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Evaluation of Different Chemicals for Controlling Powdery Mildew of Black Gram

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Abstract: One of the major constraints of black gram production is Powdery mildew (*Erysiphe polygoni*) disease. This study was an attempt of assess the efficacy of different chemicals against powdery mildew disease. The Experimental design was RCBD with three replication and Binamash-1 variety was planted under natural field conditions. Four chemicals viz. salicylic acid (1g/L), copper shulphate (0.5g/L), chitosan (0.1g/L) and thiovit (2g/L) was evaluated against powdery mildew disease. Those chemicals were applied 3 times with 7days interval after the disease initiation. Disease incidence and percent leaf area infection data was recorded three time after the application of treatments and other agronomic data was recorded after harvest. All the treatments were performed better than control in reducing the incidence of powdery mildew disease and percent leaf area infection. During the experimental period (Khrif -2, 2020), there was no incidence of other fungal foliar disease. Results represent that thiovit @ 2g/L performed best in controlling powdery mildew disease incidence (41%), percent leaf are infection (33%) and highest seed yield (520.57 kg/ha) among the treatments. We can conclude this study that, Thiovit (80% sulphur fungicide @ 2g/L) was best for controlling powdery mildew of black gram among the treatments and it (applied 3 times with 7days interval after the disease initiation) can be used for controlling this disease.

Keywords: Powdery mildew; Black gram; Incidence; Thiovit.

INTRODUCTION

Black gram [*Vigna mungo* (L.)] is well known and important pulse crop of Asia. It is from *Fabaceae* family and it is believed to have originated in India (Chatterjee and Bhattacharya, 1986). It is mainly a day neutral warm season crop commonly grown in semi-arid to sub-humid low land tropics and sub-tropics (Mane *et al*., 20118).

In Bangladesh, Black gram is one of the highly prized pulses and it is locally known as "Mashkalai". It ranks third among the pulses with an area of about 98006 acres with production of 35,151 MT (BBS, 2016). Black gram is a short duration crop and can fits well in to the intensive cropping system that is potentially useful in improving cropping pattern. The percentage area under Black gram in Bangladesh is 10.67% (BBS, 2016). The average yield of Black gram is about 1000 kg/ha and the protein is 25-26% (BINA 2004).

Powdery mildew (c/o: *Erysiphe polygoni*) is one of the major foliar diseases of plant in all over the world. Linnaeus (1767) established a gene *Erysiphe*. De condole (1802) describe many species of the genus. Powdery mildew is distributed in India and Southeast Asian countries and becomes severe in dry season causing 9.0-50.0 percent yield loss (Reddy *et al* 2008 and Panday *et al* 2009).

The pathogen of powdery mildew (*Erysiphe polygoni*) is obligate parasite and wide range of host. If the pathogen infects the crop before flowering, that may cause serious damage and high yield loss and also if this disease occurs in seedling stage, it results in complete loss of the crop. Abbaiah (1993) reported that the powdery mildew in black gram was generally noticed in 45 days old crop. In absence of suitable resistant cultivars, use of fungicides has become mandatory for controlling this disease. To overcome this problem, the present study was conducted to find out the effective chemicals or fungicide against powdery mildew disease of black gram.

MATERIALS AND METHODS

Experimental site and planting materials

The experiment was conducted at the field of Plant pathology division, Bangladesh Institute of Nuclear Agriculture (BINA), BAU campus, Mymensingh during the period of Kharif-2 season 2020 (Figure 1). Binamash-1(Black gram variety) is used as planting material, which collected from Plant breeding division of BINA.

