The Journal of Plant Protection Sciences, **4**(2) : 25-31, December, 2012

Efficacy of sedomil 72WP and recozeb 80WP to control die-back (*Colletotrichum gloeosporioides*) of tea in Bangladesh

[1]M.S. Islam, [2]M.Ali, and [3]I. Ahmad

[1]SSO (Plant Pathology Division), [2]CSO (Pest Management Department), Bangladesh Tea Research Institute, Srimangal

[3]Department of Food Engineering and Tea Technology, Shahjalal University of Science and Technology, Sylhet, Bangladesh

E-mail: iftekharfet.sust@yahoo.com

A B S T R A C T

A study was conducted to find out the efficacy of sedomil 72WP (mancozeb) and recozeb 80WP (mancozeb + metalaxyl) to control of dieback disease (*Colletotrichum gloeosporioides*) of tea in Bangladesh. The pathogen, *C. gloeosporioides* was isolated from the dieback infected tea twigs on PDA medium. Mycelial blocks of the isolated pathogen were transferred to PDA plates amended with sedomil 72WP (mancozeb) @ 720, 1080, 1440 and 1800 ppm and recozeb 80WP (mancozeb + metalaxyl) @ 800, 1200, 1600 and 2000 ppm concentrations. Sedomil 72WP and recozeb 80WP caused colony growth inhibition, respectively by 75.00-90.77% and 75.88-91.33% in 2008 and 74.66-90.55% and 75.66-91.11% in 2009. In a field experiment at the main farm of Bangladesh Tea Research Institute (BTRI), both fungicides were applied as foliar spray for three times at 1.0, 1.5, 2.0 and 2.5 kg ha^{-1}. In 2008, sedomil 72WP gave 45.52-92.78% and recozeb 80WP gave 46.47- 90.39% reduction in PDI. In 2009, the reduction in PDI was 45.84-90.83% and 45.65-89.98% respectively under sedomil 72WP and recozeb 80WP. The use of sedomil 72WP and recozeb 80WP @ 2.5 kg ha^{-1} and 2.0 kg ha^{-1} are equally effective in controlling the disease. Both the fungicides are recommended at 2.0 kg ha^{-1} against the dieback disease of tea and its causal organism.

Keywords: Tea, dieback diseases, *Colletotrichum gloeosporioides,* mancozeb

Introduction

Tea is an important cash crop of Bangladesh. It is grown in about 54,900 hectares of land producing about 59.27 million kg of made tea during 2010 (Anon 2011). The country earns about 224.64 million taka exporting 1.61 million kilogram of tea during 2011-12 (Anon 2013). In Bangladesh, the average yield of tea per hectare is quit low as compared to other tea growing countries of the world. Many factors are associated with such low yield. The loss of tea in Bangladesh tea due to various pests, diseases and weeds has been estimated to be about 10-15% (Sana 1989). Among the diseases, dieback is the major one. The causal organism of the disease in tea is *Colletotrichum gloeosporioides* (Penz.), Sacc. (Sana 1989, Ali *et al.* 1993). The disease was first noticed in the year 1984 (Huq 1995) in the Nucleus Clone Plot (NCP) of Bangladesh Tea Research Institute (BTRI) on the clone BT4. He stated that more than 40% of tea bushes were found to be attacked by the disease. In the same year the disease was also reported from Tipracherra tea estate on 30% of the seed nursery beds (Huq 1995). In Bangladesh, about 55-60% of the plants die due to this disease. Since then, the disease appears every year with a variation in its intensity depending on climatic factors (Huq 1995). *C. gloeosporioides* is a destructive pathogen of many crop species. It causes diseases in many annual, biennial and perennial plants. The fun-

