ISSN: 2224-0616
Int. J. Agril. Res. Innov. & Tech. 3 (1): 60-65, June, 2013 Available online at http://www.ijarit.webs.com

BIOEFFICACY OF PLANT EXTRACTS TO CONTROL CERCOSPORA LEAF SPOT OF MUNGBEAN (*Vigna radiata*)

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Received 30 April 2012, Revised 31 May 2013, Accepted 20 June 2013, Published online 30 June 2013

Abstract

The experiment was conducted at Bangladesh Agricultural Research Institute farm, Joydebpur, Gazipur during March to July 2007 to evaluate the bioefficacy of some plant extracts in controlling *Cercospora* leaf spot of mungbean. Six indigenous plant species i.e. Neem leaves extract (1:4 w/v), Garlic cloves extract (1:5 w/v), Biskatali leaves extract (1:4 w/v), Alamanda leaves extract (1:6 w/v), Arjun leaves extract (1:4 w/v) and Debdaru leaves extract (1:5 w/v) were used in this experiment. The experiment was laid out in RCBD with seven treatments and four replications. Data on disease incidence, severity, yield contributing characters and yield of mungbean were recorded. Naturally, infection of the disease was considered in this experiment. The lowest disease incidence (7.33%) at 60 DAS was found in T1. Lowest and similar disease severity (PDI= 4.55) was found in T2 and T3 at the same DAS. Neem extract treated plots gave better response in yield (1.26 t ha^{-1}) and all the yield contributing parameters like inflorescences $plant^{-1}$ (13.45), tallest plant (51.44 cm), the maximum number of pods $plant^{-1}$ (26.81), length of pod (8.56 cm), number of seeds pod^{-1} (12.64) and 1000 seeds weight (27.33 g) followed by T2 and T3. The highest disease incidence (26.50%) and disease index (13.65%) were recorded in treatment T7 at 60 DAS. Yield and all yield contributing factors were lowest in same treatment. The results of the experiment suggested that the use of neem leaves extracts are effective for minimizing *Cercospora* leaf spot incidence, severity and increasing yield of mungbean.

Keywords: Mungbean, *Vigna radiate,* Cercospora Leaf Spot, Control, Plant extracts

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Introduction

Mungbean (*Vigna radiata*), belongs to the family leguminosae and sub family papilionaceae, is one of the most important pulse crops having global economic importance as a dietary ingredient of the staple food in tropical and subtropical region. It is grown three times in a year covering 21862 ha with an average yield of 0.82 t ha^{-1} (BBS, 2009). It can fix atmosphere nitrogen through symbiotic relationship with soil bacteria and improve the soil fertility (Yadav *et al*., 1994). Mungbean has been considered as a "poor men's protein" (Mian, 1976). Apart from 26% protein, it also contains 51% carbohydrate, 10% moisture, 4% minerals and 3% vitamins (Khan, 1981). In Bangladesh, total sixteen diseases of mungbean have been recorded (Fakir, 1983 and Bakr, 1993) which are responsible for lower yield of mungbean. Among the diseases, *Cercospora* leaf spot is a serious disease of mungbean (Verma and Sandhu, 1992) and causes yield losses of up to 58% (Lal *et al*., 2001). It is widely distributed all over the country where mungbean is cultivated. The causal organisms of this disease are *Cercospora cruenta*, *C. conescens*, *C. kikuchii* and *C. caracallae*. Among these, *Cercospora cruenta* is the most prevalent species (Talukder, 1974). The initial symptoms of the disease appear as water soaked spot on leaves. As spots become older may coalesce together, causing enlarged dead area on the infected leaves. Heavy infections of *Cercospora* can cause premature defoliation of the mungbean plant. Sometimes the leaves may become malformed and wrinkled. Maturity is delayed in the diseased plants resulting poor pod formation. Seeds that developed on severely infected plants are small and immature (Poehlman, 1991). Different approaches such as spray of chemical fungicides (Singh and Singh, 1978), spray of different plant extracts and use of resistant variety are tried to control *Cercospora* leaf spot of mungbean. Though the released varieties of mungbean in Bangladesh are described as resistant variety but most of them show susceptible reaction towards