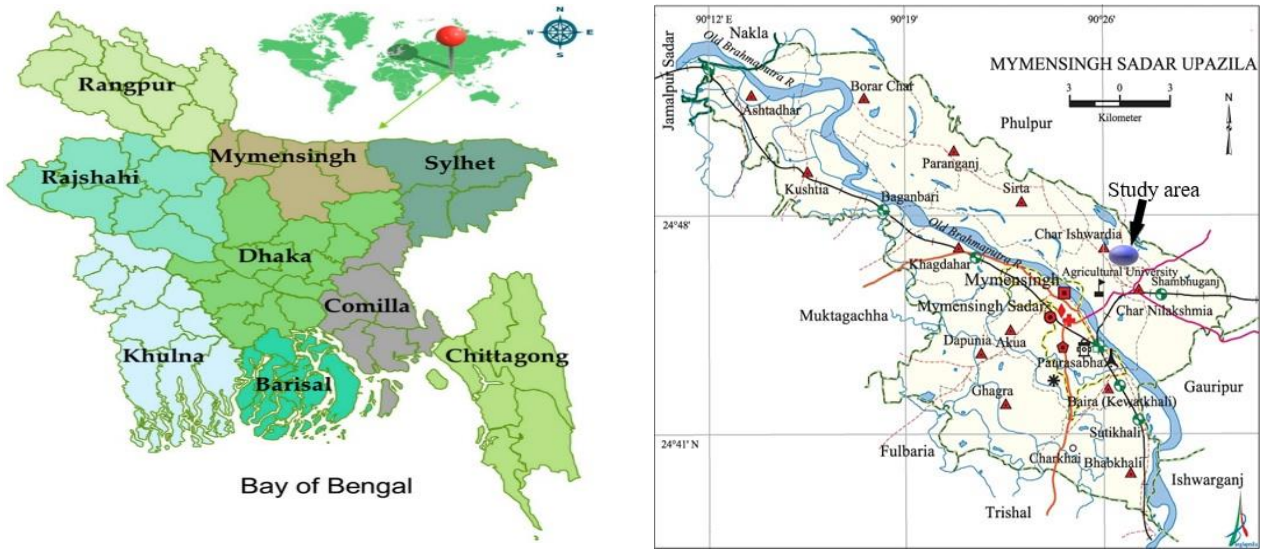

Figure 1. Map of Bangladesh and Mymensingh sadar including study area

Experimental treatment and design

This experiment was carried out to evaluate the efficacy of the chemicals Viz. salicylic acid (1g/L), copper sulphate (0.5g/L), chitosan (0.1g/L) and thiovit (80% sulphur fungicide @ 2g/L) against the foliar disease powdery mildew of Black gram.

The design of the experiment was randomized complete (RCBD) with three replications. Where every replication was divided in to five plots according to treatments and put all the treatments to the plot randomly. The unit plot size was 2 m × 2 m with maintaining row to row and line to line distance 75 cm and 30 cm respectively.

The experiment was conducted under rainfed condition in the year 2020, kharif-2 season and Binamash-1 used as variety. All the agronomical practices such as thinning, weeding etc. were done whenever required and fertilizer applied according to Fertilizer Recommendation Guide (BARC 2018).

After the initial appearance of the disease symptoms, first spray was taken up and next spray were given two times at 7 days interval through hand sprayer at the rate of 1g/L (salicylic acid), 0.5g/L (copper sulphate), 0.1 g/L (chitosan) and 2g/L (thiovit). The powdery mildew disease incidence and severity (% leaf area infection) was recorded using standard disease rating scale. The severity was recorded on a 0-5 scale (Mayee and Datar, 1986). The disease score as follows. (Table 1).

Table 1. The disease rating scale for assessment disease severity.

No	No infection	Immune/Resistant
1	1-10% of leaf area infected	Highly resistant
2	10-25% of leaf area infected	Moderately resistant
3	26-50% of leaf area infected	Moderately susceptible
4	51-70% of leaf area infected	Susceptible
5	>70% of leaf area infected	Highly susceptible

Percent disease index (PDI) was calculated using Wheeler's formula (1969) for powdery mildew:

$$\text{PDI} = \frac{\text{Sum of individual ratings}}{\text{Number of plants examined} \times \text{maximum disease grade}} \times 100$$

Data collection and Analysis

Powdery mildew disease incidence and severity data was collected after applying the treatments and shoot length, root length, No. of pods per plant, straw yield and seed yield data were collected after harvest. Data were analyzed statistically by using Statistix 10 software.

Determination of Yield

After threshing and winnowing, yield of each plot was weighed individually and converted to kilogram per hectare. The Seed yield was subtracted from total yield (seed + straw) of corresponding plot to get straw yield per plot and it also converted to kilogram per hectare. The produce (seed and straw) of each plot was allowed to air dry after harvest and

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weighed to record biological yield per plot which was converted to kilogram per hectare.

Results and Discussion

Efficacy of the chemicals against powdery mildew disease with yield and yield contributing attributes were determined.

