Management of grey leaf spot/blight disease of bay leaf (*Cinnamomum tamala*)

MA Wadud[1*] AHF Fahim[1] MS Naher[1] MB Sarker[1] MJ Uddin[2] and MR Humauan[3]

Present address
[1]Scientific Officer, SRC, Bangladesh Agricultural Research Institute (BARI), Shibganj, Bogra [2]Scientific Officer, BSRI, [3]Scientific Officer, RARS, BARI, Ishurdi, Pabna, Bangladesh

Correspondence*
wadudbari@yahoo.com

Accepted: 11 July, 2017

Abstract

The experiment was conducted at Spices Research Centre (SRC), Bangladesh Agricultural Research Institute (BARI), Shibganj, Bogra during 2013 to 2015 to determine the best management option against grey leaf spot disease of bay leaf. Five fungicides (Tilt 250 EC, Combi-2, Bavistin DF, Sunvit 50WP and Nativo 75 WG), one botanical extract (eucalyptus leaf extract) and one chemical fertilizer (MOP) along with control were used in this study. The experiment was laid out in Randomized Complete Block (RCB) design with three replications. A total of four sprays were applied at 15 days intervals starting from first initiation of disease symptoms. All fungicides and botanical extract were found effective significantly in controlling grey leaf spot disease over control. Lowest disease incidence (16.00% in 2013-14 and 12.60% in 2014-15) was recorded in T_2 (Tilt 250 EC @ 0.1%) treatment that was statistically similar with T_7 (Tilt 250 EC @ 0.1% + top dressing of MOP @ 50g/plant) treatment and the highest disease incidence (44.32% in 2013-14 and 41.75% in 2014-15) was recorded in T_8 (Control) treatment. Lowest disease severity (8.54% in 2013-14 and 8.45% in 2014-15) was recorded from T_2 treatment and the highest disease severity was observed in T_8 treatment. Among the fungicides, Tilt 250 EC @ 0.1% decreased the disease severity as well as increased the fresh leaf yield (21.14 kg/plant in 2013-14 and 23.81 kg/plant in 2014-15). Based on two year results, Tilt 250 EC @ 0.1% alone or combination with MOP @ 50 g/plant will recommended for the management of grey leaf spot disease of bay leaf without hampering the fresh leaf yield.

Key words: Bay leaf, grey leaf spot, fungicide, botanical extract, disease incidence, disease severity

Introduction

In Bangladesh, the spice plant *Cinnamomum tamala* Nees and Eberm (Synonym: *Cinnamomum albiflorum*) under the family Lauraceae is commonly known as 'Tejpata or Indian Bay Leaf', which is also distributed in the Mediterranean region, West and Central Asia, South Asia, South East and East Asia, Africa, South East America, Australia, India, China and Myanmar. It is origin of south slopes of the Himalayas and the mountains of north eastern India, extending into Burma. The main production was recorded in Nepal and Sikkm but it is also cultivated in our country. Sri Lanka has been the major producer of cinnamon in the world responsible for more than 70% of the world market. It grows throughout Bangladesh but cultivated more in southern region as spice as well as for medicinal value. Since ancient time it was used as condiments, medicinal and culinary uses.The leaves give of a sweet aroma when broken and added to dishes. When slightly wilted and dried, they are strongly aromatic. It contains many notable derived compounds, minerals and vitamins that are essential for good health. Cinnamom, although a hardy plant, is subjected to attack by variety of pests and diseases during its different degrees of development. These pests and diseases are responsible for considerable reduction in the yield of cinnamon leaf, the economic product and also for reducing the quality of other products such as leaf oil, bark oil and root bark oil although, they are not economically significant. The important diseases of Cinnamon reported from South East Asia are Leaf Spot caused by *Colletotrichium gloeosporioides* (Rov *et al*.,1976), leaf blight caused *by Glomerella cingulata* (Khan and Hossain, 1985), rust caused by *Aecidium cinnamomi* (Goswami and Bhattacharjee, 1973) and grey leaf spot/blight caused by *Pestalotia cinnamomi* (Anonymous, 1996). *Phytopthora cinnamomi* causing stripe

canker (Rands, 1922) and the pink disease caused by *Corticium saimonicolor* (Weiss, 2002) affecting stems of cinnamon and *Phellinus iamaensis* causing brown root rot have also aroused some attention by the researchers in South East Asia. Among the diseases, grey leaf spot/blight is one of the most serious diseases widely distributed in all bay leaf growing areas. Small yellow brown spots appear on the cinnamon leaves is the first symptom. Later, these spots turn grey with a border and spread to the lamina. Dark acervuli are produced in older lesions appearing as black dots in the centre. This disease can cause severe damage and defoliation. In India, the disease was reported to be caused by *Pestalotia palmarum* causing foliar damage up to 90% (Karunakaran *et al.,* 1993). *Pestalotia furierea* causing similar leaf spot symptoms were reported from Dominician Republic and also from Pakistan (Ciferri, 1926; Ciferri and Fragoso, 1927).

