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GENETIC RESISTANCE AND SELECTION RESPONSE IN MOTHBEAN AGAINST YELLOW MOSAIC VIRUS DISEASE

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Abstract

Mothbean is severely attacked by Yellow Mosaic Virus (YMV) disease. The virus is considered to be transmitted through vector whiteflies (*Bemisia tabaci* Genn) a sucking insect of *Vigna* group. The only way to overcome this problem is development of disease resistant varieties. The local land races are highly susceptible to this dread disease. To purify the available germ plasms accessions a country-wide survey was conducted and some 66 lines of mothbean including the accession from PGRI, NARC, Islamabad were collected for screening against YMV. All the 66 germ plasm accession were planted at Agricultural Research Institute, D.I.Khan during 2004. Most of the lines were totally destroyed by YMV. Some desirable tolerant, moderately tolerant, resistant and highly resistant plant were selected. The seed thus obtained was again planted during next year 2005 along with susceptible checks for confirmation of host plant resistance and study of selection response of mothbean against YMV. The disease data were recorded on 1-9 rating scale. The observations revealed that there exists greater genetic variability in mothbean lines against their response to yellow mosaic virus. The results further revealed that selection response was quite positive. The lines showing resistance in previous year had again shown the resistance and vice versa.

Introduction

Mothbean **{***Vigna aconitifolia* (Jacq) Marechal} is one of the minor pulses. It has not been included in the mandate of any research institute of country. Mothbean not only fixes atmospheric nitrogen in soil, but also contains 20 to 25% protein in dry seed. The inclusion of such pulses is also important for maintaining the crop biodiversity in eco-system. The available land races are highly susceptible to yellow mosaic virus. The disease not only reduce the grain and fodder yield, but also affect on the quality of fodder crop. The YMV disease is caused through whiteflies (*Bemisia tabaci* Genn), a vector for transmitting the causal virus. Keeping in view the importance of crop a research project was initiated at Agricultural research Institute, D.I.Khan with entire assistance of Agricultural Linkages Programme (ALP), PARC to screen out high yielding YMV resistance line of mothbean. Sheikh *et al*., (1987) screened out 60 *Vigna radiata* mutants along with exotic and local collection and identified the local lines " Sitakundu" and "Mb-55" as resistance to Yellow Mosaic Virus (YMV). They further reported that resistance lines produced 15% more yield than susceptible lines. Bhaskar *et al*., (1990) evaluated 10 *Vigna aconitifolia* varieties as a fodder crop during kharif and found the lines IL1184-1 as immune to yellow mosaic virus while IL51-1 was rated resistant to YMV. They also reported that resistance varieties were among the lowest yielding genotypes. Bhavsar & Birari (1991) provided the information on genetic diversity derived from the data on 12 yield components in 40 lines *Vigna aconitifolia* grown during 1985-86. They reported a wide range of variability in mothbean lines regarding the response to yellow mosaic virus ranging from susceptibility to resistance. Hakim (1991) studied the performance of some V*igna* lines on dry land in Indonesia and observed greater genetic variability among the six varieties for various

developmental and yield characteristics. They also noted the variable response of genotypes to yellow mosaic virus (YMV) disease. Morales *et al*., (1991) studies 8 varieties of mungbean {*Vigna radiata* (L.) Wilczek} under different environments and observed genetic differences among varieties and varieties x environment and found significant genotypes-cum-environment interaction. Jain (1992) screened out 8 promising mothbean lines for yield and resistance to yellow mosaic virus and reported IPCMO 926 and IPCMO344 as tolerance to yellow mosaic virus. Reddy & Raju (1993) conducted a survey on pigeonpea sterile virus and reported the incidences of disease in various part of India. Khatri (2002a) conduced survey and determined the spread of yellow mosaic virus (YMV) disease and extent to damage caused by the disease on mothbean (*Vigna aconitifolia*). They further observed that YMV was the most important disease of mothbean in the region during both years. Yaqoob *et al*., (2005) identified some resistance lines of mothbean in available land races.

