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SOURCES OF RESISTANCE IN MUNGBEAN GERMPLASMS TO MUNGBEAN YELLOW MOSAIC VIRUS (MYMV) AND IT'S MANAGEMENT

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Abstract

An experiment was conducted at Pulses Research Sub-Station (PRSS), Bangladesh Agricultural Research Institute, Joydevpur, Gazipur and Regional Agricultural Research Station (RARS), Jessore, Bangladesh during kharif-1, 2014 under rain fed condition to find out the tolerant genotypes against Mungbean Yellow Mosaic Virus (MYMV) where viz. Gk - 22, SMZ - 134, VC - 3669, VC - 3960 A - 88, VC - 3960 A - 89, VC 6144, VC - 6144 (47 - 28 - 2), VC - 6148 (50 - 12), VC - 6153 - B - 20, VC - 6153 - 20P, VC - 6173, VC - 6173 B - 33, VC - 6372 - (45 - 8), VC - 6773 - B - 6, VC - 6897 and BARI Mung - 4 Mungbean genotypes were screened. It was found that the genotype VC - 6153 - B - 20 may be a wonderful source of MYMV tolerance. In the same time another experiment was carried out at Golapgonj, Sylhet and PRSS, Joydevpur for development of management package against the vector of this virus. For these reason five different treatments namely Furadan 3G, Furadan + Admire, Furadan + Neem leaf extract (NLE), Furadan + Sobicron and control were used, where Furadan treated as a basal dose. It was observed that Furadan + Admire treated plots have the lowest incidence (score - 2) of MYMV at both locations and produced the highest yields as compared to the other treatments. It is recommended that Admire can be used as a package for controlling MYMV.

Keywords: Mungbean, MYMV, genotypes, fungicides, screening.

Introduction

Mungbean (*Vigna radiata*) is an important pulse crop having global economic importance as dietary ingredient of the staple food. It also improves the fertility status of soil through nitrogen fixation. Earlier, Mungbean as a food legume was considered as the cheap source of protein and known as the "Poor men's meat". But now-a-days all pulses has gone out of the reach of general people due to the drastic reduction of production vis-à-vis price escalation (Rahman, 2007). Generally grain legumes are limited by the low sulfur containing amino acids like cysteine and methionine but still both of these amino acids are comparatively more in Mungbean. In Bangladesh, the average yield of Mungbean is 617.50 kg ha^{-1} which is low as compared to other pulse growing countries in the world (Anon, 2006). So far twenty diseases of mungbean have been recorded, of which viral diseases are the most damaging (Bakr and Rashid, 2007). Yellow mosaic is the most destructive yield damaging viral disease of Mungbean in Bangladesh. The causal organism is Mungbean Yellow Mosaic Virus which is non-persistently transmitted by whitefly (*Bemisia tabaci*) and grafting but not sap inoculation. MYMV can cause up to 85 % yield loss when infection start from the 4th week of sowing (Rashid and Bakr, 2007). Reports on management of MYMV are scanty. The control of insect vector is an important tactic for managing yellow mosaic disease of Mungbean. Some chemicals were found to be effective in reducing the incidence of yellow mosaic disease (Borah, 1996). Though injudicious application of these chemicals pollute the environment and cause health hazard but other alternate approach like plant extracts was not found effective against the vector. Considering these facts present investigations were undertaken to find out the tolerant genotypes and determine the efficacy of selected chemicals in reducing the incidence and severity of Mungbean yellow mosaic virus and also determine the relationship among the virus, vector and seed yield of Mungbean.