Among the diseases, grey leaf spot disease caused by *Pestalotia spp*. attacks the bay leaf trees and decreases the growth and development of the trees as well as the yield of the leaves. *Pestalotia spp*. (*Pestalotia cinnamomi* and *P. palmarum*) can be controlled by different way such as using immune or resistant sources against grey leaf spot, fungicides, botanical extracts and antagonistic agents (Uchida, 2004) but among these the use of fungicide is most effective in controlling *Pestalotia spp*. In previous investigations on the fungicidal effect against *Pestalotia spp*. several fungicides like Bavistin DF, Cupravit-50 WP, Dithane M-45, Macuprax, Nemispore 80 WP, Ridomil 72WP, Conza 5EC, X-tra care 300 EC, Topsin M 70 WP etc. (Rahman *et al.,* 2013; Khalequzzaman *et al.,* 2003; Sanjay *et al.,* 2006; Parveena *et al.,* 2002) were found effective. It was also reported that the disease can be minimized by the application of potassium fertilizer top dressed with fungicides. It has been established that Cl-containing chemicals (KCL or NaCl) influenced the growth of seedlings and increased their resistance to the pathogen against *Pestalotia spp* (Abad and Blancaver, 1975; Alonzo and Paloma, 1980). But fertilizer application cannot effectively control a disease individually but decreased the disease infection when potassium fertilizer was used as top dressed with fungicide. There is limited work done on the management practices to control *P. cinnamomi* of bay leaf in Bangladesh. Therefore, the present study was undertaken to determine the effective management option for controlling grey leaf spot disease of bay leaf.

Materials and Methods

The experiment was conducted at Spices Research Centre (SPC), Bangladesh Agricultural Research Institute (BARI), Shibganj, Bogra during 2013-14 and 2014-15. The land was medium high and the soil was clay loam in texture. Medium aged (about 8-10 years old) bay leaf plants were taken as test crop. For this, twenty four small sized (about 8-10 years old) bay leaf plants were selected for treatment application, observation and data recording. The weeds and stubbles of previous crops were collected and removed from the soil. The soil was clay loam in texture. The land was fertilized with cow dung 10 kg/plant, and TSP_{300}, MOP_{300} $Urea_{200}$, $Gypsum_{100}$, Boric $Acid_{20}$, Zinc $Sulphate_{30}$ g/plant, respectively. The entire quantity of cow dung, TSP, MOP, 50% of Urea, Gypsum, Boric Acid and Zinc Sulphate were used as basal applicatin during 2013 and 2014. The experiment was laid out in RCB design with three replications. Advanced bay leaf line (CTB 002) was used. Five fungicides, one botanical extract, top dressing of MOP fertilizer with fungicide and one control treatment were used. The treatments were, T_1 = 5% water extract of eucalyptus leaves; T_2 = Tilt 250 EC (Propiconazole) @ 0.1%; T_3 = Combi-2 (15% Propiconazole + 15% Difenoconazole) @ 0.1%; T_4 = Bavistin DF (50% Carbendazim) @ 0.1%; T_5 = Sunvit 50WP (Copper Oxychloride) @ 0.5%; T_6 = Nativo 75 WG (25% Trifloxystrobin + 50% Tebuconazole) @ 0.05%; T_7 = Tilt 250 EC (Propiconazole) @ 0.1% + top dressing of MOP @ 50g/plant and T_8 = Control. Top dressing of MOP was applied into 4 (four) equal instalments. Three times irrigation were required for the growth and development of the trees. Rest 50% of urea was applied at 25 days after application of basal dose followed by irrigation.

The treatmets were applied 4 times at 15 days intervals starting from first appearance of the disease symptoms. Data were recorded from ten (10) randomly selected tertiary branches of each selected plants at 15 days interval after application of treatment (three trees in each replicate). Data on number of fresh leaves per

tertiary branch, number of diseased leaves per tertiary branch, disease incidence, percent disease severity and percent fungicide efficacy were recorded by counting spotted leaves and visual estimation, respectively. Fresh leaf yield (kg/plant) and yield increased over control were recorded after harvesting the leaves during first week of June.