Materials and Methods

A field experiment was conducted at Agricultural Research Institute, D.I. Khan during summer 2005 involving 36 mothbean germ plasm accessions (including susceptible checks repeated after each test line). These lines were previously selected out of 66 germplasm accessions during 2004 and were again planted during 2005 for confirmation host plant resistance and studying the selection response.

The crop was sown in a nonreplicated (Augmented) design having three rows per treatment. The Inter-cum-intra row spacing was kept at 30 cm and 10 cm respectively. Fertilizer was applied @ 20:50 Kg Nitrogen: Phosphorus ha^{-1}. Disease severity/incidence data were recorded during the growing season. The initial damage were recorded after 100% mortality in susceptible checks (Including DMB-106, DMB-109, DMB-111, DMB-112, DMB113, DMB-115) while final rating was done at pod formation stage. The accession response to YMV was recorded on 1-9 rating scale. The response of host plants to YMV was rated 1 for highly resistant, 3 for resistant, 5 for moderately resistant, 7 for susceptible and 9 for highly susceptible.

Results and Discussion

Among the various biotic stresses the Yellow Mosaic Virus is the most important disease of *Vigna* group of pulse crops. It is commonly known as mungbean yellow mosaic virus. This disease is spread through sucking type pest whiteflies (*Bemisia tabaci* Genn). The control of this disease through pesticides is not feasible. Only alternate to overcome this devastating disease is development of resistant varieties against YMV. The available local land races are highly susceptible to YMV. The framers are therefore, reluctant to involve this crop in cropping system. Consequently the area and production of mothbean reduced to the extent that it is not quotable in under statistical terms.

In the present investigations an effort has been made to exploit the sources of resistance in available land races/germ plasm accessions in country. For this purpose a set of 66 germ plasm accession was evaluated for various plant traits including their response to yellow mosaic virus. The desirable lines showing highly resistance, resistance, tolerance, moderately tolerance and susceptibility against YMV were identified. The entries with a rating of 5 or even less were selected for further evaluation. These lines were again evaluated in field during 2005 alongwith susceptible lines as check. The disease severity/incidence data were recorded on 1-9 rating scale.

Table 1. Disease severity of yellow mosaic virus in mothbean accessions germplasm.

Accessions	Disease rating	Accessions	Disease rating	Accessions	Disease rating
DMB-106	9	DMB-118-A	1	013412-A	1
DMB-107-A	3	DMB-108-D	1	DMB-113	9
DMB-115	9	DMB-116	9	DMB-103	7
DMB-107-B	5	DMB-118-B	3	013412-B	1
DMB-107-C	3	DMB-112	9	013416-A	3
DMB-107-D	3	DMB-118-C	1	013416-B	5
DMB-107-E	1	DMB-118-D	3	013425-A	1
DMB-107-F	1	DMB-118-E	5	DMB-111	9
DMB-108-A	3	DMB-118-F	5	013425-B	3
DMB-108B	3	013393-A	3	013427	3
DMB-108C	5	013393-B	1	013388	1
DMB-109	9	013393-C	3	013392	3

Table 2. Number of mothbean lines along with their response to yellow mosaic virus disease.

Rating score	Category	Accessions
1	Highly resistant	**10-*Accessions*** = DMB-107-E, DMB-107-F, DMB-108-D, DMB-118-A, MB-1118-C, 013393, 013412-A, 013412-B, 012425-B, 013388
3	Resistant	**13-*Accessions*** = DMB-107-A, DMB-107-C, DMB-107-D, DMB-108-A, DMB-108-B, DMB-118-B, DMB-118-D, 013393-A, 013393-C, 013416-A, 013425-B, 013427, 013393
5	Moderately resistant	**5-*Accessions*** = DMB-107-B, DMB-108-C, DMB-118-E, DMB-118-F, and 013416-B
7	Susceptible	**1**-Accession = DMB-103
9	Highly Susceptible	**7-*Accessions*** = DMB-106, DMB-109, DMB-111, DMB-112, DMB-113, DMB-115, DMB-116.

