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Effect of dose and frequency of garlic tablet spray on the incidence of cercospora leaf spot of chilli

M. Asaduzzaman, M.M. Hossain[1], M.N. Parvez[2], M.A. Islam[3] and M.B. Meah[4]
Shahid Ziaur Rahman College, Moheshpur, Jhenaidah, [1]On Farm Research Division, BARI, Khulna, [2]Md. Shahidul Islam Degree College, Moheshpur, Jhenaidah [3]Padma Pukur College, Moheshpur, Jhenaidah, [4]Department of Plant Pathology, BAU, Mymensingh

Abstract: The experiment was conducted at the Plant Disease Clinic (PDC) and in the field laboratory of the Department of Plant Pathology, Bangladesh Agricultural University (BAU), Mymensingh during October, 2010- June, 2011. The aim of the experiment was to test the efficacy of garlic tablet in controlling cercospora leaf spot of chili. The experiment was laid out in a Randomized Complete Block Design (RCBD) with four replications. Three different concentration of garlic tablet solution viz. 1:3, 1:2, 1:1 along with 0:0 and three frequencies spraying keeping 15 days interval were taken as treatment. In vitro screening of plant by garlic tablet solution against *Cercospora capsici* was found promising in inhibiting radial mycelia growth of *Cercospora capsici*. Garlic tablet solution spray at 1:1 w/v concentration for three times was found most effective to reduce per cent leaf infection, per cent fruit infection, per cent leaf area diseased (LAD%) and number of spots per leaf and considerable increase of yield. For successful management of cercospora leaf spot of chili cv. Bindu, spray of garlic tablet solution may be recommended at 1:1 w/v concentration at flowering (95 days age), initial fruiting (110 days age) and fruiting stage (125 days age).
Key word: Dose, frequency, cercospora leaf spot, garlic tablet, chilli,

Introduction

Chilli (*Capsicum annuum* L.) is one of the important spice crops in the world. In Bangladesh, in *Kharif* season, 33481.78 ha land is under its cultivation and total production is 33,000 m.tons per annum, approximately and per acre yield is 0.40 m. tons; and in Rabi season, 158866.40 ha land is under its cultivation and total production is 1,45,000 m. tons per annum, approximately and per acre yield is 0.33 m. tons (Anonymous, 2008). This yield is very low compared to that of other chili growing countries of the world. There are many factors responsible for the low yield of the chili crop in our country; fungal diseases are one of them. Chili is known to suffer as many as 83 different diseases, of which more than 40 are caused by fungi (Rangaswami, 1979; Walker, 1952). Among the fungal diseases, cercospora leaf spot caused by *Cercospora capsici* is one of the major problems of chilli cultivation in Bangladesh. Fungicide has been successfully used in controlling the disease and gave better results than any other management practices (Hawlader, 2003). Some fungicides have been found to give reasonable control of the disease in Bangladesh. Seed treatment with fungicides reduced seed-borne infection and higher seedlings vigor. However, spray of chemical fungicides pollute environment, its application in the soil kills beneficial microorganisms and seeds treatment leaves residue in the soil. Thus chemical fungicides are hazardous, unfriendly to environment. On the contrary, organic materials of botanical source are eco-friendly and inexpensive. Garlic tablets formulated at the IPM Lab, BAU have been used in recent days successfully for control of phomopsis leaf blight and fruit rot of eggplant (Meah, 2003), collar rot of eggplant (Meah, 2003) and Collar rot of indian spinach (Ahmed and Islam, 2000). However, garlic tablet has not been tried for control of leaf spot of chilli. Considering the fact and necessity, the present research program was designed to test the efficacy of garlic tablet in controlling cercospora leaf spot of chilli.

Materials and Methods

Efficacy of garlic tablet spray in reducing cercospora leaf spot of chilli cv Bindu was evaluated in the field. Garlic tablet solution of three concentrations (1:1, 1:2, and 1:3) was sprayed at three stages (flowering, initial fruiting and fruiting) of chilli plants at 15 days interval. For artificial inoculation of chilli plant in field, inoculum suspension of *Cercospora capsici* was prepared. For this, the diseased leaf samples were washed in running tap water to make these free from dust and sand. The infected portion along with the healthy part of the leaves was cut into small pieces (1-1.5 cm) and surface sterilized with 10% chlorox solution for 1 minute. Then the cut pieces (inocula) were washed in sterilized water thrice and placed on filter paper to remove excess water adhering to the surface of the inocula. Thereafter, five inocula were plated in Carrot Agar plates aseptically maintaining equal distances. The plates were incubated at 25±1^{O}C with 12 hour light and 12 hour dark for 72 hours under near ultra violet light (NUV) following ISTA rules to enhance the sporulation of the pathogens. After 72 hours of incubation the fungal pathogen grew out of diseased tissues were observed under stereoscopic microscope. Temporary slides were prepared and observed under a compound microscope. Based on morphological characteristics of the fungus, especially morphology of conidia and conidiophores, the pathogenic fungus causing leaf spot was identified as *Cercospora capsici* (Ellis and Gibson, 1975). After identification, purified culture of the fungus was prepared following single spore technique. Purified culture of *C. capsici* was transferred to carrot agar plate (Rangaswami, 1979) and was placed in an incubator at 25±1^{O}C for 10-15 days. *C. capsici* grown on Carrot Agar medium in petri dish at 25^{0}C temperature and formed conidia (in about 15-20 days), Then added 5ml/plate sterile water and the spore masses were scraped away with sterile needle. The conidial suspension thus made with additional 95ml sterile water was then blended in an electric blender for 2 minutes in medium speed and filtered through sterile cheesecloth.