Twenty leaves were randomized collected from randomly selected ten tertiary branches of each tree. The infection on each leaf was rated by using a numerical index (containing 5 infection category) ranged from 0 = Healthy, which represented no infection on the leaf, 1= ¼ leaf area covered by infection, 2 = 1/3 leaf area covered by infection, 3 = less than ½ leaf area but more than 1/3 leaf area covered by infection and 4 = More than ½ leaf area covered by infection or the leaf is destroyed. Disease severity was calculated following the equation developed by Towsend and Heuberger (1943).

% Disease severity = $[(n \times v)/4N] \times 100$

Where,

n = Number of leaves within infection category.

v = Numerical value of each category.

N = Total number of leaves.

Fungicide effecacy was calculated by using Abbott equation (Frolich, 1979)

$$\% \text{ Fungicide efficacy} = \frac{C - T}{C} \times 100$$

Where,

C = Disease severity in the control.

T = Disease severity in the treatment.

All the recorded data were analyzed statistically to find out the level of significance and the variations among the data were compared by following Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Effect of botanical extract, fungicides and fertilizer against grey leaf spot disease

Results on effect of botanical extract, fungicides and fertilizer (MOP) in controlling grey leaf spot of bay leaf are presented in Table 1. Significant effects were found on number of fresh leaves per tertiary branch, number of diseased leaves per tertiary branch, disease incidence and disease severity. The maximum number (204.90) of fresh leaves per tertiary branch were recorded from T_2 (Tilt 250 EC) treatment which was identical with T_7 (Tilt 250 EC + top dressing of MOP @ 50 g/pant) treatment but statistically significant than other treatments, and the minimum number (60.35) of fresh leaves per tertiary branch were recorded from T_8 (Control) treatment. T_3 (Combai-2), T_4 (Bavistin), T_5 (Sunvit) and T_6 (Nativo) treatments gave 146.60, 157.50, 144.30 and 136.40 number of fresh leaves per tertiary branch, respectively which were stastically similar. The lowest number (20.08) of diseased leaves per tertiary branch was recorded in T_7 treatment which was identical with T_2 treatment, and the highest number (100.20) of diseased leaves per tertiary branch was recorded in T_8 treatment. The lowest disease incidence (16%) was obtained from T_2 which was identical with T_7 treatment, and the highest (44.32%) was in T_8 treatment. The lowest disease severity (8.54%) was achieved in T_2 treatment followed by T_7. The tested fungicides were differed in their disease control efficacy. In this respect, T_2 treatment resulted in the highest efficacy (80.30%) followed by T_7 (77.19%).

Results on effect of botanical extract, fungicides and potassium fertilizer in controlling grey leaf spot of bay leaf are presented in Table 2. All the fungicides and botanical extract resulted in significant reduction to the disease severity. Maximum number (237.20) of fresh leaves per tertiary branch were recorded from T_2 (Tilt 250 EC) treatment which was statistically significant than other treatments and the minimum number (61.92) of fresh leaves per tertiary branch were recorded from T_8 (Control) treatment. Lowest number (10.42) of diseased leaves per tertiary branch was recorded in T_7 treatment which was identical with T_2 treatment, and the highest number (109.50) of diseased leaves per tertiary branch was recorded in T_8 treatment. Lowest disease incidence (12.60%) was obtained from T_2 which was identical with T_7 treatment, and the highest (41.75%) was in T_8 treatment. Lowest disease severity (8.45%) was achieved in T_2 treatment followed by T_7 (10.05). The tested fungicides were differed in their disease control efficacy. In this respect, T_2 treatment resulted in the highest efficacy (82.08%) followed by T_7 (78.69%).

Table 1. Effect of botanical extract, fungicides and fertilizer against grey leaf spot disease of bay leaf in the cropping year 2013-14

Treatment	Number of fresh leaves per tertiary branch	Number of diseased leaves per tertiary branch	Disease incidence (%)	Disease severity	Percent fungicidal efficacy
T_1 = 5% water extract of eucalyptus leaves	93.88 c	90.42 ab	34.12 b	25.45 b	41.64 d
T_2 = Tilt 250 EC @ 0.1%	204.90 a	23.59 d	16.00 d	8.54 e	80.30 a
T_3 = Combi-2 @ 0.1%	146.60 b	78.78 b	27.44 bc	18.70 c	56.64 c
T_4 = Bavistin DF @ 0.1%	157.50 b	56.58 c	24.56 c	13.5 cde	68.54 abc
T_5 = Sunvit 50 WP @ 0.5%	136.40 b	87.04 ab	30.45 bc	15.20 cd	64.76 bc
T_6 = Nativo @ 0.05%	144.30 b	55.82 c	28.79 bc	16.41 c	61.84 c
T_7 = Tilt 250 EC @ 0.1% + top dressing of MOP @ 50 g/plant	197.5 a	20.08 d	16.44 d	9.87 de	77.19 ab
T_0 = Control	60.35 d	100.20 a	44.32 a	42.99 a	0.00 e
LSD (0.01)	30.97	15.87	7.21	5.56	13.83
CV (%)	8.93	10.19	10.68	12.15	10.10