Table 3. Means of various traits in mothbean germplasm.

Accessions	Yield (g)	Accessions	Yield (g)	Accessions	Yield (g)
DMB-106	7.76cde	DMB-118-A	25.00a	013393-C	19.00b
DMB-107-A	8.95cde	DMB-108-D	20.08b	013412-A	9.78cd
DMB-107-B	5.28e	DMB-116	9.71cd	013412-B	10.96c
DMB-107-C	21.68ab	DMB-118-B	9.13cde	013416-A	7.65cde
DMB-107-D	9.65cd	DMB-118-C	5.93de	013416-B	8.61cde
DMB-107-E	22.71ab	DMB-118-D	6.52de	013425-A	7.67cde
DMB-107-F	7.93cde	DMB-118-E	7.50cde	013425-B	8.78cde
DMB-108-A	6.96cde	DMB-118-F	19.68b	013427	8.62cde
DMB-108B	21.10ab	013393-A	8.30cde	013388	20.24b
DMB-108C	18.88b	013393-B	7.50cde	013392	8.66cde

CV% 5.90

The results on disease severity of YMV are given in Tables 1 and 2. A study of Table 1 revealed a distinct variation in genotypes against YMV ranging from 1 to 9. Out of 36, ten accessions including DMB-107-E, DMB-107-F, DMB-108-D, DMB-118-A, MB-1118-C, 013393, 013412-A, 013412-B, 012425-B and 013388 were found to be

highly resistant to YMV by scoring 1. Thirteen lines viz., DMB-107-A, DMB-107-C, DMB-107-D, DMB-108-A, DMB-108-B, DMB-118-B, DMB-118-D, 013393-A, 013393-C, 013416-A, 013425-B, 013427 and 013393 were found resistant to YMV as they were rated 3. Similarly, 5 accessions scored 5 and were rated as moderately resistance against disease. These accessions include DMB-107-B, DMB-108-C, DMB-118-E, DMB-118-F, and 013416-B. Among a set of 36 lines only one (DMB-103) was rated as susceptible due to its poor score against YMV. All the check lines including DMB-106, DMB-109, DMB-111, DMB-112, DMB-113, and DMB-115 remained highly susceptible as they succumbed to YMV disease pressure. The susceptible checks were totally destroyed due to disease attack. These check lines were also identified as highly susceptible in previous year in mothbean germ plasm screening trial-2004. Similarly, other desirable mothbean lines had also performed well and their response to YMV disease remained stable in present experiments as they were ear marked during 2004. This clearly revealed a positive response of genotype selection against disease. Bhavsar, *et al*., (1990), Bhavsar *et al*., (1991), Jain (1992), Henry & Kackar (2002), Khatri *et al*., (2002a), Khatri *et al*., (2002b) and Selvi *et al*., (2003) have also screened out various moth bean lines and observed genetic variability against YMV. Yaqoob *et al*., (2005) have also reported the availability of resistant line in mothbean germ plasm in Pakistan.

The data regarding grain yield of various accessions given in Table 3 revealed that Highest yield of 25 gm was produced by line DMB-118-A with YMV rating at 1. It was closely followed by other resistant 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. Their disease rating was 1, 3 and 1 respectively. This revealed that resistance lines produce higher yield as compared to susceptible and moderately susceptible lines. The present results are in line with those of Bhavsar & Birari (1991) and Yaqoob *et al*., (2005) who noted that resistant lines of moth bean produce higher grain yield as compared to susceptible. The results are however contradicted with the finding of Bhaskar *et al*., (1990) who reported that lines immune to yellow mosaic virus were among the lowest yielding ones. These differences in findings might be due to different genetic materials used and various environmental conditions under which the experiments were conducted.

The desirable lines are source of resistance to YMV disease that can be possibly exploited through hybridization for development of high yielding disease resistant varieties of mothbean. A small quantity of seed is available with Mothbean Improvement Project (ALP), PARC, Agricultural Research Institute, D.I.Khan for further studies.

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