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GENETIC DIVERGENCE IN SOME MOTHBEAN [*VIGNA ACONITIFOLIA* (JACQ) MARECHAL] GENOTYPES

MUHAMMAD YAQOOB[1*], NAJIBULLAH[2] AND PERVEZ KHALIQ[2]

[1]*Agricultural Research Institute, D.I. Khan, Email: yaqoobawan313@gmail.com*
[2]*Crop Sciences Division, PARC, Islamabad.*

Abstract

Mothbean crop has entirely been eliminated from the Punjab and NWFP provinces while it is very rarely and partially grown in some part of Sindh and Balochistan provinces of Pakistan with very poor yield production. The main reason for low production of this crop is non-availability of high yielding disease resistant varieties. An effort has been made to collect and screen out mothbean germplasm for high yield and resistance to disease. For this purpose a set of 66 mothbean germplasm accessions (collected from various part of country) was evaluated at Agricultural Research Institute, D.I.Khan during 2004. Most of the accessions were usually found a mixture of several variable genotypes. High yielding, desirable, plants were screened for further investigations. The materials thus selected, were again planted during successive year (2005) in a triplicated randomized complete block design for studying genetic variability in various morphological traits. The results revealed a significant variation in all the characters except number of clusters per plant. The phenotypic co-efficient of variation (PCV) were higher in magnitude then genotypic co-efficient of variability (GCV) indicating the dominant influence of environment on the traits under study. High h^2 (86.08 %)was calculated for number of pods per plant.

Introduction

In Pakistan mothbean [*Vigna aconitifolia* (Jacq) Marechal] has received little attention by researchers. Consequently, no any desirable variety is available in country. Its yield has been reduced up to the discouraging point**.** The area as well as production of mothbean has much been decreased up to miserable level. This valuable crop has been confined to very limited areas of Balochistan and Sindh, where its yield is far below the potential level.

The Pulses scientists working at various research institutions are only focusing on chickpea, lentil, mungbean and mashbean. The mothbean crop has never been included in the mandate of any research institution of country. The available local land races are not only poor yielding, but also highly susceptible to Yellow Mosaic Virus disease. It is, therefore, dire need to conduct research for the development of high yielding mothbean cultivars. Malik *et al*., (1988) reported high h^2 coupled with high genetic advance for number of pod in chickpea. Bhaskar *et al*., (1990), Bhavsar & Birari (1991), Hakim (1991) studied various mothbean genotypes and observed significant variability in various morphological traits. Yaqoob (1995) has shown higher magnitude of heritability linked with high genetic advance for pods in mungbean. Kumar (2001) studies phenotypic stability of quantitative traits in 11 mothbean (*Vigna aconitifolia*) genotypes and observed significant genotypic variation in most of the traits.

Similarly, Henry & Kacker (2002) studied the adaptability and performance of 15 genotypes of moth bean (*Vigna aconitifolia*) for 3 years in 4 different environments and observed significant variation in genotypes and genotype x environment interaction for seed yield and yield components. Khatri *et al*., (2002a) conducted surveys at farmer fields in Bikaner, Rajasthan, India and determined the spread and the extent of damage caused by yellow mosaic virus (YMV) disease on mothbean (*Vigna aconitifolia*). They declared YMV as a dread disease of mothbean Khatri *et al*., (2002b) studied various genetic parameters for 8 traits (days to maturity, plant height, number of primary branches per plant, number of pods per cluster, number of clusters per plant, pod length, fodder yield and seed yield per plant) in 35 moth bean genotypes and observed highly significant variation for all the traits. The phenotypic coefficient of variation (PCV) was higher than the genetic coefficient of variation (GCV) for all the characters. High heritability coupled with high genetic advance was observed for the number of clusters and number of pods per plant, whereas high heritability with moderate genetic advance was observed for days to maturity and plant height, indicating the dominance of additive gene effects for these traits. Khatri *et al*., (2002c) studied genetic variation, heritability and correlation for seed yield and yield components using 18 mothbean (*Vigna aconitifolia*) genotypes and reported a highly significant variability in genotypes for various characters. High estimates of genetic and phenotypic coefficients of variation were recorded for most of the traits. Sinhag *et al*., (2004) studied genetic variability and heritability in 62 genetic accessions of mothbean (*V. aconitifolia*) and observed maximum range of variation in most of the traits. Heritability was high for all the characters except pod length and number of seeds/pod, whereas genetic advance was high for number of pods/plant and number of clusters/plant. Yaqoob *et al*., (2005) have also reported genetic variation in various characteristics in different mothbean accessions.