For preparation of garlic tablets, a certain amount of garlic cloves was taken and washed in tap water, crushed in a mortar and pestle. The crushed materials were blended in an electric blender for fresh extract, added required amount of sterile water at 11: for solution. The blend was

filtered through sterile cheesecloth. The supernatant was mixed with carrier material supplied from IPM Lab. The mixture was put into wooden pellet device, thus the tablet was prepared. To make garlic tablet suspension each tablet was soaked in four times water. Double the amount of tablet suspension was required for seed treatment and eight times dilution for foliar spray.

Seedlings of chilli planted in experimental field were raised in plastic trays in the net house to ensure disease free healthy growth of seedlings (Islam, 2006). Before seeding, the tray was prepared with soil, sand and decomposed cow dung in the proportion of 2:1:1. The medium was sterilized with 5% formalin solution@ 200 ml/cft. The soil heap was covered with black polyethylene for 48 hours and then ucovered and spaded to remove the fume of formalin. After 7 days of soil treatment, sterilized plastic trays (35 cmx 25 cm) were filled with the sterilized soil. The experimental field was ploughed with power tiller to ensure good tilth. The land was fertilized with N-P-K @ 65-24-50 kg/ha respectively along with cow dung 10 t/ha and oil cake 500 kg/ha. All cow dung, oil cake, P and half of K were applied as basal. N and rest of K were applied in equal installment as side dressing. Twenty five days old seedlings were transplanted with spacing of 60 cmx45 cm. All relevant data were collected during experimental period and analyzed statistically by computer package program MSTAT C. Treatment means were compared with Duncan's Multiple Range Test (DMRT).

Results and Discussion

Effect of dose: Leaf infection, fruit infection, leaf area diseased (LAD), number of spots per leaf of chilli (cv. Bindu) caused by *C. capsici* varied significantly for different doses of garlic tablet solution (Table 1). The highest leaf infection (15.68%), fruit infection (1.81%), leaf area diseased (4.09%) and number of spots per leaf (31.21%) were found in untreated control (D_0). The lowest leaf infection (6.24 %), fruit infection (1.00%), leaf area diseased (1.96%) and number of spots per leaf (10.97%) were recorded from treatment D_3. Awal (2005) reported that garlic tablet most effectively reduced seedling diseases of eggplant. In other studies, garlic tablet was effective in plant disease control (Anonymous, 2004). The results are supported partially with the findings of Mahmud (2008) who reported that the garlic and allamanda tablet controlled the seedling diseases of eggplant. Several others report also support the antifungal activity of garlic extract in controlling plant pathogens (Hossain *et al.,* 1993; Fakir and Khan, 1992; Lakhmanan *et a.,* 1990; Mia *et al.,* 1990). In case of fruit infection, treatment D_1 (1.56%) and D_2 (1.42%) as well as D_2 (1.42%) and D_3 (1.00%) did not differ significantly The highest number of fruits per plant (83.16) was recorded from D_3 treated plant and the highest yield per plot (692.50 g) was also obtained from the same.

Table 1. Effect of garlic tablet spray at different doses on the incidence of leaf spot and growth of chilli cv. Bindu

Dose of garlic tablet	Leaf infection (%)	Fruit Infection (%)	LAD (%)	Spots per leaf	Fruits per plant	Yield per plot (g)
D_0 (Control)	15.68 a	1.81a	4.09 a	31.21 a	56.19 d	422.92 d
D_1 (1:3 w/v)	10.41b	1.56b	3.17 b	23.09 b	63.28 c	625.00 c
D_2 (1:2 w/v)	8.03 c	1.42 bc	2.89 c	18.47 c	74.23 b	669.17 b
D_3 (1:1w/v)	6.24 d	1.00 c	1.96 d	10.97 d	83.16 a	692.50 a
LSD(P=0.05)	0.010	0.049	0.005	0.241	0.141	0.125

Figures in a column with common letters do not differ significantly at the values indicated.

Table 2. Effect of frequency of garlic tablet spray on the incidence of different disease and growth parameters of chili cv. Bindu

Frequency	Leaf Infection (%)	Fruit Infection (%)	LAD (%)	Spots per leaf	Fruits per plant	Yield per plot (g)
Fr- 1	11.79 a	1.64 a	3.59 a	24.41 a	63.97 c	555.31 c
F_r-2	10.04 b	1.49 ab	2.85 b	20.64 b	71.30 b	612.97 b
F_r-3	8.43 c	1.21 b	2.63 c	17.75 c	72.38 a	638.91 a
LSD(P=0.05)	0.008	0.037	0.003	0.180	0.106	0.094

Figures in a column with common letters do not differ significantly at the values indicated.