Effect of different chemicals on powdery mildew disease: Four chemicals were evaluated against powdery mildew of black gram in natural field condition. The percent disease incidence (PDI) was ranged from 41 to 90. Experimental result showed that all the treatments were perform better over control. The lowest PDI (41) was recorded in thiovit which is 80% sulphur containing fungicide and the highest PDI (90) was found in control (Table 2).

Table 2. Effect of Salicylic acid, Copper sulphate ($CuSO_4$), Chitosan and thiovit on disease incidence and severity of powdery mildew Black gram.

Treatment (s)	Powdery mildew		
	Disease incidence (%)	Disease Severity score (0-5)	% of leaf area infection (DS)
Salicylic acid	67b	4ab	72ab
Copper sulphate	54bc	4ab	53bc
Chitosan	61b	4abc	61abc
Thiovit	41c	3c	33c
Control	90a	5a	87a
$LSD_{0.05}$	17.95	1.14	29.96
CV(%)	10.17	10.21	17.29

In case of % leaf area infection (DS), the foliar spray of thiovit (80% sulphur containing fungicide) @ 2g/L found highest reduction of % leaf area infection (33%) (Table 2) and other treatments salicylic acid @ 1g/L, copper sulphate @ 0.5g/L and chitosan @ 0.1g/L were followed by 72%, 53% and 61% respectively were less effective than thiovit. The highest percent leaf area infection was found 87% in control (Table 2).

Effect of different chemicals on growth and yield contributing characters

Effect of different chemicals on those parameters has been presented in table 3. In case of shoot length, there was significant effect among the treatments. The highest shoot length (94.43 cm) was recorded by applying thiovit whereas the lowest (75.6 cm) was recorded treated by copper sulphate. The second highest shoot length (80.93 cm) was recorded by applying salicylic acid.

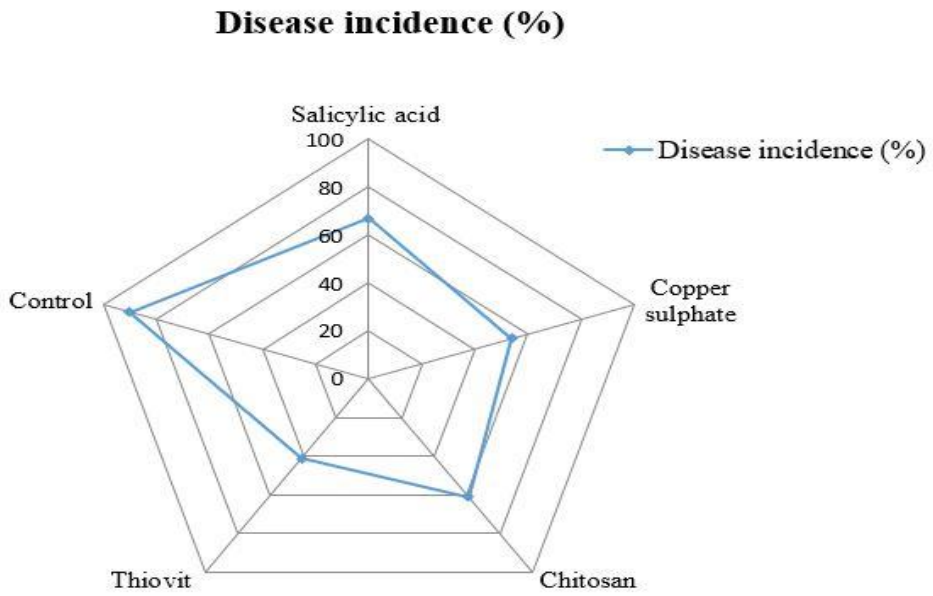

Figure 2. Percent disease incidence (DI) after applying different chemicals

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Table 3. Effect of different chemicals on yield and yield contributing characters

Treatment (s)	Shoot length (cm)	Root length (cm)	No. of pod / plant	Straw yield (kg/ha)	Seed yield (kg/ha)
Salicylic acid (T_1)	80.93ab	12.83	36.66ab	664.43	393.01ab
Copper sulphate (T_2)	75.60b	15.03	39ab	717.41	404.51ab
Chitosan (T_3)	79.73ab	12.73	32.33b	776.22	375.19b
Thiovit (T_4)	94.43a	14.13	48a	745.36	520.57a
Control (T_0)	78.3ab	14.16	28.66b	580.03	326b
$LSD_{0.05}$	17.80	8.11	15.14	223.72	140.4
CV(%)	7.73	20.65	14.56	11.40	12.35

