Received: 23 Sep 2019 | Revised: 16 Aug 2020 | Accepted: 18 Aug 2020

Electronic Journal of Plant Breeding

Research Note

Genetic assessment of relationship for leaf shape toward yield traits among F5 progenies of interspecific cross derivatives of *Vigna radiata* x *Vigna mungo*

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Abstract

The mean performances of F_5 progenies obtained from an interspecific cross between greengram (*Vigna radiata* cv (VBN(Gg)2)) and blackgram (*Vigna mungo* cv (Mash 114)) showed some of progenies viz., 7-6, 12-13, 12-24, 5-3 and 30-70 recorded significant superiority on seed yield per plant and also with some other yield traits too. Based on the leaf shape, the F_5 progenies were grouped as lobed and ovate respectively as the green gram VBN(Gg)2 is lobed and blackgram Mash 114 is ovate to know the key component besides the superiority on yield and yield components among the segregating progenies as enormous variations were observed. The association analysis among the progenies based on the leaf shape groups revealed that the association among both the leaf group on seed yield per plant and its component traits are similar except for 100- seed weight as same as the parents. Hence the association confirmed that the variation has been governed by the blackgram genome to the green gram genome. Hence, the selection indices for ovate leaf group, emphasis should be given to 100- seed weight in addition to other traits viz., plant height, the number of branches per plant, the number of clusters per plant, the number of pods per clusters, the number of pods per plant, pod length and the number of seeds per pod. However, the selection indices for lobed leaf group to be given to all the traits except 100 – seed weight. In general, among the traits studied the first and foremost importance has to be given for the number of pods per plant, the number of clusters per plant and the number of branches per plant followed by other yield traits while framing the selection procedure for the interspecific progenies. Further selection is to be based on MYMV disease resistance and yield attributes for developing superior performing varieties among the derivatives of green gram and blackgram interspecific cross.

Key words

Greengram, interspecific derivatives, correlation, leaf shape, yield attributes

Legumes represent the second largest family of higher plants, second only to grasses, in agricultural importance (Kumar *et al.*, 2013). Among legumes, greengram (*Vigna radiata* (L.) is the third most important annual crop of Asia (Alam *et al.*, 2014) due to high protein content, broad adaptation, lesser agronomical requirement and high ability to increase soil fertility (Makeen *et al.*, 2007; Zaid *et al.*, 2012). Greengram is rich in source of proteins (22-28%), carbohydrates (60-65%), fat (1-1.5%), fibers (3.5-4.5%) and iron (40–70 ppm) for nutritionally balanced cereal-based diets in South and Southeast Asia (Bains *et al.*, 2003; Weinberger, 2005). Improvement of greengram, being important pulse crop of India, is an important task for pulses breeders. Development of improved varieties with high genetic potential will increase yield to a greater extent. A huge amount of diversity is present in worldwide to be exploited by greengram breeders. As the genetic variability present in the cultivated greengram lines is less, the identification of diverse parents is of utmost important. The efficiency of selection will increase, if the nature and magnitude of inter-relationship among component character and seed yield is understood.

Interspecific hybridization is one of the methods of creation of genetic variability and widening of genetic base of a crop species. Continuous breeding efforts for improvement of greengram or mungbean [*Vigna radiata* (L.) Wilczek] and blackgram or urdbean [*Vigna mungo* (L.) Hepper] had exhausted the available variability in these crops and only limited improvement is possible. Both of these species have some desirable characters like, greengram has early maturity, erect growth habit and long pods with large number of seeds/pod and blackgram possess non-shattering pods with synchronous maturity, more clusters/plant, pods with large seeds and comparatively more durable resistance to yellow mosaic virus, which can be transferred in them via wide hybridization (Singh, 1990). In view of these considerations the investigation was undertaken on homogenous F_5 progenies emanating from a wide cross, involving greengram (VBN(Gg)2) has lobbed leaf shape and blackgram (Mash114) which has ovate leaf shape parents. Progenies were grouped based on leaf shape and the association studies was carried out among the seed yield and component traits for each group to understand the link between the leaf shape towards the yield attributes and also to identify the major contribution provided by the parental genome.

