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MUNGBEAN GERMPLASMS RESISTANCE TO CERCOSPORA LEAF SPOT DISEASE AND ITS MANAGEMENT

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Abstract

Sixteen mungbean 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 screened against Cercospora leaf spot at Pulses Research Sub-Station (PRSS), Bangladesh Agricultural Research Institute, Joydevpur, Gazipur and Regional Agricultural Research Station (RARS), Jessore, Bangladesh during 2014 under the rainfed condition. The genotypes were categorized into 0 - 8 scale to determine the differential response of Mungbean accessions to Cercospora leaf spot. On the other hand, another experiment also conducts in the same time. In another field study efficacy of three chemicals namely Score (0.2%), Secure 600WG (0.2%), Bavistin 50WP (0.15 %) and one botanical Neem leaf extract (1:1), were evaluated to find out the effective management practices for Cercospora leaf spot of Mungbean at Golapgonj, Sylhet and PRSS, Joydevpur. The plot size was 3m × 4m and the experiment was laid out in a Randomized Complete Block design (RCBD) with three replications. Considerable variations among the genotypes were observed with respect to disease reactions, none of the genotypes were found to be highly resistant to the disease. Among the genotypes VC – 6153 – B – 20 showed the lowest disease incidence with the highest yield in both locations suggested that VC – 6153 – B - 20 may be a wonderful source of Cercospora leaf spot of Mungbean tolerance. Among all the treatments, Secure 660WG treated plots showed the lowest disease incidence with the highest yield. Hence, Secure 660WG (0.2%) may be recommended for controlling the disease of Mungbean.

***Keywords*:** Mungbean, cercospora leaf spot (CLS), genotypes, yield, fungicides.

Introduction

Mungbean (*Vigna radiata)* belongs to fabaceae family along with good sources of protein, carbohydrates and vitamins for mankind all over the world. It is a short-duration, kharif-1 crops grown in tropical and sub-tropical area. In Bangladesh, it is grown three times in a year over 216.51 ha of land with annual production 185 MT and the average yield is 1349.2 kg ha^{-1} which is low as compared to the average yield of other pulse growing countries (BBS, 2010). It can improve the fertility status of soil by fixing atmospheric nitrogen through symbiotic relationship with soil bacteria (Yadav *et al*., 1994). Mungbean has been considered as "poor men's protein". It contains 26% protein, 51% carbohydrate, 4% minerals, 3% vitamins and 10% moisture (Khan, 1981). Sixteen different fungal, bacterial and viral diseases are infecting this crop (Bark, 1993) and responsible for lower yield. But the fungal disease Cercospora leaf spot is a major thereat for Mungbean production in Bangladesh (Verma and Sandhu, 1992) and causes yield loss up to 58% (Lal *et al*; 2001). It is wieldy distributed all over the country where Mungbean is cultivated. The disease is caused by *Cercospora cruenta*, *C. canescens*, *C. Kikuchii* and *C. caracallae.* Among these *Cercospora cruenta*is the most prevalent species (Talukder, 1974). Initially water soaked lesion is seen on the leaves, as spot become mature and coalesce together. Later, enlarged dead area is also seen on the infected leaves. *Cercospora* can defoliate prematurely when the Mungbean plants infect heavily. Sometimes, the leaves may become malformed and wrinkled. The disease plants maturity is delayed as a result of poor pod formation. Severely infected

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plant produce small and immature seeds (Poehlman, 1991). The disease starts appearing about 30 to 40 days after sowing. Depending upon the temperature and humidity, it spreads rapidly in susceptible varieties. Several workers had reported the effective control of the disease with the application of fungicides (Singh and Singh, 1978). The cheapest, practical and economical control of the disease can be achieved by the resistant source of the disease (Jadhav and Sharma, 1983). Therefore, it is necessary to develop resistant varieties to reduce the disease population and management package for low cost of production as well as to protect the environment.

Materials and Methods

Screening of short duration Mungbean germplasm against CLS

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 genotypes were screened against CLS at Pulses Research Sub-Station (PRSS), Bangladesh Agricultural Research Institute, Joydevpur, Gazipur and Golapganj, Sylhet during kharif-1, 2014 under the rainfed condition. The germplasms were collected from Bangladesh Agricultural Research Institute, Joydevpur, Gazipur. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The plot size was 3m × 4m and seeds were sown on 20 March PRSS, Joydevpur, Gazipur and 22 March at RARS, Jessore. The crop was harvested in June from both locations. General cultural practices were adopted to maintain the experiment in both locations except insecticidal sprays were not applied to encourage the natural disease spreading. Assessment of different germplasms were carried out at reproductive stage from 10 randomly selected plants of each plot using 0 – 8 rating scale of CLS (Haque *et al*., 1994).The grain yield data was also recorded from the whole plot. Data were analyzed using MSTAT-C (Gomez and Gomez, 1984).

