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EFFICACY OF DIFFERENT PROTECTIVE FUNGICIDES AGAINST CERCOSPORA LEAF SPOT OF MUNGBEAN (*VIGNA RADIATA* L. WILCZEK)

[a]Muhammad U. Shahbaz*, [a]Muhammad A. Iqbal, [a]Muhammad Rafiq, [a]Aasia Batool, [b]Muhammad Kamran
[a] *Pulses Research Institute, AARI, Faisalabad (Punjab), Pakistan.*
[b] *Department of Plant Pathology, University of Agriculture Faisalabad, Pakistan*

A B S T R A C T

The experiment was planned to minimize the losses in mungbean against Cercospora leaf spot disease caused by *Cercospora canescens* Ellis & Martin. For this purpose a mungbean susceptible line was sown in three sets with three replications and four treatments *i.e.* Propineb (Antracol), Metalaxl+Mancozeb (Ridomil Gold), Mancozeb and Water as control. After fungicides spray artificial inoculation of *C. canescens* was given to three sets with 5 days interval to create disease epidemic. Results showed that all the protective fungicides reduced the incidence and severity percentages of *Cercospora* leaf spot. In particular Ridomil Gold and Antracol shown better results but Ridomil Gold was the best among all which substantially reduces the number of infected leaves and lesions on foliage and pods. It was also found that Ridomil Gold gave best results where it was sprayed within 10 days of infection (on Set I). It managed disease at 18.51% disease index which was much less than the untreated block where disease index was 40.74%.

Keywords: Chemicals, management, plant diseases.

INTRODUCTION

Legume crops are the cheapest source of protein and also called poor men's protein (Mian, 1976). In legumes, mungbean is an important crop of South and Southeast Asia. Recently mungbean was grown on 136,100 ha and production was 89,300 ton in Pakistan which is less than the previous year (Anonymous, 2013). Mungbean has sown as a monocrop in different cropping systems which popular due to its early maturity and association with nitrogen fixing bacteria (Chankaew *et al.,* 2011).

Genus *Cercospora* is parasitic on many crops, herbaceous, ornamental plants and trees throughout the world. CLS is an important disease of mungbean crop caused by a biotrophic fungus *C. canescens*. Due to this disease yield losses up to 50-70% has been observed (Lal *et al.,* 2001 and Chand *et al.,* 2012). CLS can cause heavy defoliation in severe conditions on mungbean especially at optimum temperature 25-30°C with RH 90-100%. Symptoms of this disease appear mainly on leaves but also on stem, branches and pods. The disease appears initially on the lower leaves of the infected plants and then spread all over the plant. It also reduces the number and size of pods and seeds (Grewal *et al.,* 1980). Hossain *et al* 2011 described that the disease was mainly observed when crop was at flowering, pod formation and ripening stage. CLS disease mainly managed by tillage operations, crop rotations, host plant resistance and fungicides (Hanson and Panella, 2003; Khan and Smith, 2005; Khan, 2008). This disease was managed mainly through fungicides (Singh and Naik, 1977; Singh and Singh, 1978).

In the mungbean growing areas CLS had serious threat while high humidity prevails during crop season (Bashir and Zubair, 1985). This has not been thoroughly investigated disease for mungbean in Pakistan but its impact on crop yield and seed quality at maturity is alarming. The objectives of this study are to evaluate different protective fungicides for mungbean against Cercospora leaf spot.

MATERIAL AND METHODS

Planting Conditions: The experiment was conducted in the Kharif, 2013 (July - September) season at the Pulses Research Institute, Faisalabad, Pakistan, on fertile soil.

* Corresponding Author:
Email: umar739@yahoo.com

The high humidity and dry period in this cropping season in Pakistan favors the development of this disease in the region.

Planting material: The mungbean line C_2-94-4-36 was selected for this experiment due to its susceptibility to CLS disease. The same line was used as control in the trial on which distilled sterilized water was sprayed.

Experiment design: The experiment was sown in Randomized Complete Block Design (RCBD) in three sets. Each set consists of three replications and each replication comprises of four blocks of treatments. Each block of 1×4 m with 30 cm row and 10 cm plant to plant distance. The sowing was done with dibblers in the first week of July, 2013 (Fig. 1).