this disease and the susceptibility varied due to variation of weather situation during trail before release and commercial cultivation. Indiscriminate and frequently use of chemicals affects the soil health. Harmful chemical substances enter into the food chain that ultimately causes serious health hazards. Eco-friendly management like use of plant extract against plant diseases control is however, a recent approach to plant diseases management and it has drawn the special attention of the plant pathologist all over the world. Most of the plant extracts are cost effective and do not have harmful effects on beneficial soil microorganisms. In Bangladesh, only a few attempts have been made to evaluate plant extracts against plant diseases (Ashrafuzzaman and Hossain, 1992; Hossain *et al*., 1993; Ashrafuzzaman and Khan, 1992; Suratuzzaman *et al*., 1994). Many researchers reported that plant extracts have antifungal properties and potentially used against many plant diseases (Singh and Dwivedi, 1987; Tariq and Magee, 1990; Lakshmanan *et al.,* 1990). It can help to avoid environmental pollution caused by chemicals and thus become most rewarding one to our existing socio-economic conditions and environmental threats. In the light of above background, the present piece of research work has been undertaken to estimate the effects of different botanicals on the incidence and severity of the *Cercospora* leaf spot of mungbean, yield and yield contributing characters of *Cercospora* leaf spot infected mungbean.

Materials and Methods

The experiment was conducted in the farm of Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur, Bangladesh during the period from March to July 2007. In this research work, BARI moog-3 was used as test crop where as BARI moog-3 is resistant to Cercospora leaf spot and Yellow mosaic virus of mungbean. Seeds were collected from pulse crop research division of BARI, Joydebpur, Gazipur. Seven different treatments including untreated control were explored in the experiment. Treatments were T_1 = Neem (*Azadirachta indica*) leaves extract (1:4 w/v), T_2 = Garlic (*Allium sativum*) cloves extract (1:5 w/v), T_3 = Biskatali (*Polygonum hydropiper*) leaves extract (1:4 w/v), T_4 = Alamanda (*Allamanda cathertica*) leaves extract (1:6 w/v), T_5 = Arjun (*Terminalia aurjuna*) leaves extract (1:4 w/v), T_6 = Debdaru (*Polyalthia longifolia*) leaves extract (1:5 w/v), T_7 = Untreated (control). The experiment was laid out in Randomized Complete Block Design (RCBD) with four replications. The unit plot size was 4.0 m × 3.0 m. The distance between two blocks and two plots were 1.0 m and 0.5 m, respectively. The beds were prepared manually after ploughing and laddering. Then the seeds were sown in the bed in line sowing with 30 cm line-to-line distance. Fertilizers and manures were applied as per recommendation of BARI. Watering and intercultural operations were done when necessary. Plant extracts were collected from Bangladesh Agricultural Research Institute, Joydebpur, Gazipur. The extracts were prepared by using the method of Ashrafuzzaman and Hossain (1992). After washing weighted leaf, the big leaves were cut into small pieces. For getting extract, weighted plant parts were blended and then distilled water was added into the jug of the blender. The pulverized mass was squeezed through 3 folds of fine cotton cloth. For getting 1:4 (w/v) ratio 400 ml of distilled water was added with 100 g of plant parts, 1:5 (w/v) ratio 500 ml of distilled water was added with 100 g of plant parts, 1:6 (w/v) ratio 600 ml of distilled water was added with 100 g of plant parts. Plant extracts were applied in the field as foliar spray. Spraying was done 3 times at 7 days interval starting from vegetative growth. The plants were naturally infected. The disease incidence and severity was recorded at 30, 40, 50 and 60 DAS (Days after Sowing). For disease incidence, the infected plants were identified by comparing it symptoms critically with those already published by Ahmed (1985). The incidence of *Cercospora* leaf spot was calculated as follows:

Percentage Infected plants

$$= \frac{\text{Number of infected plant in each plot}}{\text{Total number of plants in each plot}} \times 100$$

Disease severity were calculate by using (0-9) disease severity score of Metha and Mondal (1978) and determined as PDI (Percent Disease Incidence) by using following formula (Krisna Prasad *et al.,* 1979).