Development of management package for controlling Cercospora leaf spot (CLS) of Mungbean

During kharif-1, 2014 healthy seeds of Mungbean variety BARIMung-4 were directly sown in two different locations Golapgonj, Sylhet, and PRSS, Joydevpur for development of management package against CLS. The plot size was 3m × 2mwith Randomized Complete Block Design (RCBD) with three replications. There were five treatments namely, Neem leaf extract (1:1), Score (0.2%), Secure 600WG (0.2%), Bavistin 50 WP (0.15%) and untreated control plot. The treatments were sprayed at 10 days interval from the first appearance of the disease symptom (3 sprays). During the growing period of the crops, the plots were monitored regularly to record the incidence of Cercospora leaf spot disease from seedling to maturity stage of the crop. For both the locations, disease incidence, the infected plants were identified following Ahmed (1975). The data was collected on the basis of percentage of disease infection and scoring them using recommended 0-8 scale of (Haque *et al*., 1994). The disease incidence and yield data was recorded.

Results and Discussion

Response of mungbean genotypes against CLS

Evaluation of CLS resistance was carried out in sixteen Mungbean genotypes on the basis of disease severity. The results revealed that a great variation was observed among the genotypes. All the genotypes were categorized into nine different classes based on disease severity. This depicts the five genotypes i.e. Gk-22, VC-3960 A-88, VC–6153–B-20, VC-6153 -20P, VC – 6372-(45-8) were found to be resistant showing 3.1-6% severity at Gazipur indicated that these lines showed the lowest susceptibility to CLS. On the other hand, in Jessore VC-6897 showed similar response to CLS. None of the genotypes were found to be free from the disease. In Jessore, 0.1-3.0% infections were recorded in Gk-22, SMZ-134, VC-3669, VC-6144, VC– 6173, VC–6773–B-6. Hence, these varieties were showed the lowest susceptibility in that site. 12.1-25% leaf area infection was recorded in SMZ-134, VC-3669, VC-6144 (47–28-2), VC-6148 (50-12), VC-6173, VC-6173 B-33, VC–6773–B-6 and VC-6897 in Gazipur although VC-3960 A-89 showed same disease infection in Jessore. The highest 50.1- 75% leaf area infection was observed in VC-3960 A-89, VC-6144 and BARIMung-4 at Gazipur. However, in Jessore VC-3960 A-88, VC-6144 (47 - 28-2), VC - 6153-20P, VC-6173 B-33 and VC - 6372-(45-8) germplasms were exhibited “3” rating score indicated 6.1-12% leaf area infection. In addition, VC-6148 (50-12) and BARIMung-4 genotypes were showed 25.1-50% disease infections.

Table 1. Screening of Mungbean germplasms against Cercospora leaf spot

Score	Infection	Genotypes	
		Gazipur	Jessore
0	Free from spot	No genotypes	No genotypes
1	0.1 –3 %	No genotypes	GK-22, SMZ-134, VC-3669, VC-6144, VC-6173, VC–6173–B–6
2	3.1 – 6%	GK - 22, VC–3960–A-89, VC– 6153-20P, VC–6153–B-20, VC–6372-(45-8)	VC–6897
3	6.1 – 12%	No genotypes	VC–3960–A-88, VC-6144 (47–28-2), VC–6153-20P, VC–6173–B-33, VC–6372-(45-8)
4	12.1-25 %	SMZ-134, VC-3669, VC-6144 (47 –28-2), VC-6148 (50-12), VC-6173, VC–6173–B-33, VC–6773 – B-6, VC – 6897	VC–3960–A–89
5	25.1 – 50%	No genotypes	VC-6148 (50-12), BARIMung-4
6	50.1-75%	VC–3960–A-89, VC-6144, BARIMung – 4	No genotypes
7	75.1 – 87%	No genotypes	No genotypes
8	> 87%	No genotypes	No genotypes

Table 2.Yield of Mungbean at Joydevpur and Sylhet locations as influenced by mungbean genotypes