The homogenized 29 F_5 progenies from the interspecific cross between green gram (*Vigna radiata*) (VBN(Gg)2) and blackgram (*Vigna mungo*) (Mash 114) with leaf shape variation and were formed the basic genetic material for the present investigation. All the progenies obtained from the green gram and blackgram interspecific cross are of green gram types predominantly. Greengram and blackgram had lobbed and ovate leaf structure respectively. The experiment was conducted at the National Pulses Research Center, (NPRC), Tamil Nadu Agricultural University, Vamban during *Rabi* 2017-18 season. All the F_5 progenies were evaluated in two rows each with a row length of 4m. Plant to plant spacing of 10cm and row to row spacing of 30cm was adopted. Recommended package of practices were followed. Among 52 F_5 segregating progenies, 29 homogenized progenies were selected and categorized based on leaf shape viz., lobbed and ovate. In that 21 progenies have ovate leaf shape and 8 progenies were found to have lobbed leaf shape. It shows the major contribution among the interspecific progenies were given by blackgram genome. Nine quantitative traits *viz.* plant height (cm), the number of branches per plant, the number of clusters per plant, the number of pods per clusters, the number of pods per plant, pod length (cm), the number of seeds per pod. 100 seed weight (g) and seed yield per plant (g) were recorded on all the individual plants among the progenies. All the single plants were grouped into two groups based on leaf shape and subjected to correlation analysis likewise. Separate correlation analysis was carried out for both the parents *viz.,* green gram (VBN(Gg)2) and blackgram (Mash 114). The simple correlation for lobbed and ovate groups of interspecific progenies performed separately for yield and its component traits were worked out as per the methods suggested by Johnson *et al.* (1955) to estimate correlation and path analysis as per the standard procedure using statistical software TNAUSTAT statistical package (Manivannan,2014).

As an interspecific derived population, enormous variations were observed among the progenies and within the progenies. Verma and Singh (1986) revealed that, the wide or interspecific crosses may lead to additional source of variation for desirable characters in greengram. Verma and Yadava (1986) observed a wide range of phenotypic variability in interspecific crosses between greengram and blackgram through systematic hybridization programme. They indicated that there is ample possibility of transferring economic characters from blackgram to greengram.

In the present investigation, 29 homogenized progenies were selected and categorized based on the leaf shape. In that 21 progenies have an ovate leaf shape and 8 progenies were found to have lobbed leaf shape. This indicated the major contribution has been rendered by the blackgram genome. The mean performances of 21 ovate and 8 lobbed leaf shaped F_5 progenies are given in **Table 1**, and **Table 2**. Among ovate leaf shaped progenies (**Table 1**) three progenies viz., 7-6, 12-13 and 12-24 expressed significantly higher seed yield per plant. The progenies 7-6 and 12-13 also recorded superiority for the number of branches per plant, the number of clusters per plant, the number of pods per plant and 100- seed weight. The progeny 12-24 also recorded superiority for the number of pods per plant and 100- seed weight. Other progenies recorded superiority for two or more yield component traits were viz., 2-36, 2-52, 3-38, and 30-66.

In case of progenies with lobbed leaf shape, 5-3 and 30-70 recorded superiority for seed yield per plant (**Table 2**). The progeny 5-3 recorded superiority for the number of branches per plant. While 30-70 had superiority for the number of branches per plant, the number of clusters per plant, the number of pods per plant and 100- seed weight. Progenies 3-2, 10-14 and 10-16 recorded superiority for two of more yield component traits. Considering the per se performances, progenies 7-6 and 12-13 and 12-24 among the ovate leaf shape and 5-3 and 30-70 among the lobbed leaf shape were considered as superior. The enhanced performance of this progeny is may be due to the combination of genes as resulted in the transgressive segregation for pods per cluster as reported by Langham (1961). Wide range of variability was created for the number of branches per plant, the number of cluster per plant, the number of pods per cluster, the number of pods per plant and seed yield per plant through systematic interspecific hybridization between *Vigna radiata* and *Vigna mungo*. These results are in close agreement with Singh (1990) and Singh and Singh (1998). The variations created through interspecific hybridization are highly useful for the genetic improvements of greengram. Hence these progenies can be further evaluated to evolve new high yielding varieties.