Materials and Methods

In field experiment 30 mothbean lines (originated from previous year screening) were evaluated for various plant traits including, days to 50% flowering, days to maturity, number of branches, number of clusters, number of pods, number of seed per pod and grain yield. The trial was conducted on well-prepared seed bed. The crop was sown manually with the help of single row hand drill. The experiment was laid out in Randomized Complete Block Design having three repeats. Each treatment comprised of three rows four meters long. Row to row and plant to plant distances were kept at 30 cm and 10 cm respectively. Fertilizer @ 20:50 Kg Nitrogen: Phosphorus ha^{-1} was applied at the time of sowing. Data on various plant characteristics were recorded and analyzed with the help of Computer's Software Package MSTAT-C. Heritability (Broad Sense) was calculated following Burton (1952), while Expected Genetic Advance was estimated according to formula proposed by Singh & Chaudhry (1983).

Results and Discussion

The results of analysis of variance regarding various plant traits in mothbean are given in Table 1 while individual comparisons of germplasm accessions are given in Table 2. The information on heritability, expected Genetic advance and Phenotypic and genotypic co-efficient of variability are provided in Table 3.

Table 1 revealed that mothbean accessions involved in present experiments were genetically variable. The characters like Days to 50% flowering, days to maturity, number of pods, number of seed per pod and grain yield were highly significantly affected due to mothbean accessions. The differences in number of branches and numbers of clusters per plant were found to be significant and non-significant respectively.

Table 1. Analysis of variance for various traits in mothbean germplasm.

S.O.V	D.F	DFL	MAT	Branch	Cluster	Pods	S/pod	Yield
Replications	2	7.22	16.878	2.433	16.033	182.344	0.433	35.602
Genotypes	29	50.362**	68.820**	2.201*	86.207NS	4443.31**	0.680**	112.862**
Error	58	11.785	21.085	1.169	70.240	227.15	0.307	7.077
Total	**89**	-	-	-	-	-	-	-

N.S=Non-significant, * = Significant, ** = Highly significant

Table 2. Mean squares of various traits in mothbean germplasm.

Genotypes	DFL	DMT	Branches	Clusters	Pods	S/pod	Yield (g)
DMB-106	64 abc	124a-f	3.67cd	16.66	54def	6.00bcd	7.76cde
DMB-107-A	57e-j	127abc	3.33d	15.66	48def	6.67ab	8.95cde
DMB-107-B	58d-h	121b-g	4.00bcd	17.33	33f	5.33de	5.28e
DMB-107-C	61b-f	127abc	5.67ab	20.00	136bc	6.67ab	21.68ab
DMB-107-D	63a-d	129a	4.00bcd	20.33	63de	6.33abc	9.65cd
DMB-107-E	59d-h	127abc	5.33abc	22.66	146ab	5.33de	22.71ab
DMB-107-F	54g-j	125a-e	3.67cd	24.66	57def	5.67cde	7.93cde
DMB-108-A	66ab	127abc	4.00bcd	21.66	50def	5.67cde	6.96cde
DMB-108B	67a	123a-g	5.33abc	18.00	133bc	6.33abc	21.10ab
DMB-108C	59c-h	116gh	5.67ab	27.33	138bc	5.67cde	18.88b
DMB-118-A	55g-j	119d-h	6.00a	31.33	169a	5.33de	25.00a
DMB-108-D	63a-d	112hi	4.33a-d	25.66	123bc	5.67cde	20.08b
DMB-116	54g-j	108i	4.33a-d	27.33	66de	6.33abc	9.71cd
DMB-118-B	57e-j	118d-h	3.67d	33.66	71d	6.33abc	9.13cde
DMB-118-C	60c-g	122a-g	3.33d	27.00	45ef	5.67cde	5.93de
DMB-118-D	56f-j	118d-h	3.67cd	32.00	46ef	5.33de	6.52de
DMB-118-E	59d-h	118e-h	4.33a-d	28.33	65de	5.67cde	7.50cde
DMB-118-F	60c-g	119d-h	5.33abc	18.00	130bc	7.00a	19.68b
013393-A	57e-j	118d-h	3.00d	16.00	51def	6.33abc	8.30cde
013393-B	52ij	123a-g	3.33d	20.66	50def	5.67cde	7.50cde
013393-C	52j	122a-g	4.00bcd	22.33	120c	5.67cde	19.00b
013412-A	52ij	117fgh	4.00bcd	20.66	68de	5.00e	9.78cd
013412-B	54g-j	120c-g	2.67d	23.33	68de	5.33de	10.96c
013416-A	54hij	120c-g	4.00bcd	23.66	65de	6.33abc	7.65cde
013416-B	58d-i	128ab	3.33d	23.66	60de	5.67cde	8.61cde
013425-A	59c-h	121b-g	4.00bcd	21.00	64de	6.00bcd	7.67cde
013425-B	54hij	124a-f	3.67cd	17.00	65de	5.67cde	8.78cde
013427	62b-e	125a-d	4.00bcd	14.66	65de	5.67cde	8.62cde
013388	55g-j	125a-d	5.33abc	16.00	136bc	6.00bcd	20.24b
013392	54g-j	121b-g	4.00bcd	13.33	59de	5.67cde	8.66cde
CV%	**5.90**	**3.77**	**25.95**	**28.25**	**18.40**	**9.44**	**22.15**