Genotypes	Yield (kg ha^{-1})	
	Gazipur	Jessore
Gk-22	1406 ab	1200 f
SMZ-134	1326 ab	1710 ab
VC-3669	1139 b	1430 c
VC-3960 A-88	1146 b	1070 g
VC-3960 A-89	1077 b	570 j
VC –6144	1107 b	1300 e
VC-6144 (47–28-2)	1208 ab	830 i
VC-6148 (50-12)	1139 b	820 i
VC – 6153– B-20	1500 a	1432 c
VC-6153-20P	1285 ab	870 i
VC-6173	1199 ab	1035 e
VC-6173 B-33	1132 b	1020 gh
VC–6372-(45-8)	1356 ab	1010 h
VC – 6773–B-6	1189 ab	1750 a
VC-6897	1368 ab	1010 h
BARIMung-4	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*

There was considerable variation in the disease severity at both locations were observed. Five genotypes were showed score "2"; eight germplasms were scored 4 and three lines were scored 5 at Pulses Research Sub-Station (PRSS), Bangladesh Agricultural Research Institute, Joydevpur, Gazipur. In contrast, six genotypes were scored "1'; two germplasms were ratted 2 and five genotypes were exhibited 3, one was having 4 score and another two genotypes were showed 5 score at Regional Agricultural Research Station, BARI, Jessore. It indicated that the CLS severity was comparatively higher at Joydebpur and lower at Jessore but Gk-22 and VC - 6153 -B-20 were showed the lowest severity in both of the locations which indicates the existence of tolerance in those genotypes. Fungal diseases including Cercospora leaf spot drastically reduce the yield of the legumes crops. The highest yield was found in VC – 6153 – B - 20 (1500 kg ha^{-1}) followed by Gk–22, VC–6897, SMZ–134, VC–6372-(45-8), VC-6153 - 20P, VC–6144 (47–28-2), VC-6173, VC–6773–B-6, and BARIMung–4 with 1406 kg ha^{-1},1368 kg ha^{-1}, 1356kg ha^{-1},

1326 kg ha^{-1}, 1312 kg ha^{-1},1285 kg ha^{-1}, 1208 kg ha^{-1}, 1199 kg ha^{-1} and 1189kg ha^{-1}yield respectively at Gazipur. There is no significant difference among the yield of these genotypes. The lowest yield was found in VC-6173 B–33 with 1132 kg ha^{-1} in the same location. In Jessore, the highest yield was recorded in VC–6773–B-6 with 1750 kg ha^{-1}and the lowest yield was found in VC–6153 -20P with 1710kgha^{-1}. However, the genotype VC–6153–B-20 had the lowest incidence at both the locations in last year with considerable yield. The results of the present study partially supported with the findings of Raje and Rao (2002) who screened 200 genotypes of Mungbean against Cercospora leaf spot and reported 174 as resistant; whereas out of 100 diverse stock of mungbean, 18 genotypes were identified as resistant to the disease (Basandrai *et al.*, 1999). Similarly, Haque *et al*. (1997) reported that twelve genotypes (NM-98, 98–cmg-003, C2/94–4-42, NM-1, NM-2, 98cmg-018, BRM-188, CO-3, Basanti, PDM-11, BARI Mung-2 and VC–3960-88) with average disease score of "1", were found highly resistant.