Antifungal treatments: The application of protective fungicides was performed after 50 days of sowing before the appearance of the disease. All the treatments were sprayed on the three sets. The distilled sterilized water was sprayed as control (T_0) and the other three fungicides were Antrocol (Dose: 2.47 kg/ha; T_1), Ridomil Gold (Dose: 618g/ha; T_2) and Mancozeb (Dose: 1.2 Kg/ha; T_3).

Preparation of inoculum: Inoculum was prepared from the old growing culture of *C. canescens*, multiplied on sterilized/ autoclaved mungbean grains and incubated at 25 ^{o}C for 10-14 days (Fig. 2). The inoculum was sprayed on set I after 5 days of the protective fungicides, on set II after 10 days and on set III after 15 days. The concentration of inoculum was adjusted at 5×10^5 conidia/ml by using haemocytometer.

Disease observations: The disease incidence and severity were recorded after one week of each inoculum spray on three sets. The incidence/ infection percentage (IP) was calculated as follows;

$$\text{IP} = \frac{\text{Infected plants in a block}}{\text{Total Plants in a block}} \times 100$$

The disease severity was calculated by using the 0-9 scale (Table 1) and Percentage Disease Index (PDI) was calculated by following;

$$\text{PDI} = \frac{\text{Sum of all disease severity ratings}}{\text{Total observations} \times \text{Highest rating in scale}} \times 100$$

Data analysis: The evaluation of the disease in each set and treatment was estimated by infection percentage and percentage disease index. Data was analyzed by using Statistix and SPSS computer programmes for analysis of variance. The least significant difference was calculated for comparing the means of treatments of three sets at 5% level of probability.

Table 1. Disease severity rating of CLS

Severity Rating	Symptoms on plants at flowering and pod formation stage
0	No visible symptoms on plants
1	1-10% foliage or pod area affected with small pinhead lesions
3	11-20% foliage or pod area affected with small round brown spots
5	21-30% foliage or pod area affected with large spots
7	31-50% foliage or pod area affected with bigger coalescing spots
9	51-100% foliage or pod area affected with bigger coalescing spots

Figure 1. CLS affected trial.

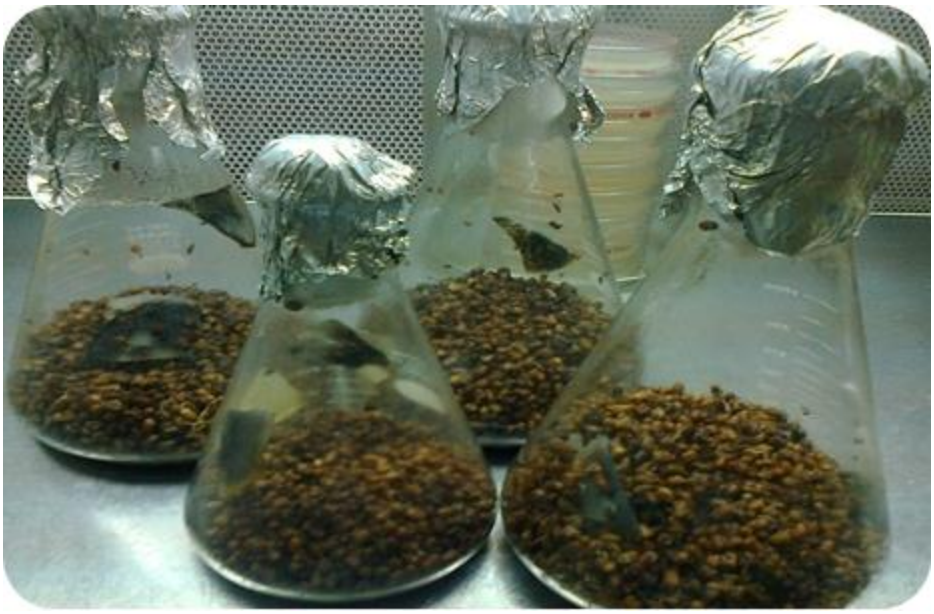
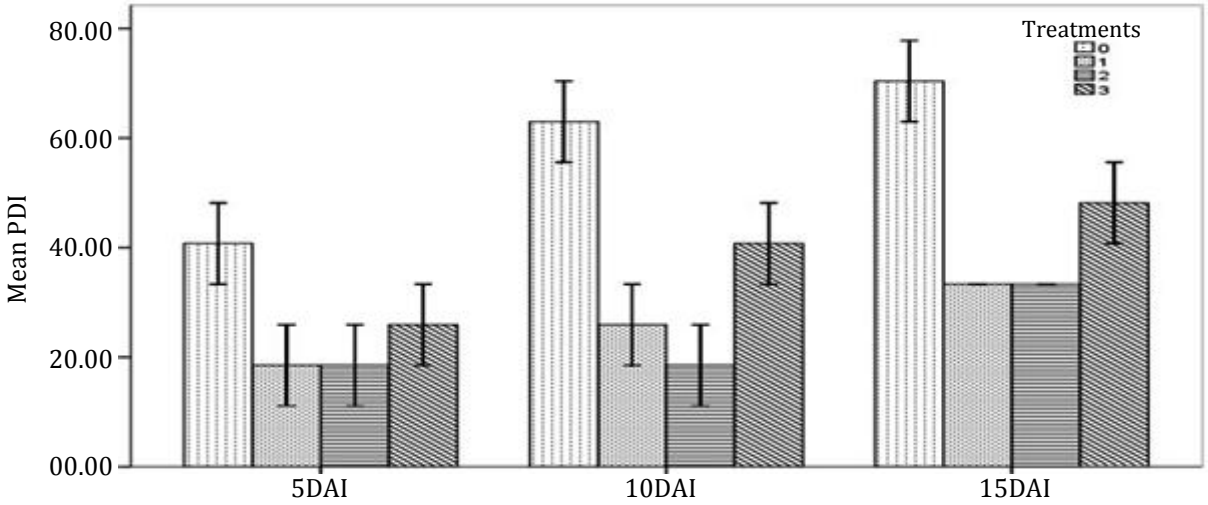