gus has got a large host range and infects a variety of economically important plants such as cucurbits, blue berries, citrus, guava, strawberry, turf grasses, cereals and some other fruit crops both in nursery and field. This pathogen exists in different forms in different hosts. It is found both in sexual (*Glomerella cingulata*) and asexual (*C. gloeosporioides*) forms. Available literature in relation to fungicidal control of the disease is very limited in tea. Though different cultural, mechanical and some chemical control measures are practiced for controlling the disease. Different chemical groups like carbendazim, copper oxychloride, copper hydroxide, hexaconazole, propiconazole are recommended for controlling the disease in Bangladesh (Huq *et al.* 2007). Ali *et al.* (1993) reported that carbendazim (bavistin 50WP) @ 100 ppm and propiconazole (tilt 250 EC) @ 200 ppm completely inhibited the growth of *Colletotrichum gloeosporioides* followed by tebuconazole (folicur 250EC) @ 400 ppm and tridemorph (calixin 75EC) @ 1500 ppm. Solano and Arauz (1995) applied mancozeb, captan, tricyclazole, chlorothalonil and prochloraz against papaya anthracnose (*C. gloeosporioides*) and found that mancozeb and prochloraz resulted in lowest disease incidence. Freeman *et al.* (1997) assessed various fungicides like folpet, captan and propiconazole for their ability to control *C. gloeosporioides*. They found that captan was effective in 50 % and 70 % concentrations. Legard (2000) found benlate, topsin-M and mancozeb as most effective in controlling the pathogen. Hussain *et al.* (2008) obtained reduced the growth of the pathogen, *C. gloeosporioides* by 49.21% and 100%, respectively when mancozeb was used alone at 100 mg/L PDA and 300 mg/L PDA. Carbendazim, copper oxychloride, copper hydroxide, hexaconazole, propiconazole are recommended for controlling the disease in Bangladesh (Huq *et al.* 2007). Recently, sedomil 72WP (mancozeb) and recozeb 80WP (mancozeb + metalaxyl) have been introduced to control different tea diseases in Bangladesh. Before recommendation, the efficacy of the fungicides against dieback needs to be tested. Therefore, the present study was carried out to test the efficacy of sedomil 72WP (mancozeb) and recozeb 80WP (mancozeb + metalaxyl) to control dieback of tea.

Materials and Methods

Effect of fungicides on in vitro growth of C. gloeosporioides in solid media

The pathogen, *C. gloeosporioides* was isolated from the dieback infected tea twigs according to Barnett and Hunter (1972) on potato dextrose agar (PDA) medium. Pure culture of the pathogen was prepared following single spore method and maintained on PDA medium. Mycelial block of half centimeter diameter were cut using a cork borer from young PDA culture of *C. gloeosporioides* colony. The blocks were transferred to PDA plates amended with seadomil 72WP (mancozeb) @ 720, 1080, 1440 and 1800 ppm and recozeb 80WP (mancozeb + metalaxyl) @ 800, 1200, 1600 and 2000 ppm concentrations. Three plates were used for each treat-

ment. Inoculated plates were incubated at room temperature amended 30±2ºC. After incubation the colony diameters of *C. gloeosporioides* grown on poisoned medium were recorded and compared with that of control. Inhibition of mycelial growth was computed according to Sundravadana *et al.* (2007).

$$M_i = \frac{M_c - M_t}{M_c} \times 100$$

Where Mi =Inhibition (%) of mycelial growth, Mc=Colony diameter of control set, Mt = Colony diameter of target fungi on poisoned medium.

Efficacy of fungicides to control dieback under field condition

A field experiment was conducted at the VP nursery of main experimental farm of Bangladesh Tea Research Institute (BTRI) during 2008 and 2009 to evaluate the efficacy of the fungicides. The experiment was carried out on 1.0 - 1.5 year-old saplings. Forty-five saplings with uniform symptom of the said disease were chosen and treatments were assigned employing completely randomized design with three replications. Sedomil 72WP and recozeb 80WP were applied as foliar spray @ 1, 1.5, 2.0 and 2.5g/L of water. The control plots were sprayed with plain water to ensure equal moisture as treated one. Three sprays were given, first at initial appearance of symptoms followed by two sprays at 15 days intervals. Disease severity was assessed regularly at 7 days after fungicidal application using a 0-5 scale; 0= no infection, 1=1-20% infection, 2=21-40% infection, 3=41-60% infection, 4=61-80% infection and 5=more than 80% infection of the disease (Suharban *et al*. 1985). Percent Disease Index (PDI) was worked out following standard formula as described by Singh (2000):

$$PDI = \frac{\text{Sum of (disease score} \times \text{number of plants within that score)}}{\text{Highest score} \times \text{total number of plants checked}} \times 100$$

Data was analyzed using MSTAT-C computer programme. Mean separation was done using Duncan's Multiple Rang Test (DMRT).

Results and Discussion

Effect of fungicides on in vitro colony growth of C. gloeosporioides

In both the years, the highest colony diameter of 9.0 cm was recorded from control plate where PDA was used without fungicidal amendment. All treatments with two fungicides at different concentrations caused significant inhibition of colony growth (Fig 1) in both years. Sedomil 72WP gave 75.00-90.77% and 74.66-90.55% and recozeb 80WP caused 75.88-91.33% and 74.66-91.11% growth inhibition, respectively in 2008 and 2009. The colony growth of the fungus decreased gradually with the increase of dosages

of each fungicide and the differences in growth at different levels was significant (Table 1). Prashanth *et al.* (2008) reported that among the non-systemic fungicides, combi-product carbendazim + mancozeb recorded highest per cent inhibition of mycelial growth (89.23%) of fungus, which was followed by propineb (87.78%). Adil *et al.* (2008) reported that the low dose of 100 mg mancozeb/L PDA reduced the growth of the pathogen by 49.21% after 7 days, which remained the same after 14 days.