Effect of frequency: Incidence of cercospora leaf spot had significant variation as recorded after three sprays of garlic tablet solution keeping 15 days interval. For each of disease parameters, frequency of garlic spray had significant effect (Table 2).

Percentage of the highest leaf infection (11.79%), fruit infection (1.64%), leaf area diseased (3.59%), number of spots per leaf (24.47%) were obtained from Fr-1 treatment i.e. plants with one time garlic tablet spray. Plants showed the lowest leaf infection (8.43%), fruit infection (1.21%), leaf area diseased (2.63%), number of spots per leaf (17.75%) when garlic tablet solution sprayed at three times (Fr-3). In case of, fruit infection, treatment Fr-1 (1.64%) and Fr-2 (1.49%), were statistically identical. Similarly treatment Fr-2 (1.49%) and Fr-3 (1.21%) did not differ statistically. The findings of the present investigation are well supported by the findings of Dhali (2006) who reported that garlic and allamanda tablet spray in field condition reduces phomopsis blight and fruit rot of egg plant by 60% at different doses and frequencies. Meah

(2003) also reported that garlic bulb extract controlled the nursery diseases in the net house and reduced the fruit infection of egg plant by 71-75 % in the field at different frequencies. In Fr-3, the lowest percentage of leaf infection, fruit infection , leaf area diseased (LAD), number of spots per leaf were helped to produce the highest number of fruits per plant (72.38) that results the highest yield per plot (638.91 g).

Treatment combination: Treatment combination of dose and frequency of garlic tablet spray had significant effect on the incidence of cercospora leaf spot of chilli (Table 3). The best combination was D_3F_3 i.e. garlic tablet solution sprayed three times at 1:1 concentration produced the lowest percentage leaf infection, fruit infection, LAD and number of spots per leaf. It also yielded the highest number of fruits per plant (91.41 g) and the highest yield per plot (722.50 g).

Table 3. Effect of total treatments (dose and frequency) of garlic tablet spray on the incidence of different disease parameters of chili cv. Bindu

Treatment combination	Leaf infection (%)	Fruit infection (%)	LAD (%)	Spots per leaf	Fruits per plant	Yield per plot (g)
D_0F_1	15.90 a	1.78 b	4.15 a	33.40 a	53.41 k	403.75 i
D_0F_2	15.63 a	1.88 a	3.70 b	29.23 c	57.80 j	415.00 h
D_0F_3	15.50 a	1.77 b	4.41 a	31.00 b	57.35 j	450.00 g
D_1F_1	12.37 b	1.70 c	3.68 b	25.45 d	61.15 i	545.00 f
D_1F_2	10.88 c	1.60 d	3.21 c	23.88 e	64.90 g	648.75 d
D_1F_3	7.97 f	1.38 g	2.62 d	19.95 g	63.80 h	681.25 c
D_2F_1	9.82 d	1.67 c	3.66 b	20.45 g	67.50 f	622.50 e
D_2F_2	8.22 f	1.53 e	2.85 cd	21.25 f	74.30 d	683.13 c
D_2F_3	6.04 g	1.08 h	2.15 e	13.70 i	80.90 c	701.88 b
D_3F_1	9.06 e	1.43 f	2.88cd	18.35 h	69.86 e	650.00 d
D_3F_2	5.42 g	0.95 i	1.64 f	8.20 j	88.20 b	705.00 b
D_3F_3	4.24 h	0.63 j	1.35 f	6.35 k	91.41 a	722.50 a
LSD(P=0.05)	0.031	0.147	0.014	0.722	0.422	0.374

Figures in a column with common letters do not differ significantly at the values indicated. D $(_{0, 1, 2, 3})$: 0:0, 1:3, 1:2, and 1:1 concentration of garlic tablet solution. F $(_{1, 2, 3})$: garlic tablet sprays for 1, 2 and 3 times.

The second best treatment combination was D_3F_2 i.e. garlic tablet solution sprayed two times at 1:1 concentration had significantly lower incidence of leaf spots and higher number fruits per plant (88.20) and the yield obtained 705.00 g per plot. Untreated plants (D_0F_1) had the highest incidence of leaf spot (33.40) and yielded the lowest number of fruits per plant (53.41 g) and the lowest yield was 403.75 g per plot.

Three times spray produced significantly lower disease and higher yield than all other treatments. Among the doses, the concentration 1:1 of garlic tablet solution reduced significantly the incidence of disease and increased yield. Of the treatment combinations, garlic tablet concentration 1:1 sprayed at three times (D_3F_3) was the best to reduce leaf infection by 73.58% and increased yield by 79.15%. The second best treatment combination was D_3F_2 (conc. 1:1 sprayed two times) and third best treatment was D_2F_3 (concentration 1:2 sprayed three times).

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