Materials and Methods

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Screening of short duration Mungbean germplasm against MYMV: Fifteen genotypes and a check variety BARI Mung - 4 were screened against MYMV at Pulses Research Sub-Station (PRSS) and Regional Agricultural Research Station (RARS), Jessore during kharif-1, 2014 under the rain fed condition. The germplasms viz. Gk - 22, SMZ - 134, VC - 3669, VC - 3960 A - 88, VC - 3960 A - 89, VC 6144, VC - 6144 (47 - 28 - 2), VC - 6148 (50 - 12), VC - 6153 - B - 20, VC - 6153 - 20P, VC - 6173, VC - 6173 B - 33, VC - 6372 - (45 - 8), VC - 6773 - B - 6, VC - 6897 and BARI Mung - 4 were collected from Bangladesh Agricultural Research Institute, Joydevpur, Gazipur. The experiment was laid out in RCBD with three replications. The plot size was 3 m × 4 m and seeds were sown on 20th March and the crop was harvested within June 2014 at both locations. General cultural practices were adopted to maintain the experiment except that insecticidal sprays were not applied to encourage the population of the vector for natural disease spreading. Assessment of different germplasms were carried out on the basis of percentage of disease infection and scoring them using recommended 1 - 9 scale (Singh, 1995) at reproductive stage from 10 randomly selected plants of each plot. The yield was calculated from the grain of whole plot (t ha^{-1}) and analyzed statistically using MSTAT-C (Gomez and Gomez, 1984) and the results are presented in Table 1.

Development of management package for controlling Mungbean Yellow Mosaic Virus (MYMV): Healthy seeds of mungbean variety BARI Mung - 4 (susceptible) were directly sown in two different locations Golapgonj, Sylhet, and PRSS, Joydebpur during Kharif-1 2014 for development of management package against MYMV. The plot size was 3 m × 2 m with RCBD having three replications. There were five treatments, namely, Furadan 3G, Furadan + Admire, Furadan + Neem leaf extract (NLE) (spraying), Furadan + Sobicron and control. The insecticides were sprayed at 20, 30 and 40 days after sowing. During the growing period, plots were inspected regularly to record the incidence of MYMV disease from seedling to maturity stage of the crop. MYMV affected plants were counted regularly. For both the locations, the disease was rated on 1 - 9 scoring scale (Singh, 1995) for MYMV. The scale was 1 = 0 % mortality (R), 2 - 3 = 10 % or less mortality (MR), 4 - 5 = 11 – 20 % mortality (T), 6 - 7 = 21 - 50% mortality (MS) and 8 - 9 = 51 % or more mortality (S). The disease incidence, severity and yield data was presented in Figs. 1, 2 & 3.

Results and Discussion

Response of mungbean genotypes againast MYMV: Sixteen mungbean genotypes were evaluated on the basis of the disease scoring scale. The results revealed that there was great variation among the genotypes. All the genotypes were categorized into ten different classes based on disease severity. This depicts the four genotypes i.e. Gk - 22, SMZ - 134, VC - 6153 -20P and VC - 6773 - B - 6 were found to be resistant at disease rating "1" showing 0 % of the disease symptoms that means there is no disease in these genotypes but their yields were 1406, 1326, 1285 and 1189 kg ha^{-1} respectively at Gazipur. On the other hand, ten genotypes i.e. VC - 3669, VC - 3960 A - 88, VC - 3960 A - 89, VC - 6148 (50 - 12), VC - 6144 (47 - 28 - 2), VC - 6153 - B - 20, VC - 6173, VC - 6173 B - 33, VC - 6372 - (45 - 8) and VC - 689 exhibited 10 % MYMV infection and having rating scale "3" and 1139, 1146, 1077, 1208, 1139, 1500, 1199, 1132, 1356 and 1368 kg ha^{-1}, respectively yield was recorded in the same place. In RARS, Jessore Gk - 22, SMZ - 134, VC - 3669, VC - 3960 A - 88, VC 6144, VC - 6153 - B - 20, VC - 6153 - 20P, VC - 6173, VC - 6173 B - 33, VC - 6773 - B - 6 and BARI Mung - 4 were showed rating scale "3" with 1200, 1710, 1430, 1070, 1300, 820, 870, 1035, 1010, 1750 and 1660 kg ha^{-1}, respectively yield. But VC - 6144 (47 - 28 - 2) and VC - 6897 were designed with "5" and VC - 3960 A - 89, VC - 6148 (50 - 12) and VC - 6173 B - 33 were recorded "7' rating scale with 830, 1010, 570, 820 and 1020 kg ha^{-1}, respectively yield in the same area. In Gazipur, VC 6144 and BARI Mung - 4 were showed "5" rating of disease infection with yield 1107 and 1312 kg ha^{-1}, respectively. It appears from the table that there were considerable differences in the disease incidence at both locations. Four genotypes were showed no disease; ten genotypes were scored three and two were recorded five at Pulses Research Sub-Station (PRSS), Bangladesh Agricultural Research Institute, Joydevpur, Gazipur. In contrast, eleven genotypes were "3"; two genotypes were "5" and three genotypes were "7" at Regional Agricultural Research Station, BARI, Jessore. It was indicated that the MYMV incidence was low at Joydebpur and high at Jessore. The genotypes GK - 22, SMZ - 134, VC - 6773 - B - 6 and VC - 6153 - 20P had the lowest incidence of MYMV (scale - 1) at Joydebpur. Therefore, it is necessary to investigate in-depth whether the genotypes has the escaping mechanism of MYMV. However, the genotypes VC – 6153 - B - 20 had the lowest incidence at both the locations in last year with considerable yield. So VC - 6153 - B - 20 may be a wonderful source of MYMV tolerance.

