Int.J.Curr.Microbiol.App.Sci (2018) *7*(2): 703-709

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 7 Number 02 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.702.088

Genetic Variability, Heritability and Genetic Advance Analysis in Segregating Population of Black Gram [*Vigna mungo* (L.) Hepper]

Rakesh Gandi*, N. Shunmugavalli and Muthuswamy

Agricultural College and Research Institute, Killikulam (TNAU), India

**Corresponding author*

Keywords

Black gram, Variability, Heritability and Genetic advance as per cent of Mean

Article Info

Accepted:
07 January 2018
Available Online:
10 February 2018

A B S T R A C T

In the present investigation, nine crosses of black gram (*Vigna mungo* L.) were evaluated in $F_2$and F_3generations for the effective selection for yield and yield components. The segregating generation of the crosses included were PU 06-20 x VBN 4, IPU 2006-01 x ADT3, IPU 2006-01 x VBN 4, IPU 2006-01 x TNY LOCAL, IPU 02-33 x VBN 4, IPU 02-33 x VBN 4, IPU 02-33 x TNY LOCAL, WBG 26 x VBN 3, MASH 114 x VBN 3 and MASH 114 x TNY LOCAL. The estimates of PCV values are higher than that of GCV. The genotypic variance was found to be high for clusters per plant, pods per cluster and single plant yield in both the generations in the cross MASH 114 x TNY LOCAL. High heritability coupled with high genetic advance as per cent of mean in both generations was recorded by IPU 02-33 x TNY LOCAL for the characters clusters per plant, pods per cluster, pods per plant, seeds per pod and single plant yield. Thus, these two crosses were shortlisted as the ones amenable for selection.

Introduction

Black gram is also called as urd bean and black lentil. It is an important multipurpose grain legume extensively cultivated in arid, semi-arid and subtropics. Black gram is photo insensitive in nature and can be cultivated throughout the year. Black gram fits well in different cropping system as it is relatively drought tolerant. It is also grown as catch crop, mulch crop inter crop, mixed crop and green crop. Jayamani *et al.,* (2012) reported that about 70 percent of the total pulse production area is in the central and southern parts of the country and this contributes about more than 77 per cent of the total production.

Lack of sufficient genetic variability for economically important characters is one of the reasons attributed for insignificant progress in crop improvement. Hence, it is advocated that, extensive hybridization involving larger number of parents of diverse origin be adopted to synthesize broad based gene pool (Jain, 1975 and Ramanujan, 1975). Genetic variability for economic traits is a pre-requisite for any successful breeding programme. The presence of genetic variability for economic traits is a key factor for improving the locally adapted variety with regard to specific traits. However, the assessment of variation made on truly diverse germplasm provides the correct picture of the extent of variation which would help in assessing the variability and factors for limited progress made in blackgram. From this point of view, the present investigation was undertaken involving nine cross combinations of black gram genotypes.

Materials and Methods

The material for the present study was generated at the Department of Plant Breeding and Genetics, Agricultural College and Research Institute (TNAU) Killikulam. Nine high yielding cross combinations were selected from the F_1 generation of the previous study based single plant yield along with the VBN 4 variety as the check. The experiment was laid out in homogenous block following randomized block design (RBD) with three replications. The spacing between the rows was 30 cm and spacing between the individual plants was 10 cm. Recommended agronomic practices were followed to raise the crop. Observations on 8 quantitative characters were recorded. The estimates of variability, heritability and genetic advance were estimated by using the statistical methods suggested by Burton (1952), Lush (1944) and Johnson *et al.,* (1955) respectively.