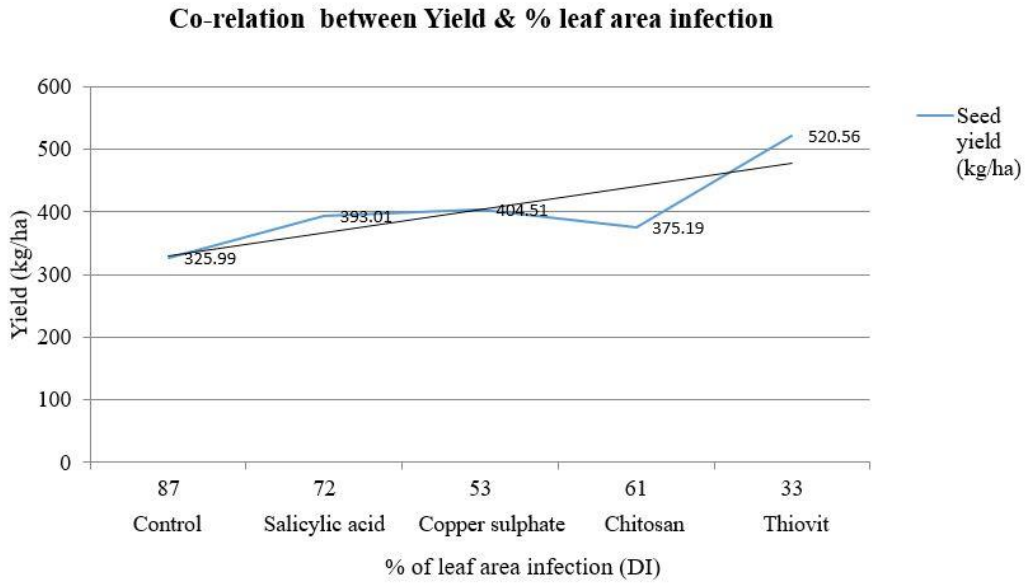

Figure 3. Relationship between seed yield and % leaf area infection.

Among the treatments, there was no significant effect on root length and straw yield (Table 3). We found significant effect of the treatments in No. of pods plant^{-1} and seed yield. In case of thiovit treatment, the highest No. of pods plant^{-1} (48) and seed yield (52.57 kg ha^{-1}) was recorded. That means thiovit also performed better in both no. of pod plant^{-1} and seed yield production. The second highest seed yield (404.51 kg ha^{-1}) was found in copper sulphate (Table 3). The lowest no. of pod plant^{-1} (28.66) and seed yield (326 kg ha^{-1}) was recorded in control respectively (Table 3). The result come out from the study disclose that, all the treatment significantly increases the shoot length, No. of pods plant^{-1} and seed yield over control.

Figure 3. Represent the Relationship between % leaf area infection and seed yield. Result showed that among the treatments, thiovit (80% sulphur containing fungicide) performed best in lowering the % leaf area infection and maximized the yield among the treatments. Similar result was found by Moghe, S.V. *et al* (1982) where among the 8 effective fungicides, sulphur dust and sulpen-80 (80% sulphur) gave complete control of Powdery mildew and increased yield by 171.59 and 141.56% respectively. Raut, B. T. *et al* were also reported that out of eight fungicides tested against powdery mildew (*Erysiphe polygoni*) of green gram (*Vigna radiatia*) and Black gram (*V. mungo*) Calixin was the best fungicide in controlling the disease and increasing the per hectare yield. Karathane EC and Thiovit were the next better fungicides in controlling the disease and increasing the yield.

CONCLUSIONS

Different chemicals were evaluated in field condition against powdery mildew of black gram caused by *Erysiphe polygoni.* According to this study, most of the treatments were performed better over control. Among the treatments, thiovit (80% sulphur fungicide) performed best for controlling the disease incidence (41%), reducing the percent leaf area infection (33%) and also increase seed yield (520.57kg/ha). The result of present study indicates that, Thiovit effectively control the disease as well as increase the yield of black gram. Application of thiovit (80% sulphur fungicide) with proper dose can be recommended against powdery mildew disease of Black gram.

Conflict of Interest

There are no conflicts of interest declared by the authors.

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