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CONTROL OF PHOMOPSIS BLIGHT OF EGG PLANT THROUGH FERTILIZER AND FUNGICIDE MANAGEMENT

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Abstract

The experiments were conducted at Laboratory of the Department of Plant Pathology and in the farm of Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh during Rabi season of the year 2007-2008. Four fungicides viz. Bavistin 50 WP (Carbendazim), Tilt 250 EC (Propiconazole), Cupravit 50 WP (Copperoxychloride) and Dithane M-45 (Mancozeb) and micronutrients (Gypsum, ZnO and Boric acid) were evaluated against *Phomopsis vexans* causing Phomopsis blight and fruit rot of eggplant. The fungicides and micronutrients either applied individually or in combination showed significant effect in terms of per cent leaf infection, fruit infection, leaf area diseased and fruit area diseased in comparison to control. Effect of each fungicide applied in combination with micronutrients always showed better performance in reducing disease incidence and disease severity than the fungicides applied alone. Among the fungicides, Bavistin 50 WP (0.1%) proved to be effective arresting the spore germination and mycelia growth of *Phomopsis vexans* assayed in *in vitro* test. Reduction of leaf area diseased caused by Bavistin 50 WP (0.1%) in combination with micronutrients were 58.17, 67.37, 78.41 and 85.25%, respectively at pre-flowering, post-flowering, fruiting and fruit ripening stages while Bavistin 50 WP (0.1%) alone reduced by 52.22, 58.67, 74.19 and 83.09%, respectively at those stages. Similarly reduction of fruit area diseased caused by Bavistin 50 WP (0.1%) in combination with micronutrients were 57.93 and 79.79%, respectively at fruiting and fruit ripening stages while Bavistin 50WP (0.1%) alone reduced by 56.93 and 76.14%, respectively at those stages. Micronutrients had little effect against the disease but significantly better than control.

Keywords: Phomopsis Blight, Egg Plant, Fertilizer and Fungicide Management

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Introduction

Eggplant (*Solanum melongena*) is an important vegetable in Bangladesh cultivated round the year in all districts of the country (Anonymous, 2001). The eggplant is of much important in the warm areas of Far East and grown extensively in India, Bangladesh, Pakistan, China and Philippines. It is thought to be originated in Indian sub-continent with the secondary centre of origin in China (Zeven and Zhukovsky, 1975). Eggplant is locally known as "Begun" and its early European name is Aubergine or Egplant.

Eggplant is nutritious and widely grown vegetable in Bangladesh as well as in the world and has multifarious use as a dish item (Bose and Som, 1986; Rashid, 1993). About 8 million farm families are involved in eggplant cultivation. Its position in terms of acreage production is second in vegetable crops (BBS, 2003). It is grown round the year both as winter (Rabi) and summer (Kharif) crops. Eggplant is thus regarded as a cash crop. The total acreage of eggplant is 44,377 acres with total annual production of 1,25,080 metric tons (BBS, 2010). A large number of cultivars are grown in Bangladesh, which show a wide range of variation in yield performance. This gives small, marginal and landless farmers a continuous source of income and provides employment facilities for the rural people. For most of the time, except peak production period, market price of eggplant compared to other vegetables remains high which is in favor of the farmer's solvency. Therefore, it plays a vital role to boost our national economy.

Eggplant suffers from 12 diseases of which Phomopsis blight and fruit rot caused by *Phomopsis vexans* has been treated as major constraints of its cultivation in our country (Das, 1998). The causal organism of the disease, *Phomopsis vexans* viable for about 14 months in soil debries and in the seed from infected fruits. The pathogen is reported both externally and internally seed borne. The disease was first reported from Gujrat in 1914 and since then from many parts of India. Fakir (1983) and Ahmad (1987) have reported occurrence of the disease in Bangladesh. The disease has become a major constraint in case of intensive cultivation of eggplant. The disease affects the crops from seedling to maturity (Singh, 1992).

Crop losses due to this disease are evident, loss ranges from 15-20% in general but 30-50% in severe case which estimated as a losses equivalent to TK. 1255 million ($20 million) per annum (BBS, 2003; Das, 1998). It is a serious disease, which may cause damping off symptoms if attacked at seedling stage. When the leaves are infected, small circular spots appear which become grey to brown with a light color centre. The infected leaves may turn yellow and die. Lesion may also develop on petiole and stem cause blighting of affected portions. In course of time, the spot enlarges and produces concentric circular area. Ultimately, the fruits become mummified and rotten (Kumar *et al*., 1986). There is no recognized resistant variety of eggplant against fruit rot disease. A very few works have been made by different workers to control this disease (Khan, 1999; Hawlader, 2003; Nazimuddin, 2004). Therefore, the experiment was undertaken to find out the effective fungicides or micronutrients in controlling phomopsis blight of eggplant.

