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Evaluation of Some Fungicides and Bio-Agents against *Sclerotium rolfsii* and Foot and Root Rot Disease of Eggplant (*Solanum melongena* L.)

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Abstract

Two experiments were conducted in a complete randomized design (CRD) with three replications to evaluate the efficacy of some fungicides and bio-agents against foot and root rot of eggplant. Ten treatments including five fungicides, two plant extracts, one poultry manure and an antagonist were evaluated against the disease and its causal agent. Fungicides and plant extracts were sprayed at the base of each plant and adjacent soil at 40, 50 and 60 days after transplanting (DAT). Poultry manure and bio-agent were applied to the soil before transplanting. The highest reduction of mycelium growth (74.44 %) and sclerotia production (77.13 %) were recorded in Bavistin 50 WP by poison food technique. Topgan 50 WP and Ridomil Gold also had similar effects. The lowest incidence (7.10 %) of foot rot was observed in Bavistin 50 WP at 120 DAT that was similar with Topgan 50 WP and Ridomil Gold. The lowest disease severity (stem lesion area) was also found in each of Bavistin 50 WP (0.71 cm) and Topgan 50 WP which resulted in higher yield (18.07 ton/ha). Application of bio-agent (*Trichoderma harzianum*) also showed promising effect against foot and root rot disease. Bavistin 50 WP is therefore recommended for controlling the foot and root rot of eggplant.

Keywords: *Sclerotium rolfsii*, fungicides, bio-agents, eggplant

1. Introduction

Eggplant (*Solanum melongena* L.), also known as brinjal is an important vegetable crop in Bangladesh (BBS, 2011). It is being cultivated in almost all districts and consumed as a cooked vegetable in various ways. It is a small short lived perennial herb belonging to the family solanaceae of dicot angiosperm. More than ten diseases of eggplant have been reported in Bangladesh (Islam, 2005). Dasgupta *et al*. (2000) reported the highest intensity of foot and root rot and leaf rot of eggplant recorded in Midnapore and Nadia districts of India. Among them, foot and root rot may cause up to 30-50 % loss in fruit yield of eggplant (BARI, 2000).

The fungus *Sclerotium rolfsii* is a facultative saprophyte and can maintain continuity of its generation under adverse situation by the formation of sclerotia (Ahmed, 1980). As the fungus *Sclerotium rolfsii* is soil borne and omnipathogenic, it is very difficult to control even by the use of chemical fungicides. Some fungicides such as Bavistin 50 WP, Topgan 50 WP, Dithane M-45 and Bordeaux mixture have

been reported to be effective to control foot and root rot disease of eggplant caused by *Sclerotium rolfsii* (Dasgupta and Maiti, 2008; Johnson and Reddy, 2008; Tiwari and Ashok, 2004 and Patil *et al.*, 1986). Biological control could be successful alternative to chemicals. Many species of fungi and bacteria are reported to be effective as bio-control agents against soil borne plant pathogens (Mukhopadhyay, 1994 and Bari, 2000). *Trichoderma* spp. are antagonists to many plant pathogenic fungi. They are potential bio-control agent againsts several soil borne plant pathogenic fungi (Faruq *et al*., 2014; Saralamrna and Vithal, 2003; Pranab Datta and Das, 2002 and Biswas and Sen, 2000). Anti-fungal activities of garlic, neem, alamanda, have been reported by many researchers (Faruq *et al*., 2014; Islam, 2005; Rahman *et al*., 1999; Arun *et al*., 1995; Mohanty *et al.*, 2000 and Gurjar *et al*., 2003).

The present study was therefore undertaken to evaluate some fungicides, plant extracts, organic manure and bio-agent against the pathogen to find out the most effective management option for foot and root rot of eggplant.

2. Materials and Methods

The experiment was conducted in the laboratory and net House of the Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka, during November 2013 to May 2014. The experiment was carried out in a completely randomized design (CRD) with three replications. Ten treatments including five fungicides viz. Bavistin 50 WP (Carbendazim) @ 0.2 % , Topgan 50 WP (Copper-oxychloride) @ 0.2 %, Ridomil gold MZ 68 WG (Metalaxyl) @ 0.4 %, Bordeaux mixture (Cu fungicide) @ 1:1:2 (w/v), and Dithen M-45 (Mancozeb) @ 0.2 %; two plant extracts viz. Neem (*Azadirachta indica*) @ 1:2 (w/v) and Allamanda (*Allamanda cathertica*) leaf extract @ 1:2 (w/v); one poultry manure @ 25 g/plant and one bio-agent *Trichoderma harzainum* @ 1.35 x 10^9 spores/plant were tested against foot and root rot of eggplant (variety "Singnath").