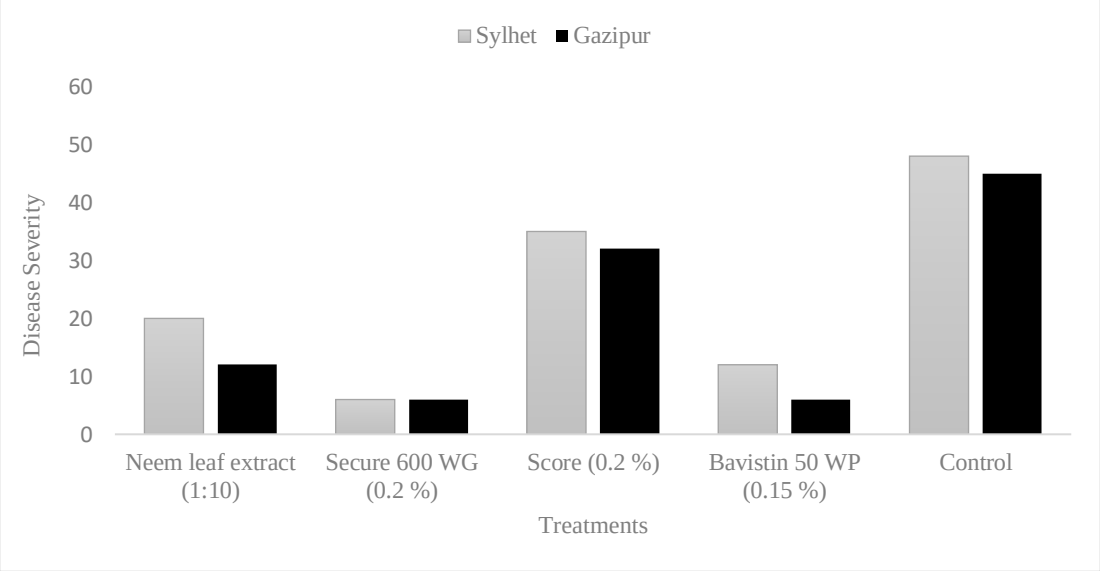

Fig. 1. Effects of different fungicides and one botanical extracts on the severity of CLS of Mungbean

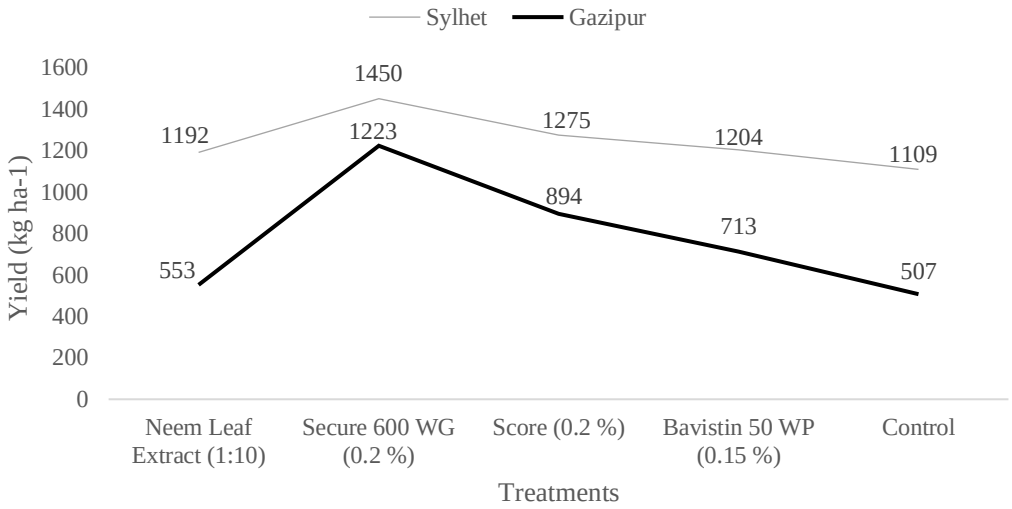

Fig. 2. Efficacy of chemicals and botanicals on yield of mungbean (BARI Mung-4) at Gazipur and Sylhet

Development of management package to control CLS of Mungbean

Results revealed that all the treatments significantly reduced the disease severity as compared to the untreated control. The minimum disease severity was recorded in Secure 600WG (0.2%) treated plot scoring "2" that means 3.1 – 6% leaf area infected at both location and the maximum 75.1– 87% disease severity was found in control plot. Likewise, effects were found in case of yield. The disease severity in Sylhet and Gazipur ranged from 6.1 to 12% having yield of 1204 and 713 kg ha^{-1} respectively. Score (0.2%) treated plots was exhibited 25.1-50% infection and produced 1275 and 894 kg ha^{-1} yield at Sylhet and Gazipur respectively. Neem leaf extracts (1:10) sprayed field showed 12.1-25 % disease severity at Sylhet and 6.1–12% at Gazipur having 1192 and 553 $kgha^{-1}$grain yield, respectively. It was clearly observed that different treatments resulted considerable difference among yield. Similar result was also observed in different locations. The highest yield was found in Secure 600WG (0.2%) treated plot. Datta *et al.* (2016) found that combined application of Bavistin 50WP and Secure 600WP combined effect suppress the Cercospora leaf spot at seedling stage.

On the basis of present investigations, VC–6153–B–20 genotype was identified as a tolerant variety and may be exploited in the breeding program aimed at the development of high level resistant variety of Mungbean against Cercospora leaf spot. In addition, spraying of Secure660WG (0.2%) may be recommended for controlling the CLS disease of Mungbean in both locations.

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