Materials and Methods

The experiment were conducted at M.S. Laboratory during September- November' 2007 and in the farm allotted for the Department of Plant Pathology, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh during Rabi season of the year 2007-2008. In the laboratory experiments completely randomized design (CRD) was followed and the field experiment was laid out in randomized complete block design (RCBD) with three replications. There were 30 unit plots altogether in the experiment. The size of the plot was 3.0 m × 1.0 m, plant to plant distance was 0.75 m and row to row distance 1.0 m. Four fungicides viz. Bavistin 50 WP (Carbendazim), Tilt 250 EC (Propiconazole), Cupravit 50 WP (Copperoxychloride) and Dithane M-45 (Mancozeb); three fertilizers viz. Urea, TSP and MP); three micronutrients viz. Gypsum, ZnO & Boric acid and control were considered as treatments. Each treatment was replicated thrice. Ten treatments including control were used. T_1 = Normal fertilization (Cowdung + Urea + TSP + MP) – Control, T_2 = Normal fertilization + Micronutrients (Gypsum + ZnO + Boric acid), T_3 = Normal fertilization + foliar spraying with Bavistin 50 WP, T_4 = Normal fertilization + foliar spraying with Cupravit 50 WP, T_5= Normal fertilization + foliar spraying with Tilt 250EC, T_6 = Normal fertilization + foliar spraying with Dithane M-45, T_7 = Normal fertilization + Micronutrients + foliar spraying with Bavistin 50 WP, T_8 = Normal fertilization + Micronutrients + foliar spraying with Cupravit 50 WP, T_9 = Normal fertilization + Micronutrients + foliar spraying with Dithane M-45 and T_{10}**=** Normal fertilization + Micronutrients + foliar spraying with Tilt 250 EC 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). Fertilizers and manures were applied as per recommendation of BARI (Bangladesh Agricultural Research Institute) ((Anonymous, 1997). Watering and intercultural operations were done when necessary. In the laboratory, Potato Dextrose Agar (PDA) was made and poured into each Petri-plate (9 cm diameter) and allowed to solidify. The pathogen, *Phomopsis vexans* was isolated by tissue plating method from naturally infected brinjal fruit collected from the Horticulture garden of Sher-e-Bangla Agricultural University, Dhaka (Islam, *et al.,* 2004). Infected tissues were cut and placed in PDA media and incubated at 22 ± 2ºC for 10 days and pycnidia were formed. Spore suspension inocula^{-1} of *Phomosis vexans was* prepared and suspension was adjusted to 10^5 conidia ml^{-1} solution and stored at 5°C. Bioassay of fungicides was done by Cup/Groove method and Disc/Zone inhibition method. Seeds of eggplant cultivar Singnath were collected from Bangladesh Agricultural Research Institute (BARI), Joydebpur, and Gazipur and were treated with Vitavax-200 (0.2%) were sown in plastic trays containing sterilized sandy soil on18th November 2007. Main field was prepared and seedlings were transplanted on 16 January 2008 in accordance with the experimental design. Plant to plant distance was maintained 75 cm and each plot contain five plants**.** *Phomopsis vexans* was inoculated by spraying to the eggplant. After spraying, the seedlings of eggplant were covered with moistened polythene with the help of bamboo. Symptoms were developed on leaves and fruits in brinjal plants. Fungicidal suspensions were prepared and sprayed at flowering, fruiting, and post fruiting stages. After inoculation and spraying of fungicides, data were recorded at every 10 days intervals on % Leaf infection, % LAD (Leaf area diseased), % Fruit infection and % FAD (Fruit area diseased).

Per cent LAD (Leaf area diseased) and per cent FAD (Fruit area diseased) were measured by eye estimation. Area of single leaf/fruit was considered as 100%. Deducting the healthy area, the diseased area was estimated. Average % LAD/FAD was then calculated by dividing the total diseased areas by the investigated leaves/fruits (Islam, 2005a). 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

Isolation and identification of causal agent

The causal fungus was isolated from both infected leaves and fruits. Symptoms of Phomopsis blight and fruit rot caused by *Phomopsis vexans* as observed in the experimental plot conform with those reported by Walker (1952) from United States of America; Kumar *et al.* (1986) and Singh (1992) from India; Das (1998) and Islam (2005b) from Bangladesh. Walker (1952) described the first phase of the disease as blight of young seedlings. Islam (2005a) observed the fungus as whitish mycelial growth in cultured media with the presence of concentric growth sporadic pycnidia partially emerges in the media. Islam (2005b) also reported that pycnidia possessed both α & β conidia.