Results and Discussion

A critical estimate of genetic variability is a pre – requisite for initiating appropriate breeding procedures in crop improvement programme, since many characters of economic importance are highly influenced by environmental conditions. The improvement of mainly depends upon the amount, nature and magnitude of the variability present in the population (Mothilal, 2000). The genotypic variance was found to be high for yield contributing characters like clusters per plant, pods per cluster and single plant yield in both the generations of the cross MASH 114 x TNY LOCAL (Table 1). For pods per plant, the genotypic variance was high in cross IPU 02-33 x TNY LOCAL in both the generation. In $F_{3,}$ the same combination recorded high genotypic variance for plant height, pods per cluster and seeds per pod. The estimates of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV). The difference was comparatively moderate inferring that there was environmental influence in all the traits studied. This is in the agreement to the findings of Joel and Thangavelu (1997). In the F_2 and F_3generations of the cross MASH 114 x VBN 3, the traits pods per plant, pods per cluster, pod length and single plant yield recorded high GCV and PCV, while, pods per plant registered low PCV and GCV values. The GCV was found to be low in F_2 and $F_3$of the cross IPU 02-33 x TNY LOCAL. The PCV and GCV were low in F_3 generation of IPU 02-33 x VBN 4 for single plant yield. These results are in conformity with the earlier findings of Konda *et al.*, (2009) in black gram indicating the better scope for improvement of pods per plant and single plant yield of the materials under present study. High variability was observed for clusters per plant in MASH 114 x TNY LOCAL (F_2 and F_3), IPU 2006-01 x TNY LOCAL (F_2 and F_3) and PU 06-20 x VBN 4 (F_3) indicated that better scope of selection for this trait. But for the rest of the crosses in both the segregating generations, low values were recorded for GCV and PCV, thus indicating low variability for this trait. Similar reports were given by Singh *et al.*, (2009) in black gram (Table 1). Low variability for 100 seed weight was noticed in all crosses in both F_2 and F_3. This result was similar to the previous reports given by Meshram *et al.*, (2013) in black gram. Majority of the combinations evaluated, showed high GCV and PCV for single plant yield and pods per cluster in both F_2 and F_3 generations and these findings are in conformity with the earlier reports of Meshram *et al.*, (2013).

Table.1 Variability for different characters in blackgram

Characters		PU 06-20 x VBN 4				IPU 2006-01 x ADT 3				IPU 2006- 01 x VBN 4			
		PV	GV	PCV	GCV	PV	GV	PCV	GCV	PV	GV	PCV	GCV
Plant height	F_2	12.81	15.77	21.49	18.77	1.85	0.16	7.25	2.19	3.15	1.492	8.02	5.52
	F_3	15.11	13.41	16.92	17.96	2.18	0.15	7.89	2.10	3.22	2.26	7.59	6.36
Clusters per plant	F_2	1.00	0.30	12.86	7.01	0.28	0.05	8.40	3.76	0.40	0.08	8.30	3.85
	F_3	6.84	5.30	33.32	29.32	0.06	0.06	3.83	3.80	0.51	0.11	8.36	3.89
Pods per cluster	F_2	2.84	1.53	31.23	26.66	0.59	0.26	28.83	24.07	0.25	0.11	28.04	23.83
	F_3	2.42	0.67	42.97	22.61	0.48	0.20	21.46	21.35	0.32	0.15	29.06	24.85
Pod length	F_2	0.69	0.39	17.59	13.32	0.82	0.28	17.88	10.52	0.81	0.46	19.05	14.32
	F_3	0.31	0.17	16.03	11.86	0.33	0.33	10.33	10.34	0.78	0.49	19.36	15.36
Pods per plant	F_2	40.23	29.31	66.26	48.65	2.12	1.48	18.47	12.35	5.88	4.24	19.41	13.20
	F_3	115.30	31.92	42.97	22.61	2.08	2.05	19.06	12.38	6.67	4.88	19.56	13.69
Seeds per pod	F_2	0.73	0.24	17.74	10.34	0.76	0.21	17.15	9.09	0.64	0.40	16.89	13.36
	F_3	0.48	0.29	14.38	11.32	1.11	0.31	17.89	9.56	0.77	0.54	17.56	14.69
100 seed weight	F_2	0.30	0.05	5.41	4.67	0.19	0.14	8.99	7.71	0.03	0.02	6.97	5.52
	F_3	0.32	0.21	11.48	9.39	0.18	0.14	8.82	7.76	0.06	0.05	7.02	6.65
Single plant yield	F_2	3.40	1.40	35.78	37.57	2.40	1.78	45.16	52.35	0.95	0.88	33.56	34.88
	F_3	3.57	2.66	48.15	55.77	2.60	1.86	45.18	53.45	1.01	0.94	33.65	34.92

Table.1 Conti….