Table 1. Mean performance of the F_5 progenies with ovate leaf shape

Lobed Progenies	Plant Height(cm)	No. of. Branches/ Plant	No. of. Clusters / Plant	No. of. Pods / Cluster	No. of. Pods/ Plant	Pod Length (cm)	No. of. Seeds / Pod	100 seed Weight (g)	Seed Yield/ plant (g)	No. of plant in progenies
1-1	41.28	2.50	7.56	2.78	23.00	8.39	10.67	3.41	5.95	18
1-11	29.79 *	2.27	6.68	2.05	15.09	7.89	10.50	3.47 *	4.01	66
2-14	33.40 *	1.60	5.00	2.40	12.60	7.88	9.00	3.56 *	3.18	23
2-17	29.00 *	1.38	4.63	2.25	10.63	7.96	10.00	3.46 *	3.83	26
2-18	30.28 *	1.50	4.11	2.00	8.06	7.78	9.83	3.37	2.29	19
2-36	36.25	2.25	9.50	3.50 *	33.50	8.77 *	11.50	3.32	8.48	24
2-40	43.48	2.94	8.76 *	2.91	24.82	8.10	10.30	3.27	6.12	33
2-47	23.48 *	1.48	3.40	2.08	7.52	7.68	8.72	3.23	1.62	25
2-49	30.56 *	2.06	5.56	1.88	11.44	7.91	9.75	3.38	2.64	27
2-52	52.63	2.16	7.40 *	2.98	23.02	8.15	10.81	3.48 *	6.20	57
3-36	34.50 *	2.50	7.50	3.00	24.90	8.04	10.10	3.33	4.55	20
3-38	49.39	2.32	7.20	2.98	21.46	8.55 *	10.80	3.50 *	5.52	41
4-34	22.83 *	2.00	5.83	2.33	14.83	7.45	8.83	3.53	3.27	45
7-6	45.91	3.41 *	12.32 *	3.00	36.91 *	8.55	11.50	3.66 *	11.23 *	22
12-02	37.41 *	1.38	5.38	3.06	15.81	7.99	9.38	3.39 *	3.82	32
12-13	52.00	3.82 *	11.00 *	3.27 *	45.27 *	8.39	11.00	3.60 *	11.77 *	21
12-24	40.29	2.64	11.86	3.00	41.36 *	8.31	10.14	3.60 *	10.46 *	24
12-40	39.76	1.76	6.16	2.96	19.84	8.36	11.12	3.38	5.48	25
12-79	39.93	2.39	8.64 *	2.64	23.43	8.07	10.11	3.34	6.27	28
30-66	44.35	2.53	7.91 *	2.79	25.35	8.57 *	10.71	3.71 *	6.65	34
31-4	38.20 *	1.92	7.00	2.76	20.80	7.94	10.28	3.35	5.30	25
Parental Mean										
V. radiata (VBN(Gg)2)	44.83	2.27	6.22	2.82	22.85	8.33	11.37	3.32	5.85	30
V. mungo (Mash114)	15.24	1.98	8.34	2.40	20.62	5.49	6.40	4.36	5.11	30

*- Significantly superior than VBN(Gg)2 at 5% respectively.