Laboratory experiment

Bavistin 50 WP (Carbendazim) was found promising against *Phomopsis vexans* in the laboratory assay. Bavistin (0.1%) completely arrested the mycelial growth and produced largest inhibition zones (6.29 cm) in culture media while assayed by food poisonic techniques following cup and disc method. The performance of Tilt 250 EC in controlling the mycelial growth of *Phomopsis vexans* was also promoting next to Bavistin 50WP. The performances of rest of the fungicides were less promising but significantly better than control. The results of the laboratory assay corroborate with the reports of Mohanty *et al.* (1994) and Islam (2005a).

Table 1. Effect of different fungicides on inhibition of mycelia growth of *Phomopsis vexans* in the laboratory

Fungicides	Active ingredients	Cup method	Disk method
		Radial mycelial growth (cm)	Diameter of inhibition zone (cm)
Bavistin 50WP	50% Carbendazim	0.00 d	6.29 a
Tilt 250EC	25% Propiconazole	4.26 c	4.31 b
DithaneM-45	80% Mancozeb	5.43 b	2.78 c
Cupravit 50WP	50% Copperoxychloride	6.61 a	1.45 d
Control	-	7.71 a	0.00 e
LSD (P=0.05)		0.30	0.45

Figures with common letters do not differ at p=0.05

Field experiment

Effect of fungicides and micronutrients at pre-flowering stage in the field condition

Effect of each fungicide applied in combination with micronutrients always showed better performance in reducing disease incidence and disease severity than the fungicides applied alone. Significantly the lowest leaf infection (14.15%) was recorded in case of application of Bavistin 50 WP in combination with micronutrients (T_7) followed by application of Bavistin 50 WP alone (T_3) and application of Tilt 250 EC in combination with micronutrients (T_{10}). The highest leaf infection (31.09%) was observed in case of control (T_1) proceeded by application of micronutrients (T_2), application of Cupravit 50 WP alone (T_4) and application of Cupravit 50 WP in combination with micronutrients (T_8).

The lowest leaf area diseased (6.12%) was recorded in case of application of Bavistin 50 WP in combination with micronutrients (T_7) followed by application of Bavistin 50 WP alone (T_3) and application of Tilt 250 EC in combination with micronutrients (T_{10}). The highest leaf area diseased (14.63%) was observed in case of control (T_1) proceeded by application of micronutrients (T_2), application of Cupravit alone (T_4) and Cupravit in combination with micronutrients (T_8).

Table 2. Efficacy of fungicides and micronutrients in controlling *Phomopsis vexans* causing leaf blight and fruit rot of eggplant at pre-flowering stage in the field condition

Treatments	% Leaf Infection (LI)	% Leaf Area Diseased (LAD)
T_1	31.09a	14.63 a
T_2	27.40b	12.21b
T_3	16.16e	6.99f
T_4	27.91b	12.37b
T_5	20.62d	8.94de
T_6	24.52c	10.49c
T_7	14.15e	6.12f
T_8	27.51b	11.79b
T_9	24.19c	10.16cd
T_{10}	19.31d	8.73e
LSD (0.05)	2.523	1.239

Figures with common letters do not differ at p=0.05

Effect of fungicides and micronutrients at post-flowering stage in the field condition

The fungicides and micronutrients either applied individually or in combination showed significant effect in terms of disease incidence (per cent Leaf Infection) and disease severity (per cent Leaf Area Diseased) in comparison to control. Significantly, the lowest leaf infection (13.65%), was recorded in case of Bavistin 50 WP in combination with micronutrients (T_7) followed by Bavistin 50 WP alone (T_3) and Tilt 250 EC in combination with micronutrients (T_{10}). The highest leaf infection (39.51%) was observed in case of control (T_1) preceded by application of micronutrients (T_2), Cupravit alone (T_4) and Cupravit in combination with micronutrients (T_8).

The lowest leaf area diseased (6.23%) was recorded in case of Bavistin 50 WP in combination with micronutrients (T_7) followed by Bavistin 50 WP alone (T_3) and Tilt 250 EC in combination with micronutrients (T_{10}). The highest leaf area diseased (19.09%) was observed in case of control (T_1) preceded by application of micronutrients (T_2), Cupravit 50 WP alone (T_4) and Cupravit 50 WP in combination with micronutrients (T_8).