Table 3. Phenotypic co-efficient variability, genotypic co-efficient of variability, heritability and genetic advance of various traits in mothbean germplasm.

Characters	PVC	GVC	Heritability (%)	Genetic advance
Days to 50% flowering	8.532	6.162	72.20	11.246
Days to maturity	4.989	3.271	65.50	6.513
Branches	29.518	14.075	47.60	32.604
Clusters	42.204	18.163	43.0	43.243
Pods	49.319	45.761	86.08	45.028
Seeds per pod	11.189	5.867	53.60	13.363
Grain yield (g)	88.456	12.010	4.10	2.634

The means regarding genotypic effects on days to 50% flowering ranged from 52 to 67. The lines 013393-B, 013393-C and 013412-A appeared to be early as they completed 50% flowering within 52 days. These lines were however, statistically at par with some other lines including DB-107-A, DMB-107-F, DMB-118-A, DMB-116, DMB-118B, DMB-118-D, 013393-B, 013412-A, 013416-A, 013425-B, 013388 and 013392 availing 57, 54, 55, 54, 57, 56, 57, 54, 54, 54, 55 and 54 days to 50% flowering (Table 1). The variation in days to maturity in various mothbean lines was also highly significant. The maturity period ranged from 108 to 129 days. The line DMB-116 was found to be early maturing as it had matured in 108 days. It was statistically similar to DMB-108-D availing 112 days to maturity. The line DMB-107-D was found to be the late as it availed 129 days to maturity (Table 2). These results are in agreement with Kumar (2001) Khatri *et al*., (2002a) Khatri *et al*., (2002b) and Khatri *et al*., (2002c) and Sinha *et al*., (2004).

The means concerning the number of primary branches in various mothbean genotypes revealed that number of branches ranged from 2.67 to 6.00. The highest number of branches per plant was produced by DMB-118-A followed by DMB-107-C and DMB-108-C each produced 5.67 branches per plant. The line DMB-118-A was also statistically at par with some other lines producing 5.33, and 4.33 branches per plant. The lowest number of branches (2.67) were produced by the lines 013412-B. It was however statistically similar to most of the lines included in the experiment (Table 2). There was a wide genetic variability for number of pods per plant due to various mothbean accessions (Table 2). Number of pods ranged from 33 to 169 per plant. The lines DMB-118-A proved its superiority by producing the highest number of pods per plant (169) followed by DMB-107-E and DMB-108-C with 146 and 138 pods per plant. The rest of lines DMB-107-C, 013388, DMB-108-B, DMB-118-F, DMB-108-D and 013393-C had also produced the higher of pods i.e., 136,136,133,130,123 and 120 per plant respectively. All the seven lines except 013393-C were statistically equal to the second best lines DMB-107-E (Table 2). Malik *et al*., (1988). Bhavsar & Birari (1991), Hakim (1991), Yaqoob (1995), Kumar (2001), Henry *et al*., (2002), Khatri *et al*., (2002a), Khatri *et al*., (2002c), Sinhag *et al*., (2004) have also reported higher magnitude of genetic variability in number of branches and pods in mothbean and other pulses.