Percent Disease Index (PDI)

$$= \frac{\text{Sum of total ratting}}{\text{Total number of observation} \times \text{Highest grade in the scale}} \times 100$$

The severity of *Cercospora* leaf spot disease was recorded according to the grade of Metha and Mondal (1978) describe in the following table:

Numeric score	Symptom severely on plants at maximum flowering and pod formation stage
0	No visible symptoms on leaves, plant growth, flowering and pod formations are normal
1	10% leaf area infection
3	11-30% leaf area infection
5	31-50% leaf area infection
7	51-70% leaf area infection
9	71% and above leaf area infection

Data on plant height (cm), number of primary branches plant^{-1}, number of inflorescences plant^{-1}, number of pods plant^{-1} were collected from standing crops and data on pod length (cm), number of seeds pod^{-1}, 1000 seed weight (g), yield plot^{-1} (kg), yield (ton) hectare^{-1} were recorded after harvesting. The data obtained for different characters were analyzed to find out the significant differences among the treatments. The analysis of variance was performed by using MSTAT program. The significance of the difference among the treatment means was estimated by DMRT (Duncan's Multiple Range Test) at 5% level of probability (Gomez and Gomez, 1984).

Results and Discussion

A gradual increasing trend for both disease incidence and severity was found with the increasing of DAS. There were no significant variations in *Cercospora* disease incidence and disease severity (0-9 scale) for different treatments at 30 DAS (Table 1). Significant differences were recorded in disease incidence and disease severity (0-9 scale) for different treatments at 40 DAS. The highest disease incidence (13.42% infected plant) and disease severity (4.85) were recorded from treatment T_7 which was close to T_6 with disease incidence (5.08% infected plant) and disease severity (2.45).The diseases incidence and diseases severity were increased gradually up to 39.72% and 116.50% respectively compare with 50 DAS. The lowest disease incidence (3.67% infected plant) and disease severity (1.95) were recorded from treatment T_1 which was statistically similar with treatment T_3 (3.92% infected plant) and (2.10). The diseases incidence and diseases severity were increased gradually up to 58.86% and 56.41% respectively compare with 50 DAS. Statistically significant differences were recorded in disease incidence and disease severity for different treatments at 50 DAS. The highest *Cercospora* disease incidence (18.75% infected plant) and disease severity (10.50) were recorded from treatment T_7 which was nearly to T_6 (8.33% infected plant) and diseases severity (3.75). The diseases incidence and diseases severity were increased gradually up to 41.33% and 30.00% respectively compare with 60 DAS.At 50 DAS the lowest disease incidence (5.83% infected plant) and disease severity (3.05) were recorded from treatment T_1 where as the diseases incidence and diseases severity were increased gradually up to 25.72% and 58.36% respectively compare with 60 DAS. At 60 DAS different treatments showed a remarkable variation in *Cercospora* disease incidence and disease severity. The highest disease incidence (26.50% infected plant) and disease severity (13.65) were recorded from treatment T_7 followed by T_6 (10.33% infected plant) and disease severity (5.00). On the other hand the lowest disease incidence (7.33% infected plant) was recorded from treatment T_1 which was statistically similar with treatment T_3 (8.08% infected plant) and the lowest disease severity (4.55) was recorded from treatment T_2 and T_3. Among the different plant extracts neem extracts was most effective. Bishkathali and garlic were also effective than alamonda, arjun and debdaru leaves extracts. Miah *et al*. (1990); Ahmed (1985) reported that neem extract had potential for controlling *Cercospora* leaf spot in mungbean. It has been observed that neem leaves extract resulted significant reduction of *Cercospora* leaf spot of mungbean over untreated (control) (BARI, 2007; Khan, 1981; Mehta and Mondal, 1978).

Table 1. Disease incidence and severity influenced by different plant extracts used for the control of *Cercospora* leaf spot of mungbean (cv. BARI moog 3) recorded at different date

Treatments	Incidence (% Plant infected)				Severity (0-9 Scale)			
	30 DAS	40 DAS	50 DAS	60 DAS	30 DAS	40 DAS	50 DAS	60 DAS
T_1	1.75	3.67 c	5.83 d	7.33 d	1.33	1.95 d	3.05 c	4.83 b
T_2	1.58	4.25 bc	6.83 cd	8.42 cd	1.30	2.15 bcd	3.25 bc	4.55 b
T_3	1.58	3.92 bc	6.25 d	8.08 d	1.18	2.10 cd	3.10 c	4.55 b
T_4	1.75	5.00 b	7.83 bc	9.67 bc	1.40	2.40 bc	3.60 bc	4.95 b
T_5	1.83	4.50 bc	7.67 bc	8.83 bcd	1.25	2.35 bc	3.25 bc	4.70 b
T_6	1.83	5.08 b	8.33 b	10.33 b	1.28	2.45 b	3.75 b	5.00 b
T_7	1.67	13.42 a	18.75 a	26.50 a	1.30	4.85 a	10.50 a	13.65 a
CV (%)	12.14	12.89	7.75	8.55	18.66	7.96	8.48	7.10