Table 3. Efficacy of fungicides and micronutrients in controlling *Phomopsis vexans* causing leaf blight and fruit rot of eggplant at post-flowering stage in the field condition

Treatments	% Leaf Infection (LI)	% Leaf Area Diseased (LAD)
T_1	39.51a	19.09a
T_2	30.63b	16.57b
T_3	14.49e	7.89e
T_4	31.09b	16.11b
T_5	21.87d	10.11d
T_6	28.79bc	13.50c
T_7	13.65e	6.23f
T_8	29.71b	15.15b
T_9	26.05c	12.73c
T_{10}	21.31d	9.78d
LSD (0.05)	2.977	1.407

Figures with common letters do not differ at p=0.05

Effect of fungicides and micronutrients at fruiting stage in the field condition

Effect of each fungicide applied in combination with micronutrients always showed better performance than the fungicides applied alone in reducing disease incidence and disease severity. Significantly the lowest leaf infection (14.24%) was recorded in case of application of Bavistin 50 WP in combination with micronutrients (T_7) that was followed by Bavistin 50 WP alone (T_3), Tilt 250 EC in combination with micronutrients (T_{10}) amd Tilt 250 EC alone (T_5). The highest leaf infection (47.03%) was observed in case of control (T_1) preceded by application of micronutrients (T_2), Cupravit 50 WP alone (T_4) and Cupravit 50 WP in combination with micronutrients (T_8).

The lowest leaf area diseased (4.60%) was recorded in case of Bavistin 50 WP in combination with micronutrients (T_7) which was followed by Bavistin 50 WP alone (T_3), Tilt 250 EC in combination with micronutrients (T_{10}) and

Tilt 250 EC alone (T_5). The highest leaf area diseased (21.31%) was observed in case of control (T_1) preceded by application of micronutrients (T_2), Cupravit 50 WP alone (T_4) and Cupravit 50 WP in combination with micronutrients (T_8).

The lowest fruit infection (16.02%) was recorded in case of Bavistin 50 WP in combination with micronutrients (T_7). The second highest performance in reducing fruit infection was recorded in case of Bavistin 50 WP alone (T_3) followed by Tilt 250 EC in combination with micronutrients (T_{10}) and Tilt 250 EC alone (T_5). The maximum fruit infection (34.35%) was observed in case of control (T_1) preceded by application of micronutrients (T_2), Cupravit 50 WP alone (T_4) and Cupravit 50 WP in combination with micronutrients (T_8).

In case of per cent Fruit Area Diseased (%LAD), the lowest fruit area diseased (4.89%) was recorded in case of Bavistin 50 WP applied in combination with micronutrients (T_7) which was followed by Bavistin 50 WP alone (T_3), Tilt 250 EC applied in combination with micronutrients (T_{10}) and Tilt 250 EC alone (T_5). The highest fruit area diseased (14.00%) was noticed in case of control (T_1) preceded by application of micronutrients (T_2), Cupravit 50WP alone (T_4) and Cupravit 50WP in combination with micronutrients (T_8).

Table 4. Efficacy of fungicides and micronutrients in controlling *Phomopsis vexans* causing leaf blight and fruit rot of eggplant at fruiting stage in the field condition

Treatments	% Leaf Infection (LI)	% Leaf Area Diseased (LAD)	% Fruit Infection (FI)	% Fruit Area Diseased (FAD)
T_1	47.03a	21.31a	34.35a	14.00a
T_2	38.47b	12.02b	29.93b	10.92b
T_3	16.50e	5.50f	17.00e	6.03f
T_4	37.65b	12.00b	28.40b	9.83b
T_5	24.21d	7.83de	20.77d	7.45de
T_6	31.03c	9.23c	24.46c	8.78c
T_7	14.24e	4.60f	16.02e	5.89f
T_8	35.51b	11.12b	27.58b	10.03b
T_9	29.18c	8.70cd	24.50c	8.19cd
T_{10}	22.50d	7.30e	20.44d	7.10e
LSD (0.05)	3.775	0.9474	2.647	0.9427

Figures with common letters do not differ at p=0.05

Effect of fungicides and micronutrients at fruit ripening stage in the field condition

The fungicides and micronutrients applied either individually or in combination showed significant effect in terms of disease incidence (%LI and %FI) and disease severity (%LAD and %FAD) in comparison to control. Effect of each fungicide applied in combination with micronutrients always showed better performance in reducing disease incidence and disease severity than the fungicides applied alone. Significantly the lowest leaf infection (15.03%), was recorded in case of Bavistin 50 WP applied in combination with micronutrients (T_7) that was followed by Bavistin 50 WP alone (T_3), Tilt 250 EC in combination with micronutrients (T_{10}) and Tilt 250 EC alone (T_5). The highest leaf infection (90.31%) was observed in case of control (T_1). The application of micronutrients alone (T_2) showed significantly lower leaf infection than control preceded by Cupravit 50 WP alone (T_4) and Cupravit 50 WP in combination with micronutrients (T_8).