In a column means followed by the same letter(s) do not differ significantly at 1% level of probability by DMRT

Table 2. Effect of botanical extract, fungicides and potassium fertilizer against grey leaf spot disease of bay leaf in the cropping year 2014-15

Treatment	No. of fresh leaves per tertiary branch	No. of diseased leaves per tertiary branch	Disease incidence (%)	Disease severity	Percent fungicidal efficacy
T_1 = 5% water extract of eucalyptus leaves	142.40 c	61.25 cd	33.15 b	28.99 b	34.31 c
T_2 = Tilt 250 EC @ 0.1%	237.20 a	12.75 e	12.60 e	8.45 d	82.08 a
T_3 = Combi-2 @ 0.1%	184.40 b	54.00 cd	29.31 bc	19.70 c	58.24 b
T_4 = Bavistin DF @ 0.1%	174.50 bc	83.33 b	26.08 bc	21.73 c	53.92 b
T_5 = Sunvit 50 WP @ 0.5%	137.30 c	63.75 c	18.74 de	23.18 bc	50.86 b
T_6 = Nativo @ 0.05%	154.60 bc	47.72 d	23.31 cd	20.07 c	57.46 b
T_7 = Tilt 250 EC @ 0.1% + top dressing of MOP @ 50 g/plant	194.2 b	10.42 e	14.17 e	10.05 d	78.69 a
T_0 = Control	61.92 d	109.50 a	41.75 a	47.18 a	0.00 d
LSD (0.01)	38.16	14.65	6.85	6.01	11.86
CV (%)	9.76	10.89	11.32	11.04	9.39

In a column means followed by the same letter(s) do not differ significantly at 1% level of probability by DMRT

Effect of botanical extract, fungicides and fertilizer on the fresh leaf yield of bay leaf

Effects of botanical extract, fungicides and fertilizer on yield of bay leaf are presented in Table 3. Significantly, the highest yield (21.50 kg/plant in 2013-14 and 23.83 kg/plant in 2014-15) was obtained from T_7 (Tilt 250 EC @ 0.1% + top dressing of MOP @ 50g/pant) which was statistically similar with T_2 (Tilt 250 EC @ 0.1%) treatment, and the lowest was in T_8 (Control) treatment. The highest yield increased over control was recorded from T_7 which was statistically similar with T_2 treatment, and the lowest was in T_1 (5% water extract of eucalyptus leaves) treatment. From the above study it is clear that all the fungicides have shown significant effect in controlling grey leaf spot of bay leaf. Out of the test fungicides, Tilt 250 Ec @ 0.1% was found to be best. These results are in accordance with the findings of Rahman *et al*. (2013). They reported that Tilt (Propiconazole) completely inhibited the pathogen *Pestalotia sp.* in vitro. Praveena and Kachapur (2002) reported that Propiconazole (Tilt) showed the maxumum mycelial growth inhibition (97.20%) at all concentration followed by Carbendazim (94.20%).

Table 3. Effect of botanical extract, fungicides and fertilizer on the fresh leaf yield of bay leaf in cropping year 2013-14 and 2014-15

Treatment	Yield (Kg/plant)		Yield increased over control	
	2013-14	2014-15	2013-14	2014-15
T_1 = 5% water extract of eucalyptus leaves	10.02 d	12.05 d	51.73 d	62.39 d
T_2 = Tilt 250 EC @ 0.1%	21.14 a	23.81 a	221.50 a	220.90 a
T_3 = Combi-2 @ 0.1%	15.69 b	18.02 b	131.10 b	142.90 b
T_4 = Bavistin DF @ 0.1%	15.86 b	17.86 b	140.40 b	140.70 b
T_5 = Sunvit 50 WP @ 0.5%	16.33 b	18.56 b	146.90 b	150.10 b
T_6 = Nativo @ 0.05%	13.07 c	15.07 c	97.77 c	103.10 c
T_7 = Tilt 250 EC @ 0.1% + top dressing of MOP @ 50 g/plant	21.50 a	23.83 a	226.20 a	221.10 a
T_0 = Control	6.59 e	7.42 e	0.00 e	0.00 e
LSD (0.01)	2.05	2.24	28.68	32.77
CV (%)	5.62	5.39	9.29	10.36

In a column means followed by the same letter(s) do not differ significantly at 1% level of probability by DMRT

In the this study, Tilt (Propicnazole) completely inhibited the *Pestalotia cinnamomi* which caused grey leaf spot disease of bay leaf and increased leaf yield. Palomar and Betonio (1982) repoted that grey spot lesions decreased when Benlate was applied to coconut fertilized with 90 mg KCl/plant. The present study completely supported to those findings.