Poison food technique was done for *in vitro* evaluation of selected fungicides, plant extracts and bio-agent against *S. rolfsii.* PDA media and distilled water were sterilized in an autoclave at 121 °C under 15 PSI for 30 minutes. *S. rolfsii* was isolated from the infected plants following tissue planting method. Pure culture of the pathogen was prepared following hyphal tip methods and subsequently multiplied on PDA in test tubes and petri dishes (Mian, 1995). Inhibition of radial growth was computed by meaning colony diameter on control plates and treated plates. Moreover, a pot experiment was done to evaluate the selected treatments against foot and root rot disease in net house. Healthy seedlings were transplanted in the earthen pot. Manures and fertilizers were applied properly. *S. rolfsii* were inoculated to the soil in the base of each plant at two months after transplanting.

Data was taken randomly from selected five plants for each plot. Percent growth inhibition, number of sclerotia production, percent disease incidence, stem lesion area (cm) and yield (t/ha) were recorded at 120 DAT. Data were analyzed statistically and the means were separated by least significant difference (LSD) following MSTAT-C software.

3. Results and Discussion

Efficacy of different treatments on radial growth of mycelia and production of sclerotia of *Sclerotium rolfsii* is shown in Table 1 and Figure 1. The lowest growth of mycelia (1.03, 1.73, 2.06 and 2.30 cm) was recorded in case of Bavistin 50 WP, where inhibition was 74.44 %. Mycelial growth was the highest in case of control, there was no inhibition of mycelia growth. The lowest number of sclerotia (124.7) was recorded in case of Bavistin 50 WP and Topgan 50 WP (130.7). The highest number of sclerotia (545.3) was recorded in control at 30 days after inoculation. The highest reduction in sclerotia production (77.13 %) was recorded in case of Bavistin 50 WP and Topgan 50 WP (76.03 %).

Table 1. Effect of selected fungicides, plant extracts and bio-agent on mycelial growth and sclerotia production of *Sclerotium rolfsii*

Treatment	Radial growth (cm)				Growth inhibition (%) at 4 DAI	Sclerotia production (no) at 30 DAI	Sclerotia reduction (%) at 30 DAI
	1 DAI	2 DAI	3 DAI	4 DAI			
T_1=Control	2.00 a	4.20 a	7.33 a	9.00 a	-	545.3 a	-
T_2=Bavistin 50 WP	1.03 d	1.73 e	2.06 g	2.30 h	74.44	124.7 h	77.13
T_3=Topgan 50 WP	1.30 c	1.80 e	2.23 g	2.80 g	68.88	130.7 h	76.03
T_4=Ridomil Gold	1.40 bc	1.93 e	2.63 f	3.23 f	64.07	222.7 g	59.16
T_5=Bordeaux mixture	1.50 bc	2.66 d	3.63 d	4.30 d	52.22	295.0 e	45.90
T_6=Dithane M-45	1.60 b	2.90 c	3.66 d	4.16 d	53.70	272.0 f	50.11
T_7=Neem leaf extract	1.50 bc	3.10 c	5.46 c	6.73 c	25.18	354.0 c	35.08
T_8=Alamanda leaf extract	1.53 bc	3.60 b	5.86 b	7.90 b	12.22	386.0 b	29.21
T_9=*T. harzianum*	1.33 c	2.46 d	2.96 e	3.46 e	61.47	314.0 d	42.41

Means followed by the same letters in a column did not differ at 5% level of significance by LSD.
DAI= Days after inoculation.

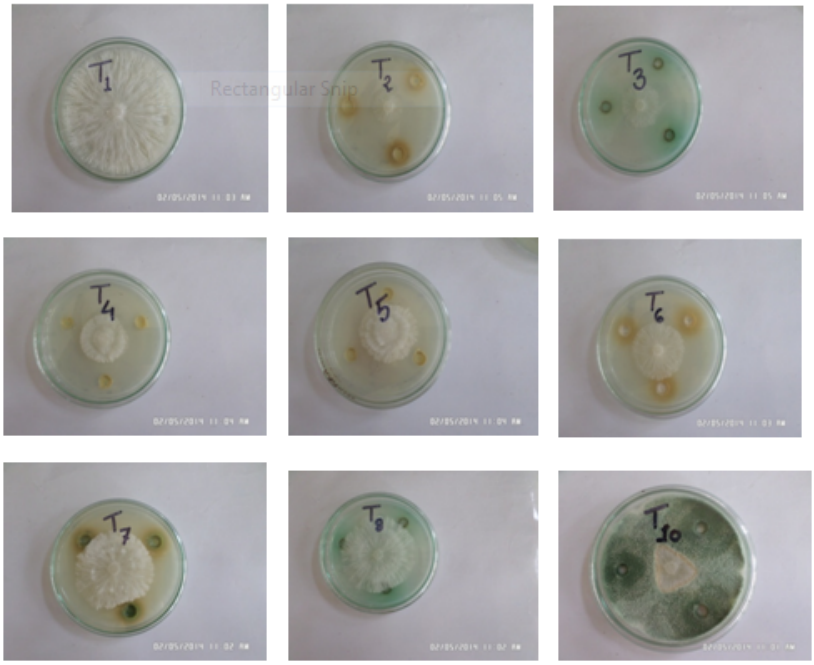

Figure 1. Bioassay of different treatments against *Sclerotium rolfsii*

Table 2. Effect of different treatments on disease incidence and disease severity (stem lesion area) at 120 days after transplanting