Characters		IPU 2006-01 x TNY LOCAL				IPU 02-33 x VBN 4				IPU 02-33 xTNY LOCAL			
		PV	GV	PCV	GCV	PV	GV	PCV	GCV	PV	GV	PCV	GCV
Plant height	F_2	14.36	8.17	15.96	12.04	14.36	8.17	15.96	12.04	12.21	9.30	20.56	17.94
	F_3	3.49	8.70	8.21	12.95	3.49	8.70	8.21	12.95	22.58	16.77	25.48	21.96
Clusters per plant	F_2	1.28	0.58	15.77	10.58	0.49	0.29	9.81	7.51	0.88	0.44	10.88	7.73
	F_3	3.89	2.95	27.22	23.70	2.14	0.33	16.92	6.65	1.80	0.54	15.51	8.50
Pods per cluster	F_2	0.20	0.09	28.61	24.05	0.30	0.29	47.33	42.88	1.46	1.07	28.04	23.83
	F_3	5.73	7.64	22.27	26.28	4.97	3.73	48.39	43.89	12.66	6.59	26.28	22.27
Pod length	F_2	0.69	0.42	17.55	13.74	2.57	2.42	33.78	33.17	0.92	0.42	20.22	13.66
	F_3	0.62	0.17	16.68	8.80	0.73	0.43	17.83	13.67	0.63	0.37	16.73	12.76
Pods per plant	F_2	8.92	6.30	17.79	12.01	29.21	\23.98	19.24	18.88	8.41	6.09	44.56	38.05
	F_3	6.62	9.22	49.70	57.36	31.23	25.69	57.36	49.70	12.69	9.11	72.32	52.2
Seeds per pod	F_2	0.75	0.46	17.55	13.74	2.91	2.81	33.78	33.17	0.91	0.41	20.22	13.66
	F_3	0.63	1.11	13.26	17.53	0.70	0.53	14.57	12.70	17.96	9.36	72.32	52.21
100 seed weight	F_2	0.05	0.05	4.69	4.56	0.58	0.53	15.51	14.83	0.15	0.09	8.18	6.15
	F_3	0.11	0.24	7.02	9.95	0.63	0.62	16.02	15.90	0.05	0.05	4.83	4.74

Characters		WBG 26 x VBN 3				MASH 114 xVBN 3				MASH 114 xTNY LOCAL			
		PV	GV	PCV	GCV	PV	GV	PCV	GCV	PV	GV	PCV	GCV
Plant height	F_2	12.21	9.30	20.56	17.94 21.96	4.79	2.48	9.57	6.89	6.31	5.330	13.60	12.50
	F_3	22.58	16.77	25.48		7.92	5.13	11.77	9.47	6.17	3.292	12.90	9.42
Clusters per plant	F_2	0.69	0.25	13.79	8.29	1.22	0.44	13.79	8.29	3.41	2.22	31.41	25.36
	F_3	0.68	0.44	10.51	8.50	1.23	0.47	13.86	8.59	4.81	3.16	32.89	26.65
Pods per cluster	F_2	2.24	1.24	9.36	22.99	0.11	0.03	7.42	3.48	2.41	1.34	28.04	23.83
	F_3	3.39	1.77	31.55	27.68	0.29	0.02	8.68	3.98	3.05	1.75	28.98	24.82
Pod length	F_2	0.89	0.38	20.01	13.16	0.79	0.29	18.84	11.59	0.90	0.39	20.01	13.16
	F_3	0.69	0.40	16.73	12.76	0.78	0.32	18.98	12.24	1.65	0.66	21.56	13.69
Pods per plant	F_2	0.12	0.34	56.44	1.18	0.61	0.41	13.77	0.76	4.23	2.05	56.44	5.86
	F_3	12.31	3.51	72.30	16.00	0.25	0.50	14.02	1.21	1.75	1.32	58.03	3.05
Seeds per pod	F_2	0.86	0.37	20.01	13.16	0.89	0.33	18.84	11.56	0.95	0.41	20.01	13.16
	F_3	1.05	0.24	18.49	8.82	1.25	0.53	19.36	12.58	0.55	0.29	20.09	14.65
100 seed weight	F_2	0.13	0.05	7.67	4.90	0.15	0.07	8.03	5.52	0.14	0.05	7.67	0.37
	F_3	0.05	0.04	4.83	4.74	0.15	0.07	8.06	5.65	0.13	0.05	7.78	0.36
Single plant yield	F_2	1.60	1.35	31.84	34.72	1.65	1.39	31.80	34.72	2.00	1.53	33.98	38.87
	F_3	1.94	1.92	39.11	39.27	1.62	1.45	32.76	34.67	2.05	1.55	33.54	38.56

Table.2 Hertiability and GA as per cent mean for different characters in black gram