Use of virus resistant genotypes has become an imperative measure for an effective disease control but there is little success achieved in this respect. The results of present screening were in close agreement with several other

findings. Naqvi *et al.* (1995) studied that out of 10 tested lines, there was no resistant line to MYMV. Shad *et al.* (2006) found that there was no resistant line against MYMV and identification of seven susceptible and 247 as highly susceptible lines exhibited meager resistance in Mungbean. Singh *et al.* (1996) reported the partial resistance in Mngbean. There was only one variety of Mungbean (Plant - U30) that was resistant to whitefly and yellow mosaic disease (Sahoo and Hota, 1991). Bashir (2003) screened 276 lines of Mungbean and out of which 10 showed resistance. Similarly, nine resistant lines were observed in field conditions from 83 lines against MYMV (Awasthi and Shyam, 2008). The results showed that there were 30 susceptible and 43 highly susceptible genotypes of Mungbean. Iqbal (2011) screened one hundred Mungbean genotypes and found that only four was resistant to MYMV. Great variation in genotype response to MYMV represents variability in their genetic makeup. It was generally reported that two recessive genes took part in the control of resistance mechanism in Mungbean (Shukla and Pandya, 1985) whereas susceptibility was controlled by single recessive gene. So, it becomes evident that susceptibility is dominant over resistance.

Table 1. Performance of screening trials against MYMV at Joydebpur and Jessore.

Genotypes	MYMV disease score (1 - 9 scale)		Yield (kg ha^{-1})	
	Gazipur	Jessore	Gazipur	Jessore
Gk - 22	1	3	1406 ab	1200 f
SMZ - 134	1	3	1326 ab	1710 ab
VC - 3669	3	3	1139 b	1430 c
VC - 3960 A - 88	3	3	1146 b	1070 g
VC - 3960 A - 89	3	7	1077 b	570 j
VC 6144	5	3	1107 b	1300 e
VC - 6144 (47 - 28 - 2)	3	5	1208 ab	830 i
VC - 6148 (50 - 12)	3	7	1139 b	820 i
VC - 6153 - B - 20	3	3	1500 a	820 i
VC - 6153 - 20P	1	3	1285 ab	870 i
VC - 6173	3	3	1199 ab	1035 e
VC - 6173 B - 33	3	7	1132 b	1020 gh
VC - 6372 - (45 - 8)	3	3	1356 ab	1010 h
VC - 6773 - B - 6	1	3	1189 ab	1750 a
VC - 6897	3	5	1368 ab	1010 h
BARI Mung - 4	5	3	1312 ab	1660 b
CV (%)	-		6.78	4.80