The results of the correlation analysis for seed yield and component traits for both parents greengram (VBN(Gg)2) and blackgram (Mash 114) are given in **Table 3**. The results indicated that the plant height, the number of branches per plant, the number of clusters per plant, the number of pods per cluster and the number of pods per plant had recorded a significant and positive association with seed yield in both parents. However, pod length and the number of seeds per pod had a significant and positive association except 100- seed weight with seed yield per plant in VBN(Gg)2 alone. This results are in agreement with Alom *et al.* (2015), Garg *et al.* (2017), Dhoot *et al.* (2017) and Singh *et al.* (2009). But, the significant and positive association was observed for 100- seed weight on seed yield per plant was observed in Mash 114 alone with other component traits. This results are in close agreement with Singh and Single (1994), Umadevi and Ganesan (2005) and Shivade *et al.* (2011). Significant and positive correlation was observed for the number of pods per cluster with the number of branches per plant and the number of clusters per plant. Significant and positive correlation was observed for pod length with the number of branches per plant, the number of clusters per plant and the number of pods per plant in VBN(Gg)2 alone. Similarly, the significant and positive association was observed for 100- seed weight with the number of branches per plant, pod length and the number of seeds per plant in Mash 114 alone.

Correlation analysis among seed yield and component traits for each leaf shape groups of plants were presented in **Table 4.** The results indicated that the seed yield per plant had a significant and positive association with plant height, the number of branches per plant, the number of clusters per plant, the number of pods per cluster, the number of pods per plant, pod length and the number of

Table 2. Mean performance of the F_5 progenies with Lobed leaf shape:

Ovate Progenies	Plant Height(cm)	No. of. Branches/ Plant	No. of. Clusters / Plant	No. of. Pods / Cluster	No. of. Pods/ Plant	Pod Length (cm)	No. of. Seeds / Pod	100 seed Weight (g)	Seed Yield/ plant (g)	No. of plants in progenies
3-2	33.40 *	1.60	8.17 *	2.96	25.59	8.30	10.93	3.54 *	6.99	46
4-4	43.33	3.00	8.67	3.33	30.67	8.60	11.00	3.50	7.43	48
5-3	35.14	3.86 *	14.14 *	2.57	45.86	7.83	10.14	3.24	11.31 *	22
7-8	33.38 *	2.21	6.79	2.30	16.49	8.42	10.64	3.51 *	4.37	61
10-14	42.00	3.57 *	13.43 *	2.71	46.71	7.34	10.29	3.31	9.40	42
10-16	33.73 *	2.80 *	10.87 *	2.33	29.20	7.93	10.60	3.55 *	6.96	25
30-70	51.20	3.20 *	10.90 *	2.85	35.70 *	8.35	10.90	3.47 *	11.09 *	20
30-98	33.53 *	1.67	6.33	2.13	15.40	7.95	9.60	3.44 *	4.35	21
Parental Mean										
***V. radiata* (VBN(Gg)2)**	44.83	2.27	6.22	2.82	22.85	8.33	11.37	3.32	5.85	30
***V. mungo* (Mash114)**	15.24	1.98	8.34	2.40	20.62	5.49	6.40	4.36	5.11	30

*- Significantly superior than VBN(Gg)2 at 5% respectively.

Table 3. Correlation analysis for seed yield and its component traits VBN(Gg)2 and Mash114

Characters	Parents	Plant Height(cm)	No. of. Branches/ Plant	No. of. Clusters / Plant	No. of. Pods / Cluster	No. of. Pods/ Plant	Pod Length	No. of. Seeds / Pod	100 seed weight (g)
No. of. Branches/ Plant	VBN(Gg)2	0.68**							
	Mash114	0.56**							
No. of. Clusters / Plant	VBN(Gg)2	0.53**	0.86**						
	Mash114	0.64**	0.56**						
No. of. Pods / Cluster	VBN(Gg)2	0.30*	0.36**	0.30*					
	Mash114	0.32*	0.24	0.17					
No. of. Pods/ Plant	VBN(Gg)2	0.63**	0.86**	0.89**	0.49**				
	Mash114	0.73**	0.64**	0.69**	0.33*				
Pod Length (cm)	VBN(Gg)2	0.42**	0.29*	0.33*	0.14	0.38**			
	Mash114	0.44**	0.13	0.21	0.06	0.04			
No. of. Seeds / Pod	VBN(Gg)2	0.41**	0.26	0.18	0.09	0.25	0.34*		
	Mash114	0.28*	0.01	0.14	0.06	-0.10	0.53**		
100 seed weight (g)	VBN(Gg)2	0.07	0.04	-0.06	0.08	-0.04	0.17	0.04	
	Mash114	0.51**	0.36*	0.23	0.09	0.20	0.32*	0.35*	
Seed Yield/ plant (g)	VBN(Gg)2	0.66**	0.83**	0.80**	0.44**	0.89**	0.32*	0.34*	0.04
	Mash114	0.83**	0.70**	0.81**	0.43**	0.87**	0.23	0.08	0.39**