Different letter (s) in the same column showed the significant different at 0.05 level of probability

T_1 = Neem (*Azadirachta indica*) leaves extract (1:4 w/v), T_2 = Garlic (*Allium sativum*) cloves extract (1:5 w/v), T_3 = Biskatali (*Polygonum hydropiper*) leaves extract (1:4 w/v), T_4 = Alamanda (*Allamanda cathertica*) leaves extract (1:6 w/v), T_5 = Arjun (*Terminalia aurjuna*) leaves extract (1:4 w/v), T_6 = Debdaru (*Polyalthia longifolia*) leaves extract (1:5 w/v), T_7 = Untreated (control).

A little variation were recorded for plant height due to application of different plant extracts used in this experiment for controlling *Cercospora* leaf spot of mungbean (Table 2). The tallest plant (51.44 cm) was recorded from treatment T_1 which was statistically similar with T_2, T_3, T_4, T_5, T_6 (50.05 cm, 50.82 cm, 49.87 cm, 49.86 cm, 49.19 cm, respectively). On the other hand, the shortest plant (44.75 cm) was recorded from treatment T_7. The highest number of

inflorescences plant^{-1} (13.45) was recorded from treatment T_1 which was identical with T_3 (13.05) (Table 2). Alternatively, the lowest number of inflorescences plant^{-1} (10.02) was recorded from the treatment T_7. Williams *et al*. (1968); Poehlman (1991); Roy and Malathi (2001) reported the similar effect on number of inflorescences per plant and plant height of mungbean. The highest number of primary branches per plant (5.38) was recorded from treatment T_1 which was more or less statistically similar with treatment T_2- T_6 (Table 2). Conversely, the lowest number of primary branches per plant (3.62) was recorded from the treatment T_7. The maximum number of pods per plant (26.81) was recorded from the treatment T_1 (Table 2). On the other hand, the minimum number of pods per plant (21.07) was recorded in treatment T_7. The maximum pod length (8.56 cm) was recorded from the treatment T_1 which was statistically similar with treatment T_3 (8.51 cm) (Table 2). On the contrary, the minimum pod length (6.08 cm) was recorded from the treatment T_7 followed by T_6 treatment (6.85 cm) which was identical T_4. The maximum number of seeds pod^{-1} (12.64) was recorded for treatment T_1, which was statistically similar with treatment T2, and T_3 (12.04 and 12.00 respectively) (Table 3). On the other, hand the minimum number of seeds per pod (10.26) was recorded from the treatment T_7 which was statistically similar with treatments T_6, T_5 and T_4 (10.82, 10.96 and 11.00 respectively). Increase of number of seeds per pod^{-1} over control showed variation for different treatments in the present experiment (Table 3). The maximum increased number of seeds pod^{-1} (23.20%) was recorded from the treatment T_1 and the minimum was recorded in treatment T_6 (5.46%). The maximum 1000 seeds weight (27.33 g) was recorded in treatment T_1 which was statistically similar with treatments T_2, T_3, T_4, T_5, and T_6 (26.15 g, 27.26 g, 26.02 g, 26 g and 26.46 g, respectively) (Table 3). Oppositely, the minimum 1000 seeds weight (23.73 g) was recorded from the treatment T_7. Increases of 1000 seeds weight over control in percentages showed variation for different treatments under the present experiment. The maximum increase 1000 seeds weight (15.17%) was recorded from the treatment T_1 and the minimum was recorded from treatment T_6 (9.57%) (Table 3).

