EFFICACY OF SELECTED FUNGICIDES AGAINST BASAL STEM ROT OR WILT OF TOMATO CAUSED BY *Sclerotium rolfsii* Sacc.

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ABSTRACT

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The efficacy of selected fungicides was tested against the basal stem rot or wilt of tomato caused by *Sclerotium rolfsii* Sacc. An in vitro assay of fungicides revealed that mancozeb (Dithane M-45) was the most effective in suppressing the colony growth and sclerotia formation of *S. rolfsii*. Manganese ethylene bisdithiocarbamate (Maneb) also significantly reduced the colony growth of the pathogen but its effectivity was lesser when heated. Captan 'Captan) and thiophanate methyl (Fungitox) reduced growth to a lesser extent while benomyl (Benlate) reduced colony growth only when not subjected to heat.

Results of the field evaluation further proved the effectiveness of Dithane M-45 and Maneb in controlling sclerotium wilt in the field. These fungicides produced the lowest disease incidence and highest percent protection on the plants during the wet season and dry season trials. Fungitox was less effective than Dithane M-45 and Maneb while Benlate was ineffective in controlling sclerotium wilt in the field.

KEYWORDS: Basal stem rot wilt. Efficacy. Fungicides. *Sclerotium rolfsii*. Tomato.

INTRODUCTION

Basal stem rot or wilt of tomato caused by *Sclerotium rolfsii* Sacc. is one of the important diseases attacking tomato in Leyte (Borines and Paningbatan, 1991). The pathogen usually girdles and rots the stem, resulting in wilting of the whole plant. The pathogen also attacks tomato fruits in contact with soil infested by the pathogen; the fruits rot and exude a mass of sclerotia.

Sclerotium wilt caused by *S. rolfsii* is reported as one of the most common and widespread fungal diseases in the country infecting about 52 plant species (Tangonan and Quebral, 1992). Crops like mungbean and rice, and ornamental plants like *Impatiens sultanii* are attacked by this fungus (Opina, 1978; Elazegui and Mew, 1983; Ou, 1985; Dizon and Pimentel, 1993).

Chemical control is usually suggested against *S. rolfsii* attacking other crops. Benomyl for instance was found effective against *S. rolfsii* on rice (Ou, 1985) while captan, chloroneb, bravo, maneb and thiophanate methyl inhibited growth of *S. rolfsii* at 1500 and 2000 ppm (Cabunagan and Soledad, 1977).

In tomato, successful production of high quality fruits is sometimes possible only with fungicide application to control sclerotium wilt. Farmers, however, are non-selective about chemicals for spraying due to lack of knowledge as to the right fungicide to use. Incorrect choice of fungicides often lead to more frequent sprayings to control a particular disease. Over-application in general can result in diverse effects on target and non-target organisms.

Thus, before chemical control measures are attempted, determination of the efficacy of locally available fungicides against sclerotium wilt is needed, hence this study.

MATERIALS AND METHODS

Isolation of the pathogen

Sclerotial bodies of *S. rolfsii* were collected from a tomato field infested by the pathogen. Sclerotia were disinfected by dipping in 0.1% NaOCl for 15 s. They were rinsed in three changes of sterile water and blotted dry with a sterile absorbent paper before they were planted in PDA plates and incubated. When mycelial growth was observed, a portion of the mycelium was aseptically transferred to PDA plants where they were maintained. For the in vitro assay, sclerotia were mass cultured in PDA plates; for the field experiment, they were mass cultured in rice grain-rice hull medium.

In Vitro assay

Five fungicides were evaluated against *S. rolfsii* in vitro. They were benomyl (Benlate), thiophanate methyl (Fungitox), mancozeb (Dithane M-45), manganese ethylene bisdithiocarbamate (Maneb) and captan (Captan). Two sets of assays were done. In the first set, the fungicides were added to the medium before sterilization and were sterilized with the medium. The fungicide-containing media were poured into sterile petri plates and allowed to harden. *S. rolfsii* grown in PDA plates were cut into discs with a sterile 6 mm diameter cork borer. One disc was placed at the center of each plated media containing fungicide. The plates were observed daily. The diameter of mycelial growth in each plate was measured 48 h after incubation. The mean number of days to sclerotia formation and mean number of sclerotia were also counted.