Characters	PU 06-20 x VBN 4		IPU 2006-01 x ADT 3		IPU 2006- 01 x VBN 4	
	Heritability	GA as % Mean	Heritability	GA as % Mean	Heritability	GA as % Mean
Plant height	76.11	33.77	59.67	1.36	47.13	7.82
	88.34	32.85	69.46	1.68	68.29	8.68
Clusters per plant	29.72	7.87	20.65	3.48	21.43	3.68
	77.64	53.15	24.36	3.75	32.36	4.42
Pods per cluster	72.22	46.88	69.48	41.40	72.32	41.71
	27.65	24.50	72.25	42.54	75.89	43.43
Pod length	57.32	20.79	34.36	12.75	56.25	22.17
	54.46	18.09	36.24	12.86	63.65	23.36
Pods perplant	53.12	73.60	44.23	17.02	46.84	18.49
	27.63	24.50	66.72	15.36	49.25	18.89
Seeds per pod	34.12	12.42	28.46	9.92	62.36	21.79
	61.25	18.36	33.19	9.87	69.47	22.86
100 seed weight	74.26	8.31	73.25	13.62	62.24	9.01
	67.37	15.84	76.89	14.87	64.56	10.03
Single plant yield	90.65	70.18	74.65	80.27	92.25	66.57
	74.28	85.62	76.04	81.69	93.26	66.59

Characters	IPU 2006-01 x TNY LOCAL		IPU02-33 x VBN 4		IPU 02-33 x TNY LOCAL	
	Heritability	GA as % Mean	Heritability	GA as % Mean	Heritability	GA as % Mean
Plant height	56.23 62.76	18.72 19.56	56.45 58.24	9.53 9.67	84.60 99.21	60.18 8.02
Clusters per plant	45.02 75.23	14.63 42.50	84.12 15.65	58.55 5.45	50.23 30.65	11.31 9.59
Pods per cluster	70.12 71.19	41.66 38.89	82.25 84.26	80.03 80.09	72.24 71.47	41.71 38.89
Pod length	61.12 27.23	22.16 9.57	96.47 58.23	67.09 21.61	45.65 58.25	19.03 20.06
Pods per plant	45.25 74.23	16.71 88.70	96.26 75.28	38.19 86.70	72.56 52.48	66.93 77.66
Seeds per pod	61.69 57.26	22.16 20.66	96.52 64.48	67.05 24.65	45.42 52.68	19.03 77.66
100 seed weight	94.89 49.27	9.130 10.20	45.42 52.68	19.03 77.66	56.61 96.23	9.53 9.58
Single plant yield	66.29 90.01	60.18 63.97	91.24 49.23	29.21 10.20	56.45 58.24	9.53 9.67

Table.2. Conti…

Characters	WBG 26 x VBN 3		MASH 114 xVBN 3		MASH 114 x TNY LOCAL	
	Heritability	**GA as % Mean**	**Heritability**	**GA as % Mean**	**Heritability**	**GA as % Mean**
Plant height						
Clusters per plant	36.65 42.25	10.27 11.89	36.81 39.26	10.28 11.05	65.45 69.12	42.20 43.36
Pods per cluster	63.23 76.12	14.75 49.83	69.23 67.69	11.61 12.62	72.26 76.61	41.71 43.98
Pod length	43.44 58.68	17.84 20.06	37.72 43.23	14.69 14.70	43.46 45.24	17.84 17.86
Pods per plant	55.43 52.56	64.54 77.66	44.46 49.19	28.06 26.89	55.05 61.09	64.54 66.39
Seeds per pod	43.24 22.44	17.84 8.68	37.23 44.45	14.69 15.70	43.23 46.25	17.84 18.97
100 seed weight	47.54 96.16	6.34 9.58	47.23 45.44	7.841 7.89	48.32 49.68	6.44 64.49
Single plant yield	84.60 99.21	60.18 8.02	84.44 82.61	60.17 60.02	0.88 0.79	64.69 62.63

Genetic coefficient of variability along with the heritability gives an idea of expected genetic gain from selection (Burton, 1952). The heritability estimates in the present investigation are of broad sense containing additive and non-additive portions of genetic variance and hence cannot provide clear predictability of breeding value of genotype. As such, heritability value can be reliable measure of predicting the resultants effects of selection only it is when accompanied by high genetic advance expressed as percentage of mean (Johnson *et al.*, 1955).

High heritability along with high genetic advance as per cent of mean for single plant yield in all crosses indicated the presence of additive gene effects (Table 2). This was in conformity with the earlier reports of Anbuselvam *et al.,* (2010).

High heritability along with high genetic advance as per cent of mean was exhibited by IPU 02-33 x TNY LOCAL in both generations for the characters clusters per plant, pods per cluster, pods per plant, seeds per pod and single plant yield indicating the predominance of additive gene effects and selection based on these characters is effective. In the present investigation, high heritability coupled with moderate genetic advance recorded for pods per plant in crosses IPU 02-33 x TNY LOCAL (F_2) and MASH 114 x VBN 3 ($F_2$and F_3). For the character seeds per pod was also had high heritability with moderate genetic advance as per cent in cross PU 06-20 x VBN 4 (F_3). Therefore by restoring to straight selection based on these characters, further improvement can be achieved reported by Gupta and Gupta (1977). Moderate heritability with high genetic advance was recorded by cross IPU 2006-01 x TNY LOCAL (F_3) for seeds per pod indicating predominant role for non-additive factors. Similar results reported earlier by Priyanka *et al.,* (2011).

Moderate with low genetic advance was observed for seeds per pod in the $F_3$of the cross IPU 2006-01 x ADT3, for hundred seed weight in the cross MASH 114 x VBN 3 and for single plant yield in both generations of IPU 02-33 x TNY LOCAL indicating the predominant role of non-additive factors in the expression of these characters. This confirms the earlier findings of Pandey *et al.*, (2007). Low heritability coupled with low genetic advance recorded by pod length for cross IPU 2006-01 x TNY LOCAL (F_3) indicates the non-additive gene action which is not amenable for selection of this cross based on this trait confirming the earlier findings of Srivastava and Singh (2012) in green gram.

References

Anbu Selvam, R. Elangaimannan, M. Venkatesan, P. Karthikeyan and K. Palaniraja. 2010. Chemically induced mutagenesis in Blackgram (*Vigna mungo* (L.) Hepper). *Electronic Journal of Plant Breeding*, 1(4): 921-924.

Burton, G.W. 1952. Quantitative inheritance in grasses. Proc. 6thInt. Grassland Congress, 1: 277-283.

Gupta, V.K. and Y.K. Gupta. 1997. Variability, inter relationships and path co-efficient analysis for some quantitative characters in sesame (*Sesamum indicum* L.). *Indian J. Heridity.*, 9: 31-37.

Jain, H. K.1975. Breeding for yield and other attributes in grain legumes. *Indian Journal of Genetics*, 35: 169-187.

Jayamani, P., N. Kumaravadivel, N. Nadarajan, A.R. Muthiah, C. Durairaj, A. Kamalakannan, S. Pazhanivelan and K. Thiyagarajan. 2012. TNAU Black gram CO6: A High Yielding Short Duration Variety. *Madras Agric. J.*, 99(1-3): 34-36.

Joel, J.A and S. Thangavelu. 1997.

Variability, heritability and genetic advance in sesame. *Madras Agric. J.*, 47:314-318.

Johnson, H.W., H.F. Robinson and R.E. Comstock. 1955. Estimates of genetic advance and environmental variability in soya bean. *Agron. J.,* 47: 314-318.

Konda, C.R., P.H. Salimath and M.N. Mishra. 2009. Genetic variability studies in productivity and its components in black gram (*Vigna mungo* (L.) Hepper). *Legume Res.*, 31(1): 59-61.

Meshram, M.P., R.I. Ali, A.N. Patil and M. Sunita. 2013. Variability studies in M_3 Generation in blackgram (*Vigna mungo* (L.) Hepper). *The Bioscan*., 8(4): 1357-1361.

Mothilal, A. 2000.Genetic variability and pattern of segregation in F_2populations of sesame. (*Sesamum indicum* L.). *J. Oilseeds Res*., 17(2): 216 – 225.

Pandey, M.K., N. Srivastava and C.R. Kole. 2007. Selection strategy for augmentation of seed yield in mung bean (*Vigna radiata* (L.) Wilczek). *Legume Res*., 30(4): 243- 249.

Priyanka, B., D.P. Singh and R.K. Khulbe. 2011. Genetic variability and association analysis of advanced lines and cultivars following intervarietal and interspecific crosses in black gram. *Journal of Crop Improvement*, 38(1):67-70.

Ramanujam, S.1975. Genetic diversity, Stability and plant type in pulse crops. In: *Proceedings of International Workshop Grain Legume*, ICRISAT, Hyderabad, pp. 167-176.

Singh, T., A. Sharma and F.A. Alie.2009. Impact of environment on heritability and genetic gain for yield and its component traits in mungbean. *Legume Res*., 32(1): 55-58.

How to cite this article:

Rakesh, Gandi, N. Shunmugavalli and Muthuswamy. 2018. Genetic Variability, Heritability and Genetic Advance Analysis in Segregating Population of Black Gram (*Vigna mungo* (L.) Hepper). *Int.J.Curr.Microbiol.App.Sci.* 7(02): 703-709.
doi: https://doi.org/10.20546/ijcmas.2018.702.088