**Data with same letter(s) in a column are not significantly different at 5% level of significance*

Development of management package for controlling Mungbean Yellow Mosaic Virus (MYMV): The effect of all the treatments has a significant impact on MYMV incidence and severity at Gazipur and Sylhet. It was clearly observed that the highest disease incidence was found in control plot (38 %) followed by Furadan 5G + Sobicron (18 %), Furadan 5G + NLE (16 %), Furadan 5G (16 %) and Furadan 5G + Admire (7 %) treated plots at PRSS, Gazipur. In case of Golapganj, the highest disease incidence also recorded in control plot (30 %) followed by Furadan 5G + Sobicron (14 %), Furadan 5G (11 %), Furadan 5G + NLE (10 %) and Furadan 5G + Admire (5 %) treated plots. The MYMV disease severity was showed the similar trend at both the locations. The yield of Mungbean were 1480 and 1231 kg ha^{-1} in Furadan 5G + Admire, 1309 and 8.68 kg ha^{-1} in Furadan 5G + Sobicron, 1232 and 727 kg ha^{-1} in Furadan 5G + NLE, 1167 and 656 kg ha^{-1} in Furadan 5G and 1075 and 456 kg ha^{-1} in control plots, respectively at Gazipur and Sylhet. It was observed from the results that Furadan + Admire treated plots have the lowest incidence (score - 2) of MYMV at both locations and produced the highest Mungbean yield 1480 kg ha^{-1} and 1309 kg ha^{-1} respectively at Gazipur and Sylhet. However the economy of these treatments, data on whitefly and effect of Admire singly are necessary before recommending the package for controlling MYMV. Use of different insecticides has impressive measures for the vector control. The results of present research were in close relation with other findings. Dubey and Singh (2010) studied that a combination of seed treatment with Thiamethoxam and Carbendazim followed by foliar applications of Thiamethoxam and Carbendazim results the highest yield in mungbean with the lowest disease intensity. Hossain (2016) found that application of Marshal 20EC

reduce the population of whitefly with the lowest intensity of MYMV and gave the highest yield. Alam (2016) reported that Admire 200SL (Imidacloprid) @ 0.5 ml l^{-1} of water treated field showed the lowest number of whitefly infestation $plant^{-1}$ at vegetative and reproductive stage.

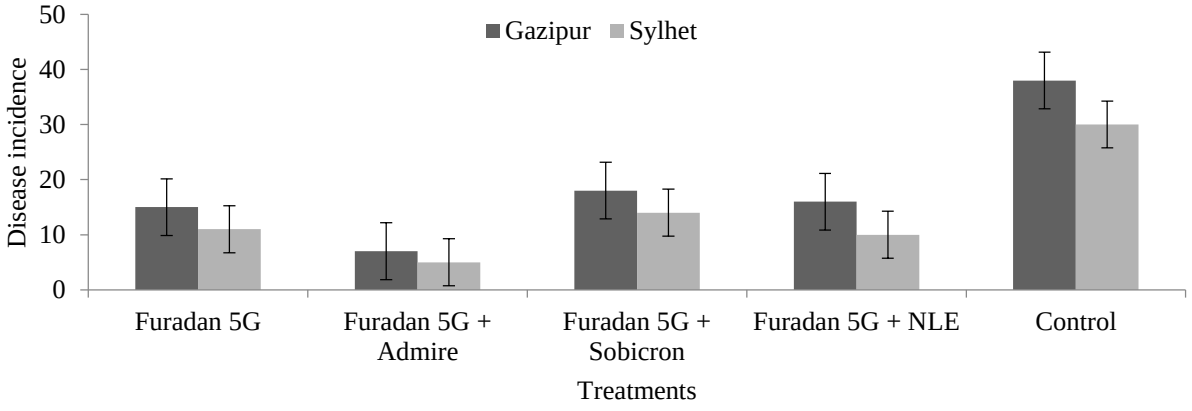

Fig. 1. Performance of different insecticide on MYMV of Mungbean at Gazipur and Sylhet.