Figure 2. Mass multiplication of *C. canescens* on Mungbean seeds.

RESULTS

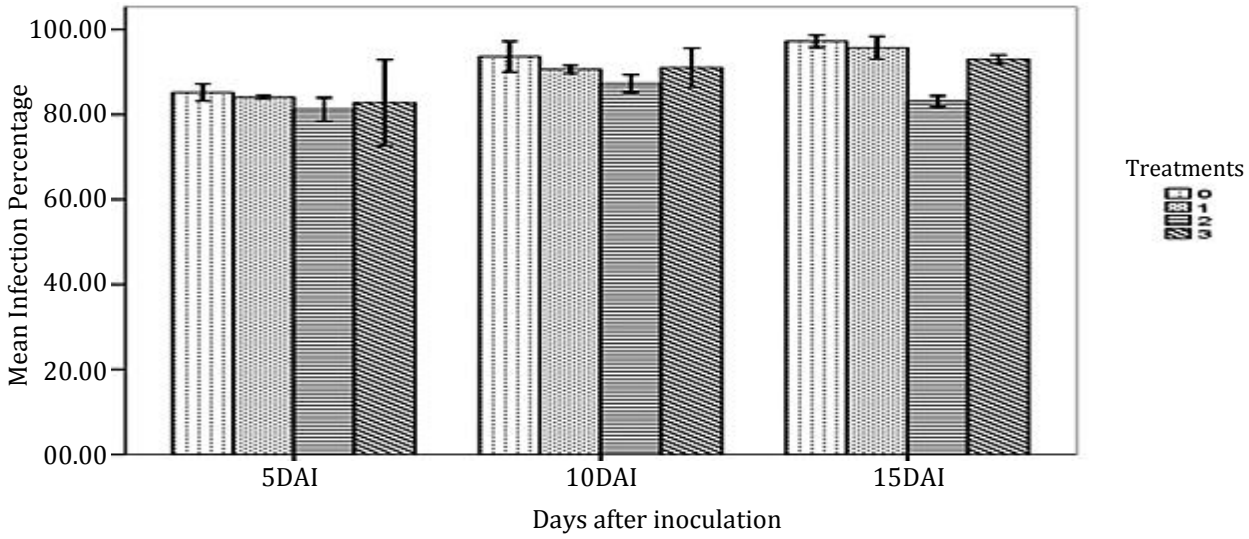
The data obtained after the evaluation of different protective fungicides revealed a gradual increase in both incidence and severity percentage with the increase of inoculation days in three sets. In set I (5 DAI) the highest IP was recorded in control (85.15%) on which simply distilled sterilized water was sprayed and lowest was on Ridomil Gold (81.17%) after that Antracol (84.01%) and Mincozeb (82.76%) respectively. The highest PDI was observed in control (40.74%) then Mancozeb (25.92%) in set I. Radiomil Gold (18.51%) and Antracol (18.52%) showed same trend in set I regarding PDI (Fig. 3 and 4).