*, ** -Significant at 5%, 1% respectively., VBN (Gg)2 – Lobed leaf shape, Mash 114 – Ovate leaf shape

seeds per pod in both leaf groups. Seed yield per plant had a significant and positive association with 100- seed weight in ovate leaf shape only. With regard to association among the traits, similar trend was observed both in leaf groups except for 100- seed weight. All the traits had significant and positive association with 100- seed weight in ovate leaf group. However, in case of lobed leaf shape, 100- seed weight had a significant and positive association with pod length only. This result in accordance with Tabasum et al. (2010). While in comparison with the association among the parents VBN(Gg)2 and Mash 114, the lobbed leaf shaped progenies has no association for 100 seed weight on seed yield per plant as same as parent VBN(Gg)2, however in ovate leaf shaped progenies has a significant positive association for 100 seed weight on seed yield per plant as same as parent Mash114. This proves that the leaf shape trait has been introgressed from the parents, as lobbed leaf shape is dominant over the ovate leaf shape and it can be fixed in earlier generation as well (Sarkar and Bhattacharyya, 2014).

Table 4. Association studies among seed yield and component traits in lobed leaf and ovate shape leaf groups of F_5 progenies

Characters	leaf shape	Plant Height(cm)	No. of. Branches/ Plant	No. of. Clusters / Plant	No. of. Pods / Cluster	No. of. Pods/ Plant	Pod Length(cm)	No. of. Seeds / Pod	100 seed weight (g)
No. of. Branches/ Plant	Lobed	0.46**							
	Ovate	0.48**							
No. of. Clusters / Plant	Lobed	0.46**	0.77**						
	Ovate	0.52**	0.73**						
No. of. Pods / Cluster	Lobed	0.43**	0.23**	0.25**					
	Ovate	0.51**	0.30**	0.28**					
No. of. Pods/ Plant	Lobed	0.53**	0.72**	0.89**	0.39**				
	Ovate	0.61**	0.70**	0.85**	0.52**				
Pod Length(cm)	Lobed	0.31**	0.22**	0.29**	0.16*	0.24**			
	Ovate	0.46**	0.37**	0.40**	0.32**	0.44**			
No. of. Seeds / Pod	Lobed	0.39**	0.27**	0.33**	0.17*	0.33**	0.75**		
	Ovate	0.39**	0.33**	0.32**	0.31**	0.35**	0.62**		
100 seed weight (g)	Lobed	0.06	0.04	0.08	0.09	0.07	0.19*	0.04	
	Ovate	0.19**	0.20**	0.20**	0.19**	0.26**	0.24**	0.18**	
Seed Yield/ plant (g)	Lobed	0.59**	0.67**	0.82**	0.39**	0.93**	0.32**	0.36**	0.15
	Ovate	0.61**	0.66**	0.80**	0.48**	0.92**	0.49**	0.42**	0.35**

*, ** -Significant at 5%, 1% respectively.

The result indicated that the association among the leaf groups on seed yield per plant and its component traits are similar except for 100- seed weight. Hence, the selection indices for ovate leaf group, emphasis should be given to 100- seed weight in addition to other traits viz., plant height, the number of branches per plant, the number of clusters per plant, the number of pods per clusters, the number of pods per plant, pod length and the number of seeds per pod. And these progenies should be selected and forwarded based on the yield attributes and MYMV resistance for developing superior performing varieties among the derivatives of greengram and blackgram interspecific cross.

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