Table 1.

Effect of different doses of fungicides on the radial growth of *C. gloeosporioides*

Fungicides	Dose (ppm)	Mycelial growth in cm on PDA (Mean of 3 replications)		Growth inhibition over control (%)	
		2008	2009	2008	2009
Control	00	9.00a	9.00a	-	-
Sedomil 72WP	720	2.25b	2.28b	75.00	74.66
	1080	1.92c	1.95c	78.66	78.33
	1440	1.36d	1.38d	85.00	84.66
	1800	0.84e	0.85e	90.77	90.55
Recozeb 80WP	800	2.16b	2.19b	75.88	75.66
	1200	1.97c	2.00c	78.00	77.77
	1600	1.48d	1.50d	83.55	83.33
	2000	0.79e	0.80e	91.33	91.11

Means within the column with a common letter (s) do not differ significantly by Duncun's Multiple Range Test (DMRT) at P= 0.05.

A B C

Fig 1. A- Seven day-old culture of *C. gloeosporioides* grown on PDA without amended, **B-** Seven days old culture of *C. gloeosporioides* grown on PDA amended with sedomil 72WP and **C-** Seven day-old culture of *C. gloeosporioides* grown on PDA amended with recozeb 72WP.

Efficacy of fungicides to control dieback

PDI of dieback disease was 69.33 in 2008 and 66.66 in 2009 under control. In 2008, spray with sedomil 72WP and recozeb 80WP reduced the PDI to 5.00- 37.77 and 6.66- 37.11 respectively. The reduction was 45.52- 92.78% under sedomil 72 WP and 46.47- 90.37% under recozeb 80 WP. In second year (2009), the PDI was reduced 6.11- 36.10 by sedomil 72WP and 6.77- 36.23% by recozeb 80WP. The reduction was 45.84- 90.83% in case of sedomil 72WP and 45.65- 89.98% under recozeb 80WP. In both years and under both fungicides, the growth reduction was significant compared to control. The rate of reduction in disease severity was corroborated with concentration of each fungicide. Effectiveness of two highest doses of each fungicide was statistically similar but significantly higher compared to the lowest dose, which was statistically similar to the second lowest dose (Table 2). Jamadar *et al.* (1998) tested the various fungicides for control of pomegranate fruit spots (*C. gloeosporioides*). Among the treatments, spraying with mancozeb along with carbendazim was most effective in reducing the incidence of fruit spot recording the disease reduction of 88.9 percent. Bhat (1991) reported captofal, mancozeb, copper oxychloride, and carbendazim inhibited the conidial germination of *C. gloeosporioides*.

Table 2.

Efficacy of different doses of two fungicides in controlling dieback disease of tea

Fungicides	Dose	PDI		Reduction in PDI over control (%)	
		2008	2009	2008	2009
Control	-	69.33a	66.66a	00	00
Sedomil 72WP	1.0 kg ha^{-1}	37.77b	36.10b	45.52	45.84
	1.5 kg ha^{-1}	27.22bc	25.0bc	60.73	62.49
	2.0 kg ha^{-1}	13.73cd	13.21cd	80.19	80.18
	2.5 kg ha^{-1}	5.00d	6.11d	92.78	90.83
Recozeb 80WP	1.0 kg ha^{-1}	37.11b	36.23b	46.47	45.65
	1.5 kg ha^{-1}	25.00bc	23.88bc	63.94	64.17
	2.0 kg ha^{-1}	13.33cd	12.96cd	80.77	80.55
	2.5 kg ha^{-1}	6.66d	6.77d	90.39	89.98

Means within the column with a common letter (s) do not differ significantly by Duncun's Multiple Range Test (DMRT) at P= 0.05

The relationship of *in vitro* colony growth of *C. gloeosporioides* and PDI of dieback with dosages of sedomil 72WP as well as recozeb 80WP were studied and found that intercept, coefficient of regression, coefficient of determination and coefficient of correlation between dosage of two fungicides and two parameters were almost identical (Table 3). It indicated that efficacy of two fungicides was more or less identical (Table 3).

Table 3.