O: Control; 1: Antracol; 2: Ridomil Gold; 3: Mancozeb

Figure 3. Effect of treatments on CLS Percentage Disease Index (PDI).

Set II (10 DAI) results shown variable response against CLS. The lowest PDI was shown by Ridomil Gold (18.56%) and highest was found in control (62.97%). Antracol and Mincozeb managed PDI at 25.92% and 40.74 %. The lowest IP 87.27% was present in Ridomil Gold among the four treatments in Set II. The incidence of Antrocol and Mancozeb were 90.60% and 91.00% respectively. The Ridomil Gold and Antracol showed the same trend in set III (15 DAI) as they show in set I but the PDI value was 33.33%. The PDI of control and Mancozeb were 70.37% and 48.15% respectively. Ridomil Gold showed the lowest incidence 83.12% in Set III while Antracol and Mancozeb shown 95.68% and 92.99% respectively (Fig. 3 and 4).



O: Control; 1: Antracol; 2: Ridomil Gold; 3: Mancozeb

Figure 4. Effect of treatments on CLS Percentage Disease Index (PDI).

In set I the incidence/ infection percentage (IP) was 83.28% while in set II and III CLS incidence was 90.62% and 92.26% respectively. The percentage disease index (PDI) in three sets was 25.92%, 37.04% and 46.30% respectively. Over all the best results was given by Radiomil Gold among the treatments. Radiomil Gold managed CLS incidence and severity at 83.85% (IP) and 23.45% (PDI) respectively which is much less than the other treatments. Antracol control CLS incidence and severity at 90.10% and 25.92%. CLS incidence and severity were 88.91% and 38.21% where Mancozeb was applied (Table 2).

Table 2. Over all comparison of treatments and three sets.

Treatments		
	Infection Percentage	Percentage Disease Index
Antracol	90.101 A	25.923 C
Ridomil Gold	83.857 B	23.454 C
Mancozeb	88.919 AB	38.271 B
Control	91.996 A	58.027 A
C.V	6.56	26.35
Sig.	0.0377	0.0000
Days After Inoculation (3 Sets)		
05 DAI (Set I)	83.278 B	25.924 C
10 DAI (Set II)	90.620 A	37.037 B
15 DAI (Set III)	92.257 A	46.296 A
CV	6.56	26.35
Sig.	0.0017	0.0001

Different letters in the same column show significant difference at 0.05 probability level.

DISCUSSION

CLS is the most important and alarming disease which seriously reduce mungbean production in Pakistan. This disease occurs in all the mungbean growing areas of Pakistan at crop maturity stage that reduces the pod formation and seed setting which ultimately cause the yield losses. As mungbean is poor men's protein (Mian, 1976) which contains 26% protein, 51% carbohydrates, 10% moisture, 4% minerals and 3% vitamins (Khan, 1981). Pakistan is a developing country and pulses are the cheapest source of protein in this country but mungbean production is decreasing from previous years (93,000 ton in 2012; 89,300 ton in 2013) (Anonymous, 2013). Also the average yield of mungbean is decreasing as compared to its yield potential of 2-4 ton/ha (Ramakrishna *et al.,* 2000). There are many factors which are responsible for its low yield among which disease infestation is the most important. Different approaches were carried out to manage CLS such as spray of fungicides and plant extracts and use of resistant varieties. Due to lack of commercialization of plant extracts and its awareness to the formers, fungicides are the immediate and good source of CLS management. Also there is no resistant variety in the country which is resistant to CLS at maturity stage. So, the efficacy of different protective fungicides was evaluated in this study to combat with CLS.

CONCLUSION

The study revealed that the tested fungicides decreased PDI and IP of CLS in mungbean. Conclusion was made that Radomil Gold gave better results as compared to other treatments. It is recommended that one spray of

Ridomil Gold (618 g/ha) at the time of just appearance of CLS can save crop from severe losses. If dry wet weather prolongs the 2nd spray after 7 days of first spray is also necessary. This will decrease CLS disease incidence to a better extent.

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