Table 2. Effects of different treatments on yield contributing characters of *Cercospora* leaf spot infected mungbean (cv. BARI moog-3)

Treatments	Plant height (cm)	Number of inflorescences plant^{-1}	Number of primary branches plant^{-1}	Number of pods plant^{-1}	Pod length (cm)
T_1 = Neem leaves extract (1:4 w/v)	51.44 a	13.45 a	5.38 a	26.81 a	8.56 a
T_2 = Garlic cloves extract (1:5 w/v)	50.05 a	12.51 bc	5.00 ab	25.42 ab	8.04 b
T_3 = Biskatali leaves extract (1:4 w/v)	50.82 a	13.05 ab	5.34 a	26.00 ab	8.51 a
T_4 = Alamanda leaves extract (1:6 w/v)	49.87 a	12.00 cd	4.74 b	25.03 ab	7.01 d
T_5 = Arjun leaves extract (1:4 w/v)	49.86 a	12.35 cd	4.94 b	25.00 ab	7.63 c
T_6 = Debdaru leaves extract (1:5 w/v)	49.19 a	11.85 d	4.71 b	24.26 b	6.85 d
T_7 = Untreated (control)	44.75 b	10.02 e	3.62 c	21.07 c	6.08 e
CV (%)	2.95	3.36	5.18	5.45	2.91

Different letter (s) in the same column showed the significant different at 0.05 level of probability

The maximum yield plot^{-1} (1.51 kg) was recorded from the treatment T_1 i.e. by applying neem extract which was statistically similar with treatment T_3 (1.45 kg) i. e. biskatali leaf extracts (Table 3). In contrast, the minimum yield plot^{-1} (1.21 kg) was recorded from the treatment T_7 where no extract was applied. Increase of yield per plot over control showed differences for different treatments in this experiment. The data of yield plot^{-1} was computed to yield hectare^{-1}. The maximum yield (1.26 ton) was recorded for treatment T_1 which was statistically similar with treatments T_3 and T_2 (1.21 and 1.20 ton) (Table 3). On the other hand, the minimum yield per hectare (1.01 ton) was recorded from the treatment T_7. The maximum increased yield hectare^{-1} (24.75%) over control was recorded from treatment T_1 and the minimum was recorded from treatment T_6 (12.87%). Among the different plant extracts, neem leaves extracts was more effective and bishkathali also had similar effects (Table 3). Islam *et al*. (2006) also informed that seed treatment with bishkathali extract increased 29.74% yield of wheat over control.

Table 3. Number of pods plant^{-1}, pod length, seed yield and increase of seed yield as influenced by different treatments used for the management of leaf spot of mungbean (cv. BARI moog-3)

Treat ments	Number of seeds pod^{-1}	Increase of seeds pod^{-1} over control (%)	1000 seeds weight (g)	Increase of 1000 seeds weight over control (%)	Yield (kg plot^{-1})	Yield (ton ha^{-1})	Increase of yield hectare^{-1} over control (%)
T_1	12.64 a	23.20	27.33 a	15.17	1.51 a	1.26 a	24.75
T_2	12.04 a	17.35	26.15 a	10.20	1.44 b	1.20 ab	18.81
T_3	12.00 a	16.96	27.26 a	14.88	1.45 ab	1.21 ab	19.80
T_4	11.00 b	7.21	26.02 a	9.65	1.42 bc	1.18 b	16.83
T_5	10.96 b	6.82	26.00 a	9.57	1.40 bc	1.17 b	15.84
T_6	10.82 b	5.46	26.46 a	11.50	1.37 c	1.14 b	12.87
T_7	10.26 b	--	23.73 b	--	1.21 d	1.01 c	--
CV(%)	5.51	--	3.25	--	3.41	3.41	--

In a column figures having dissimilar letter(s) differ significantly at 0.05 level of probability.

T_1 = Neem (*Azadirachta indica*) leaves extract (1:4 w/v), T_2 = Garlic (*Allium sativum*) cloves extract (1:5 w/v), T_3 = Biskatali (*Polygonum hydropiper*) leaves extract (1:4 w/v), T_4 = Alamanda (*Allamanda cathertica*) leaves extract (1:6 w/v), T_5 = Arjun (*Terminalia aurjuna*) leaves extract (1:4 w/v), T_6 = Debdaru (*Polyalthia longifolia*) leaves extract (1:5 w/v), T_7 = Untreated(control).

Conclusion

The overall results suggested that the use of neem leaves extracts are effective for minimizing *Cercospora* leaf spot incidence, severity and increasing yield of mungbean than other treatments. The enthusiastic researchers can be motivated to explore other plant extracts and spell out the extract concentration for control *Cercospora* leaf spot of mungbean.

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