Treatment	% Disease incidence	Incidence reduction (%)	Stem lesion area (cm)
Control	64.90 a	-	2.23 a
Bavistin 50 WP	7.10 e	89.06	0.71 d
Topgan 50 WP	19.63 de	69.75	0.99 cd
Ridomil Gold	25.90 cde	60.09	1.16 cd
Bordeaux mixture	25.90 cde	60.09	1.19 bcd
Dithane M-45	41.53 abcd	36.00	1.60 bcd
Neem leaf extract	38.43 bcd	40.78	1.59 bcd
Alamanda leaf extract	47.80 abc	26.34	1.83 ab
Poultry manure	62.53 ab	3.65	1.87 ab
T. harzianum	31.93 cd	50.80	1.40 abc

Means followed by the same letters in a column did not differ at 5% level of significance by LSD.

Table 3. Effect of different treatments on yield of eggplant at 120 DAT

Treatment	Yield (ton/ha)	Yield Increase over control (%)
Control	4.867 h	-
Bavistin 50 WP	18.07 a	271.27
Topgan 50 WP	15.79 b	224.42
Ridomil Gold MZ 68WG	13.41 c	175.52
Bordeaux mixture	12.40 d	154.77
Dithane M-45	10.95 e	124.98
Neem leaf extract	10.66 e	119.02
Alamanda leaf extract	9.420 f	93.54
Poultry manure	7.660 g	57.38
Trichoderma harzianum	11.58 de	137.92

Means followed by the same letters in a column did not differ at 5% level of significance by LSD.

Data on the effect of fungicides and bio-agents on the incidence and severity of foot and root rot of eggplant are presented in Table 2. Bavistin 50 WP (7.10 %), Topgan 50 WP (19.6 %) and Ridomil Gold MZ 68WG (25.9 %) gave the lowest incidence. The highest disease incidence was recorded in control treatment (64.9 %) at 120 DAT. The reduction in incidence was the highest in Bavistin 50 WP (89.06 %), Topgan 50 WP (69.75 %) and Ridomil Gold (60.09 %) treated pots. The lowest lesion area was observed in case of Bavistin 50 WP (0.71 cm) and Topgan 50 WP (0.99 cm). Neem leaf extract (1.59 cm) and *Trichoderma harzianum* (1.40 cm) also showed better performance as compared to control. The highest lesion area (2.23 cm) was recored in control.

Effect of different treatments on yield of eggplant is presented in Table 3. The highest yield (18.07 ton/ha) was recorded in Bavistin 50 WP. Topgan produced 15.79 ton/ha and Ridomil gold MZ 68WG yielded 13.41 ton/ha. The yield was 11.58 ton/ha in case of *Trichoderma harzianum*. The lowest yield (4.86 ton/ha) was recorded in control plot. The highest increase of yield over control (271.27 %) was recorded in Bavistin 50 WP followed by Topgan 50 WP (224.42 %) and Ridomil Gold (175.52 %).

Figure 2. Infected eggplant showing mycelium of *Sclerotium rolfsii*

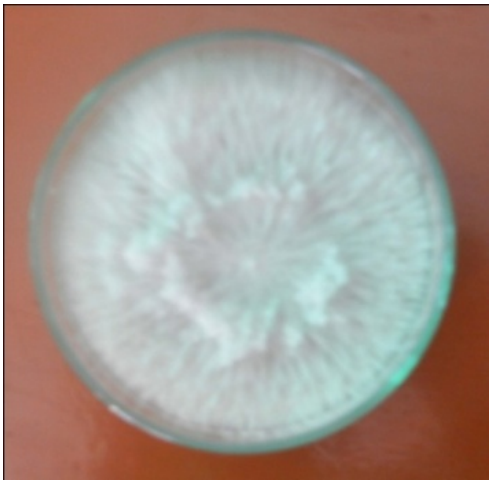

Figure 3. Pure culture of *Sclerotium rolfsii*

From the results of the study it is revealed that Bavistin 50 WP was the best in reducing the incidence of foot and root rot disease and increasing the yield of eggplant. Similar findings were reported on foot and root rot of other crops (Sheoraj *et al*., 2005; Vanitha and Suresh, 2002; Mishra and Bais, 1987; Dutta, 1975). Neem leaf extract was promising against the *Sclerotium rolfsii* causing foot and root rot of eggplant (Seshakiran, 2002; Dayaram and Tewari, 1994). *Trichoderma harzianum* was also effective in controlling *Sclerotium rolfsii*, the causal agent of foot and root rot of eggplant (Islam, 2005).

4. Conclusions

Bavistin 50 WP showed the best effects among the treatments in reducing the foot and root rot disease and increasing the yield of eggplant. So, Bavistin 50 WP may be suggested to use by the farmer for controlling foot and root rot disease of eggplant.

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