The effect of fungicides and micronutrients in reducing percent fruit infection (%FI) was more or less similar to that of percent leaf infection (%LI). The lowest fruit infection (15.57%) was recorded in case of Bavistin 50 WP applied in combination with micronutrients (T_7) which was followed by Bavistin 50 WP alone (T_3), Tilt 250 EC in combination with micronutrients (T_{10}) and Tilt 250 EC alone (T_5). The highest fruit infection (68.89%) was observed in case of control (T_1) preceded by application of micronutrients (T_2), Cupravit 50 WP alone (T_4) and Cupravit 50 WP in combination with micronutrients (T_8).

In case of per cent leaf area diseased (%LAD), the lowest leaf area diseased (4.38%) was recorded in case of Bavistin 50 WP applied in combination with micronutrients (T_7) that was followed by Bavistin 50 WP alone (T_3), Tilt 250 EC in combination with micronutrients (T_{10}) and Tilt 250 EC alone (T_5). The highest leaf area diseased (29.69%) was observed in case of control (T_1) preceded by application of micronutrients (T_2), Cupravit 50 WP alone (T_4) and Cupravit 50 WP in combination with micronutrients (T_8).

Similar trend of effect of fungicides and micronutrients was observed in case of %LAD. The lowest fruit area diseased (9.09%) was recorded in case of application of Bavistin 50 WP in combination with micronutrients (T_7)

followed by Bavistin 50 WP alone (T_3), Tilt 250 EC in combination with micronutrients (T_{10}) and Tilt 250 EC alone (T_5), Dithane M-45 in combination with micronutrients (T_9). The highest fruit area diseased (25.19%) was observed in case of control (T_1) preceded by application of micronutrients alone (T_2), Cupravit 50 WP alone (T_4) and Cupravit 50 WP in combination with micronutrients (T_8).

Table 5. Efficacy of fungicides and micronutrients in controlling *Phomopsis vexans* causing leaf blight and fruit rot of eggplant at fruit ripening stage in the field condition

Treatments	% Leaf Infection (LI)	% Leaf Area Diseased (LAD)	% Fruit Infection (FI)	% Fruit Area Diseased (FAD)
T_1	90.31a	29.69a	68.89a	25.19a
T_2	52.51b	14.93b	43.51b	18.43b
T_3	17.82e	5.02e	16.82e	6.01e
T_4	52.06b	13.40b	42.31b	17.19b
T_5	28.69d	8.05d	23.39d	8.89d
T_6	37.55c	10.24c	32.13c	13.77c
T_7	15.03e	4.38e	15.57e	5.09e
T_8	48.21b	13.12b	38.63b	16.48b
T_9	35.67c	9.19cd	29.66c	11.79c
T_{10}	25.04d	7.55d	20.22de	8.05d
LSD (0.05)	4.350	1.904	4.962	2.022

Figures with common letters do not differ at p=0.05

In field condition, Bavistin 50 WP (0.1%) in combination with micronutrients and Bavistin 50 WP (0.1%) showed promising performance in leaf infection, fruit infection, leaf area diseased and fruit area diseased applied as post inoculation spray at pre-flowering, post flowering, fruiting and fruit ripening stages. Reduction of leaf area diseased caused by Bavistin 50 WP (0.1%) in combination with micronutrients were 58.17, 67.37, 78.41 and 85.25%, respectively at pre-flowering, post-flowering, fruiting and fruit ripening stages while Bavistin 50 WP (0.1%) alone reduced by 52.22, 58.67, 74.19 and 83.09% LAD, respectively at those stages. Similarly reduction of fruit area diseased caused by Bavistin 50 WP (0.1%) in combination with micronutrients were 57.93 and 79.79%, respectively at fruiting and fruit ripening stages while Bavistin 50 WP (0.1%) alone reduced by 56.93 and 76.14% FAD, respectively at those stages. Bavistin 50 WP (0.1%) in combination with micronutrients control Phomopsis blight and fruit rot of eggplant somewhat more than Bavistin 50 WP (0.1%) alone but both are statistically similar.

Conclusion

Effect of each fungicide applied in combination with micronutrients always showed better performance in reducing disease incidence and disease severity than the fungicides applied alone. Bavistin 50 WP (0.1%) alone or in combination with micronutrients (Gypsum, ZnO and Boric acid) could be used for management of Phomopsis blight and fruit rot of eggplant. The enthusiastic researchers can be motivated to experiment on other fertilizers and fungicides for control of phomopsis blight of eggplant.

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