Conclusion

The present study showed that among the five test fungicides, one botanical extract and one fertilizer (MOP); Tilt 250 EC @ 0.1% alone or combination with MOP @ 50 g/plant gave better control against the disease.

Based on two years study it revealed that Tilt 250 EC @ 0.1% alone or combination with MOP @ 50 g/plant provided better performance against grey leaf spot disease control of bay leaf as well as increasing the fresh leaf yield.

References

Abad RG and Blancaver. 1975. Coconut leaf spot/blight and their control. PCA-ARD Annual Report 1975-76.

Alonzo JC and Palomar MK. 1980. Effect of seawater and seaweed salt on coconut grey leaf spot disease. Philipp. J. Coconut Studies: 27-32.

Anonymous, 1996. Cinnamon: Cultivation and Processing. Technical Bulletin 5, Dept. of Export Agriculture, Ministry of Agriculture, Lands and Forestry, Sri Lanka, pp.7-8.

Ciferri R and Fragoso. 1927. Saprophytic fungi of the (11th Series), Bot. R. Soc. 27 (6): 267-280.

Ciferri R. 1926. Report on Phytopathology principle of diseases of cultivated plants observed during 1926, Segundolnforme Annual Estac. Nac. Agron. Moca, Republica Dominicana. pp. 36-44.

Frolich G. 1979. Phytopathologye and Pflanzenschutz VEB Gustay Fischer Verlay, Jena. pp 295.

Gomez KA and Gomez AA. 1984. Statistical procedures for agricultural research. 2nd Ed. New York: John Wiley and Sons.

Goswami R N and Bhattacharjee S. 1973. Rust a new disease of Tejpata. Current Science. 42(7): 257.

Karunakaran P, Nair MC and Das L. 1993. Grey blight disease of cinnamon *(Cinnamomum verum* Bercht. & Presl.) Leaves. Spices Aromatic Plants. 2 (1-2): 66-67.

Khalequzzaman KM, Uddin MK, Hossain MS, Islam MS and Rashid M H. 2003. Yearly incidence and effect of fungicides in controlling leaf spot of sapota. Asian J.of Plant Science. 2: 442-444.

Khan A R and Hossain M. 1985. Leaf blight of bay-leaf plants caused by *Glomerella cingulata* in Bangladesh. Bangladesh J. of Bot. 14(2): 181-182.

Palomar M K and Betonio P A. 1982. Control of gray leaf spot disease of coconut with

fungicides and potassium chloride. Philipp. J. Crop Sci. 7(3) : 166-169.

Parveena R and Kachapur MR. 2002. In vitro evaluation of fungicides against grey leaf spot of coconut caused by *Pestalotia palmarum* Cooke. Proceedings of the 15th Plantation crops Symposium Placrosym XV, Mysore, India. 570-571.

Rahman S, Adhikary SK, Sultana S, Yesmin S and Jahan N. 2013. In Vitro Evaluation of some selected fungicides against *Pestalotia palmarum* (Cooke.) causal agent of grey leaf spot of coconut. J. Plant Pathol. Microb. 4: 197.

Rands RD.1922 Stripe canker of cinnamon caused by *Phytophthora cinnamomi* Meded. Inst. Voor Plantenzieketen. 54 : 53.

Rov A R, Jamaluddin and Prasad M M. 1976. Some new leaf spot diseases in India. Current Science. 45(16): 604.

Sanjay R, Ponmurugan P and Baby UI. 2006. Evaluation of fungicides and biocontrol agents against grey blight disease of tea in the field. J. Crop Prot. 27: 689-692.

Towsend GK and Heuberger TW. 1943. Methods for estimating losses caused by disease experiments. Plant Dis. Rept., 27: 340-343.

Uchida JY.2004. Pestalotiopsis diseases. Diseases and Disorders of Ornamental Palms. 27-28.

Weiss EA. 2002. Essential oil crops, CAB international. l9lp.