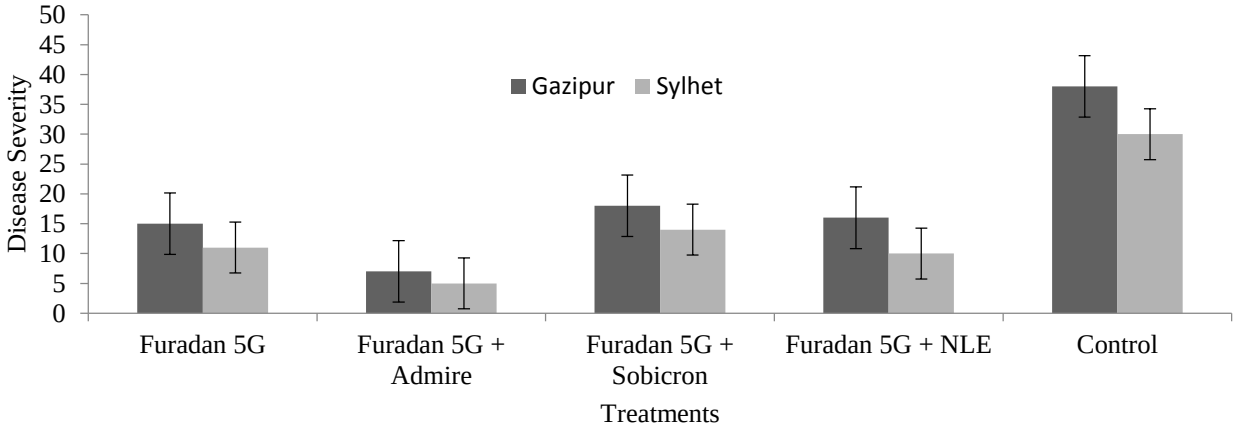

Fig. 2. Different insecticidal effects on the MYMV of Mungbean at Gazipur and Sylhet.

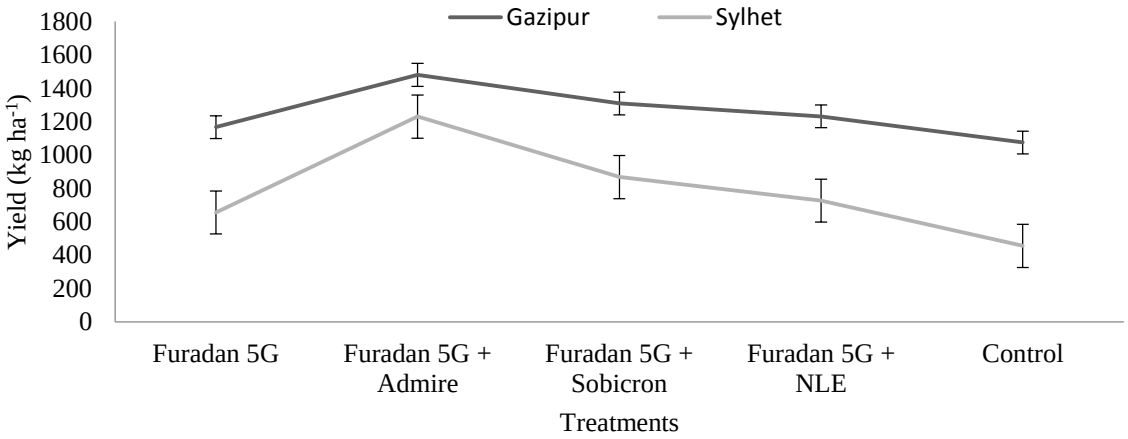

Fig. 3. Effects of insecticide on yield of mungbean at Gazzipur and Sylhet.

Screening these sixteen gremplasms, it was found that only one genotype showed tolerance against Mungbean Yellow Mosaic Virus with higher yield. Lack of resistant varieties necessitates the development of virus resistant varieties through genetic engineering and biotechnology in future. Several trails will be required in different locations and years to recommend Admire as a management package of whitefly.

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