In the second assay, fungicide was added to the sterilized medium aseptically just before the mixture was poured into plates. The same method was followed as in the first assay.

Field evaluation

Preparation of inoculum

S. rolfsii was mass produced in rice grain-rice hull (1:3 v/v) medium placed in glass jars. Each jar was filled to 2/3 volume with rice grain-rice hull medium plus water (¼ of the volume of the medium) and covered with aluminum foil for sterilization in a pressure cooker at 20 psi (1034 mm Hg) for 30 min. The medium in each jar was seeded with an agar block of 2-wk old cultures of *S. rolfsii* and the pathogen was allowed to grow for 2 wks. This medium containing mycelia and sclerotial bodies of *S. rolfsii* served as the inoculum source for soil inoculation or infestation.

Layouting and planting

Tomato seeds (var Marikit) were sown in small plastic bags containing sterile soil and arranged in seedboxes in the greenhouse. Field layout was done a day before transplanting with proper distances between plots and blocks.

Each plot measured 3 m x 4 m, consisting of four rows. There were six treatments comprising the five fungicides and one untreated (control), replicated three times. Mungbean was planted between plots as barrier.

Inoculation and chemical treatment

One tablespoonful (15 mL) of the inoculum in the rice grain-rice hull medium was incorporated into the soil near the roots of each tomato plant. The same five fungicides: Benlate, Fungitox, Dithane M-45, Maneb and Captan at the recommended rate of 0.5, 0.62, 8.13, 3.75 and 12.5 g/L, respectively, were applied to the soil near the root zone of each plant using a knapsack sprayer. Wet season and dry season trials were made.

Data gathered

Initial observation and recording of the degree of infection of the disease was taken before the first fungicide application. Fungicides were applied at 2-wk intervals after inoculation until harvest. The final disease incidence was taken after the last fungicide application. Disease incidence was computed by dividing the number of infected plants over the total number of plants in the two inner rows of each plot. The corrected incidence in each treatment was computed using the formula:

$$\text{corrected incidence} = \frac{\text{final incidence - initial incidence}}{\text{final incidence}} \times 100$$

RESULTS AND DISCUSSION

In vitro assay

In the laboratory evaluation of fungicides against *S. rolfsii*, Dithane M–45 was the most effective in suppressing the colony growth of the pathogen (Table 1 and Figure 1). *S. rolfsii* had the smallest colony diameter (0.8 cm) in the plates treated with both sterilized and unsterilized Dithane M–45 compared to 6.07 cm and 5.78 cm in the untreated plates. Maneb was also effective, producing a colony diameter of 2.6 cm when sterilized and 0.8 cm when not sterilized. Captan and Fungitox plates also produced significantly smaller colonies but their effects were inferior to those of Dithane M-45 and Maneb.

Table 1. Colony diameter, number of sclerotia and number of days from inoculation to sclerotia formation of *S. rolfsii* as affected by five fungicides in vitro[1]

Treatment	Colony Diameter (cm)		No. of sclerotia	Days to sclerotia formation
	Sterilized[2]	Unsterilized[3]		
Mancozeb *(Dithane M-45)*	0.80c	0.80d	0d	—
Manganese ethylene bisdithiocarbamate *(Maneb)*	2.60d	0.80d	0d	—
Captan *(Captan)*	2.05d	1.68c	44.50c	8
Benomyl *(Benlate)*	5.78a	1.72c	73.00c	6
Thiophanate methyl *(Fungitox)*	4.05b	2.78b	218.25b	5
Control	6.07a	5.78a	595.25a	2
CV	8.90	8.90	15.6 9	

[1]Means within a column followed by a common letter are not significantly different at 5% level (DMRT).
[2]Fungicides were sterilized with the medium.
[3]Fungicides were unsterilized and added to PDA medium.

It was noted that the effectiveness of Maneb, Captan and Fungitox was lowered when these fungicides were subjected to heating during sterilization. Dithane M-45 was stable even when heated. Benlate, when not heated, significantly reduced colony growth of the fungus (1.72 cm) but not when heated (5.78 cm).

With respect to the effect of the fungicides on sclerotia formation, