Material and Method

The present investigation entitled "Study of Combining ability in Mungbean (*Vigna radiata* L. Wilczek)" was carried out during *Kharif* 2016 at experimental field of Agricultural Research Station, Badnapur. The material comparised were followed in the present investigation by using 4 lines, 6 testers and their 24 F1's along with check BM 2003-2. The parents for experiment included six genotypes of mungbean *(Vigna radiata* L. Wilczek) as testers and four varieties *viz*. BM 4, BPMR145, AKM 8802, and VAIBHAV as lines. Each female was crossed with six selected male genotypes. Fresh mean sum of squares along with the variance of general combining ability (GCA) of the parent and specific combining ability (SCA) of the hybrids were worked out based on the procedure developed by Kempthorne (1957) [7].

Result and Discussion

The mean sum of squares due to genotypes were highly significant for all the traits studied. This indicated the presence of substantial genetic variability among genotypes for all the traits studied. Further partitioning of genotypic variance into components *viz.,* parents, crosses and parents vs. crosses revealed that the parents differed significantly among themselves for all the characters under study. The mean square due to crosses also showed highly significant differences for the nine traits except the pod length. Similar results were reported by Aher *et al.* (2001). Among the crosses, the crosses BPMR 145 x BPMR 135 and AKM 8802 x BPMR 135 was found to be earliest for days to maturity. The cross BM 4 x BMG 108 was recorded highest mean performance for plant height. The cross BPMR 145 x BPMR 135 was revealed highest mean performance for number of clusters per plant. The cross BM 4 x TBM 11 was recorded highest mean performance for number of pods per clusters. The cross BPMR 145 x BM 2011-1 was recorded highest mean performance for number of pods per plant. The cross BPMR 145 x BM 2011-1 was recorded highest mean performance for number of seeds per pod. The cross BPMR 145 x TBM 9 was recorded highest mean performance for length of pod. The cross BPMR 145 x BPMR 75 was recorded highest mean performance for hundred seed weight. The cross AKM 8802 x BM 2011-1was recorded highest mean performance for grain yield per plant. Thus, these cross combinations with high *per se* performance for most of the traits can be employed for improvement of these traits.

Line x tester analysis in twenty four crosses obtained by crossing four lines with six testers was carried out and the total variance due to crosses was partitioned into portions attributable to females (lines), males (testers), interaction females vs. males (lines vs. testers) and error sources. The variance due to females were significant for days to 50% flowering,number of clusters per plant,number of pods per cluster, number of pods per plant,number of seeds per pod, pod length (cm) 100 seed weight (g) and seed yield per plant (g). While the variance due to males were significant for plant height (cm). The variance due to lines vs. testers were highly significant for number of pods per plant, plant height (cm), seed yield per plant (g). This indicate the presence of significant differences between males and females.

Among female parents, BM 4 exhibited significant GCA effects for number of clusters per plant, number of pods per plant. The line BPMR 145 exhibited significant GCA effects for number of clusters per plant, number of pods per plant, Pod length (cm), 100 seed weight (g) and seed yield per plant (g). While AKM 8802 was good general combiner for days to 50% flowering, days to maturity and 100 seed weight. Out of six testers TBM 9 was a good general combiner for days to 50% flowering, number of pods per plant, whereas TBM 11 was found good general combiner for number of pod per plant. The tester BM 2011-1 was found good general combiner for plant height number of pods per plant and seed yield per plant (g) where as BPMR 75 were and BPMR 135 a good general combiner for Plant height (cm) Similar results were reported by Reddy and Sreeramulu (1982), Choudhary (1986) [3], Halkunde *et al.*, (1996) [5], Dasgupta *et al.,* (1998) [4], Jahagirdar (2001) [6], Aher *et al.,* (1999) [1], Singh (2005) [11], Barad *et al*., (2008) [2] and Patil *et al.*, (2011) [9]. The cross combination BPMR 145 x BPMR 135(3.27) and Vaibhav x TBM 9 (2.10) had recorded highest significant desirable SCA effect for number of clusters per plant. Similar results were also reported by Manjare (1976) and Shanthi Priya *et al.* (2012) [8, 10]. The cross combination AKM 8802 x BM 2011-1 (5.05) recorded highest significant desirable SCA effect for grain yield per plant. Similar result has also been reported by Barad *et al.* 2008 [2] and Patil *et al.* (2011) [9] for seed yield per plant.

Table 1: Estimation of general combining ability with respect to ten characters in Mungbean (V*igna radiata* L. Wilczek)

Genotype	Days to 50% Flowering	Days to maturity	Plant height (cm)	Number of clusters per plant	Number of pods per cluster	Number of pods/ plant	Number of seeds / pod	Pod length (cm)	100 seed weight (g)	Yield per plant (g)
Lines										
BM 4	0.98*	0.97	0.61	1.39*	0.18	6.29*	-0.34	-0.93*	-0.61*	-0.69
BPMR 145	0.56	-0.18	0.34	2.12*	0.09	6.26*	0.40	0.67*	0.63*	2.44*
VAIBHAV	0.47	1.14	-1.33	-1.20*	0.05	-4.07*	-0.22	0.08	-0.33*	-0.94
AKM 8802	-2.02**	-1.93**	0.37	-2.30**	-0.33**	-8.48**	0.15	0.17	0.31**	-0.81
S. E. ±	0.61	0.86	1.01	0.47	0.14	0.97	0.37	0.35	0.15	0.72
CD at 5%	1.26	1.77	2.09	0.98	0.30	2.01	0.77	0.73	0.31	1.49
CD at1%	1.71	2.41	2.83	1.33	0.41	2.72	1.05	0.99	0.42	2.02

Testers										
TBM 9	-1.10*	-0.14	-5.44*	0.32	-0.006	3.02*	0.14	-0.22	-0.15	-1.00
TBM 11	-0.10	0.47	-4.49*	0.40	0.21	1.82*	-0.10	0.62	0.02	0.90
BM 2011-1	0.27	-0.64	2.26*	0.30	-0.05	2.14*	0.39	-0.05	0.14	1.33*
BMG 108	1.27*	1.73*	1.75	-1.02*	0.01	-3.30*	-0.15	-0.09	0.12	-0.10
BPMR 75	0.14	-1.02	2.76*	-0.12	-0.08	-1.57	0.07	0.03	0.33	0.27
BPMR 135	-0.47	-0.39	3.15*	0.12	-0.09	-2.15*	-0.34	-0.27	-0.25	-1.40*
S. E. ±	0.74	1.05	1.23	0.58	0.18	1.19	0.46	0.43	0.18	0.88
CD at5%	1.54	2.17	2.56	1.20	0.37	2.46	0.95	0.89	0.38	1.83
CD at1%	2.09	2.95	3.47	1.63	0.50	3.34	1.29	1.21	0.51	2.48

* and ** indicates significance at 5 and 1 per cent level respectively

Table 2: Estimation of specific combining ability with respect to ten characters in Mungbean *(Vigna radiata* (L.) Wilczek)

S. No	**Crosses**	**Days to 50% flowering**	**Days to maturity**	**Plant height**	**Number of clusters per plant**	**Number of pods per cluster**	**Number of pods/ plant**	**Number of seeds/ pod**	**Pod length**	**100 seed weight**	**Seed Yield per plant**
1	BM 4 x TBM 9	-0.23	1.89	-1.19	-0.39	0.09	-0.19	0.04	-0.27	-0.05	-0.92
2	BM 4 x TBM 11	-0.23	-0.72	-3.64*	1.03	0.66*	3.18	-0.70	-0.12	-0.11	-0.31
3	BM 4 x BM 2011-1	-1.10	-1.10	1.44	-1.06	-0.26	-6.16*	-0.10	0.34	0.01	-1.15
4	BM 4 x BMG 108	2.39*	1.02	6.22*	1.25	-0.43	4.34*	0.74	0.18	0.02	-1.44
5	BM 4 x BPMR 75	0.02	-1.79	-0.45	0.75	0.06	2.10	0.60	0.20	0.24	3.62*
6	BM 4 x BPMR 135	-0.85	0.64	-2.39	-1.59	-0.12	-3.26	-0.57	-0.32	-0.09	0.21
7	BPMR 145 x TBM 9	-0.31	-1.93	2.38	-0.42	-0.11	-2.41	-0.01	0.66	0.19	1.22
8	BPMR 145 x TBM 11	-0.81	1.43	2.93	-1.30	-0.44	-1.41	0.14	-0.23	-0.07	-1.28
9	BPMR 145 x BM 2011-1	1.31	0.06	-3.83*	0.10	0.13	3.07	0.54	-0.01	-0.14	-0.01
10	BPMR 145 x BMG 108	-0.68	2.68	-5.32*	-2.77*	-0.04	-9.65*	-0.01	0.12	-0.23	-0.06
11	BPMR 145 x BPMR 75	-0.56	0.43	2.66	1.12	0.15	4.85*	-0.14	-0.25	0.34	-0.47
12	BPMR 145 x BPMR 135	1.06	-2.68	1.18	3.27*	0.31	5.56*	-0.52	-0.28	-0.08	0.61
13	VAIBHAV x TBM 9	0.27	-0.27	-1.03	2.10*	0.22	10.40*	0.52	-0.19	-0.11	-0.73

Contd. Table 2.

S. No	**Crosses**	**Days to 50% flowering**	**Days to maturity**	**Plant height**	**Number of clusters per plant**	**Number of pods per cluster**	**Number of pods/ plant**	**Number of seeds/ pod**	**Pod length**	**100 seed weight**	**Seed Yield per plant**
14	VAIBHAV x TBM 11	0.27	0.60	0.01	0.73	-0.20	-0.68	0.47	0.10	-0.01	2.09
15	VAIBHAV x BM 2011-1	-0.14	-0.27	1.75	-0.46	-0.12	-4.20*	-0.02	-0.22	0.02	-3.88*
16	VAIBHAV x BMG 108	-0.60	-3.14	-0.94	0.05	0.09	-0.98	-0.17	-0.48	-0.11	1.98
17	VAIBHAV x BPMR 75	0.02	0.10	-0.44	-1.64	0.09	-3.62*	-1.21	-0.10	-0.04	-1.03
18	VAIBHAV x BPMR 135	0.14	2.97	0.66	-0.79	-0.09	-0.90	0.41	0.90	0.26	1.57
19	AKM 8802 x TBM 9	0.27	0.31	-0.15	-1.29	-0.19	-7.79*	-0.55	-0.18	-0.03	0.43
20	AKM 8802 x TBM 11	0.77	-1.31	0.69	-0.46	-0.01	-1.07	0.09	0.26	0.19	-49.00
21	AKM 8802 x BM 2011-1	-0.10	1.31	0.63	1.43	0.25	7.30*	-0.40	-0.11	0.12	5.05*
22	AKM 8802 x BMG 108	-1.10	-0.56	0.42	1.45	0.38	6.29*	-0.55	0.17	0.33	-0.47
23	AKM 8802 x BPMR 75	0.52	1.18	-1.76	-0.24	-0.31	-3.33	0.75	0.15	-0.54	-2.12
24	AKM 8802 x BPMR 135	-0.35	-0.93	0.54	-0.89	-0.10	-1.39	0.67	-0.28	-0.08	-2.40
S. E. ±		1.49	2.10	2.47	1.06	0.36	2.38	0.92	0.86	0.36	1.79
CD at 5%		3.09	4.35	5.12	2.19	0.74	4.92	1.90	1.78	0.76	3.66

* and ** indicates significance at 5 and 1 per cent level respectively.

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