Relationship between *in vitro* colony growth of *Colletotrichum gloeosporioides* and PDI of dieback disease of tea in two consecutive years

Treatments	Regression equation		Coefficient of determination		Coefficient of correlation	
	2008	2009	2008	2009	2008	2009
% *In vitro* radial colony growth inhibition						
Sedomil 72WP	Y= 7.45-0.0043X	Y= 7.46-0.0043X	0.803	0.805	0.896	0.897
Recozeb 80WP	Y= 7.44-0.0039X	Y= 7.45-0.0039X	0.893	0.799	0.893	0.894
PDI						
Sedomil 72WP	Y= 66.83-25.868X	Y= 63.73-24.491X	0.989	0.983	0.994	0.991
Recozeb 80WP	Y= 67.51-25.157X	Y= 63.43-24.380X	0.968	0.978	0.984	0.989

Results of the experiment revealed that at all the doses of sedomil and recozeb caused significantly reduction the severity of dieback disease in tea as well as growth of mycelium of *C. gloeosporioides* compared to control. In the present investigation, both the fungicides @ 2.5 kg ha^{-1} showed the highest performance in reducing PDI and growth inhibition followed by 2.0 kg ha^{-1}, 1.5 kg ha^{-1} and 1.0 kg ha^{-1}. The protective fungicide when sprayed it comes in contact with the spores or propagules of the pathogen and kills them. Our result suggested that the use of sedomil 72WP and recozeb 80WP @ 2.5 kg ha^{-1} and 2.0 kg ha^{-1} are equally effective in controlling the disease. Therefore both the fungicides may be recommended at 2.0 kg ha^{-1} for the control of dieback disease of tea.

Literature Cited

Adil H Fazli R Hakim K. 2008 *In vitro* integrated control of *Colletotrichum gloeosporioides* with biological and chemical agents. *Sarhad Journal of Agriculture* **24**(1): 79-84.

Ali MA Ali M Huq M Ahmed M. 1993 *In vitro* studies on fungicides against *Colletotrichum gloeosporioides* (Penz.) Sacc.- the dieback of tea. *Sri Lanka Journal of Tea Science* **61**(1): 25-31.

Anonymous. 2013 *Statistical Bulletin of Bangladesh Tea Board*, January, 2013, Bangladesh Tea Board (BTB), Bangladesh, 8p.

Anonymous. 2011 *Annual Bulletin of Statistics*, 2011, International Tea Committee Ltd. 1, Carlton House Terrace, London, SW1Y5DB, UK, pp 42-47.

Barnett HL Hunter BB. 1972 *Illustrated Genera of Imperfect Fungi*, Burgess Publishing Co. Minneapolis, MN, USA, 241p.

Bhat N. 1991 Studies on fruit rot of pomegranate caused by *Colletotrichum gloeosporioides* and *Aspergillus niger*. *M.Sc (Agri) Thesis,* University Agricultural Science, Dharwad (India).

Freeman S Nizan Y Dtatan S Even S Sando T. 1997 Control of *Colletotrichum acutatum* in strawberry under lab, green house and field conditions. *Plant Disease* **81**: 749-52.

Huq M. 1995 Studies of *Colletotrichum gloeosporioides*- the die-back pathogen on new clones and seedlings of tea. *Tea Journal Bangladesh* **31** (1&2): 23-28.

Huq M Ali M Islam MS. 2007 *Approved Fungicides and Weedicides for Bangladesh Tea*. *Circular No. 119*. Bangladesh Tea Research Institute, Srimangal*,* 6p.

Hussain A Raziq F Khan H. 2008 *In vitro* integrated control of *Colletotrichum gloeosporioides* with biological and chemical agents. *Sarhad Journal of Agriculture* **24**(1): 79-84

Jamadar MM Shaikh MK Balikai RA. 1998 Chemical control of pomegranate fruit spot. *Advanced Agriculture Research,* India, 10: 13-15.

Legard D. 2000 *Colletotrichum* crown rot (anthracnose crown rot) caused by *Colletotorichum fragariae* and *Colletotrichum gloeosporioides*. University of Florida, Gulf Coast Research & Education Wing.

Prashanth A Arun RS Naik MK Patil MB Rajesh SP. 2008 Evaluation of fungicides, bioagents, and botanicals against pomegranate anthracnose. *Indian Journal of Plant Protection* **36**(2): 283-87.

Sana DL. 1989 *Tea Science*, Ashrafia Boi Ghar 36, Bangla Bazar, Dhaka, pp. 216-17.

Singh RS. 2000 Assessment of disease incidence and loss. In *Introduction to Principles of Pathology*, 3rd Ed, Oxford & IBH Publishing Co. Pvt. Ltd, 328p.

Suharban M Philip S Thomas Y. 1985 Fungicidal control of leaf spot disease of mango seedlings. *South Indian Horticulture* **33**: 125-26.

Sundravadana S Alice D Kuttalam S Samiyappan R. 2007 Efficacy of Azoxystrobin on *Colletotrichum gloeosporiodes* Penz growth and on controlling mango anthracnose. *Journal of Agricultural and Biological Science* **2**(3): 10-15.

Solano V Arauz LF. 1995 Combating anthracnose in papaya fruit through fungicide application in Atlantic region of Costa Rica. *Agronomia Costarricense* **19**: 25-30.