The variation in number of seeds per pod was highly significantly affected due to various mothbean genotypes. The number of seed per pod ranged from 5 to 7. The line DMB-118-F remained statistically superior to all the accessions by showing the maximum number of seeds per pod (7). It was statistically equal to lines including DMB-107-A, DMB-107-C, DMB-118-B, DMB-107-D, DMB-116, 013416-A, DMB-108-B and 013393-A with 6.67, 6.67, 6.33, 6.33, 6.33, 6.33, 6.33, and 6.33 number of seeds per pod, respectively. The line 013412-A remained very poor by producing the least number of seed per pod. It was however statistically equal to most of the lines showing 5.67 seed per pod (Table 2) Bhaskar *et al*., (1990), Hakim (1991), Yaqoob (1995), Kumar *et al*., (2001), Khatri *et al*., (2002a, 2002b, 2002c), Sinhag *et al*., (2004) have also noted a wide range of genetic variability in various developmental characters of mothbean and other kharif pulses

The average grain yield ranged form 5.28 to 25 gm per plant. The line DMB-118-A again superseded all the 29 lines by producing the highest grain yield of 25 gm per plant. It was closely followed by the lines DMB-107-E, DMB-107-C and DMB-108-B possessing the yield of 22.71, 21.68, and 21.10 gm per plant respectively. All these lines were statistically equal to high yielding line DMB-118-A. The lines 013388, DMB-108-

D, DMB-118-F, 013393-C and DMB-108-C had also produced the reasonable yield (20.24, 20.08, 19.68, 19.00 and 18.88 gm) and remained statistically similar to DMB-107-E, DMB-107-C and DMB-108-B. The poor performance in this experiment was shown by DMB-107-B with the yield of only 5.28 gm per plant. It was however, statistically similar to all those 16 lines producing grain yield of below 9.65 gm per plant. The results are in conformity with the observations of Bhaskar *et al*., (1990), Hakim (1991), Yaqoob (1995), Kumar *et al*., (2001), Khatri *et al*., (2002a, 2002b) and Yaqoob *et al*., (2005) who also reported significant variability in grain yield in mothbean.

Results in Table 2 further revealed that lines DMB-118-A and DMB-107-E were superior among all the germ plasm accessions. Both the lines had produced the higher number of branches, pods and ultimately produced the higher grain yield. Both the lines may be involved in breeding programme for development of high yielding mothbean cultivars.

The estimates of phenotypic and genotypic co-efficient of variability revealed that PCV were higher in magnitude than GCV for all the characters studied. The extent of co-efficient of variability showed that grain yield had the highest phenotypic co-efficient of variability (88,452%) followed by number of pods per plant (49.319%). In case of Genotypic co-efficient of variability (GCV) the highest magnitude was computed for number of pods (45.761%) followed by number of clusters per plant. Yaqoob (1995), Kumar *et al*., (2001), Henry *et al*., (2002) Khatri *et al*., (2002a, 2002b) have also reported similar results in mothbean and other pulses.

The highest broad sense heritability (h^2) was exhibited for number of pods per plant (86.08%) followed by days to 50% flowering and maturity with 72.20 and 65.50% heritability. The grain yield had shown the lowest value of h^2 (4.10%). The expected genetic advance exhibited considerable range 2.634 to 45.028 for various traits. The number of pods (45.028) and number of clusters (43.243) had expressed the higher magnitude genetic advance. The grain yield along with some other characters exhibited low magnitude of genetic advance indicating that grain yield cannot be improved to the desired level as such. The high broad sense heritability with high genetic advance was observed for number of pods per plant. This could be due to additive gene effect for these traits (Table 3). Malik *et al*., (1988), Yaqoob (1995) and Khatri *et al*., (2002b) have also reported high heritability coupled with high genetic advance for number of pods in chickpea and mungbean, respectively.

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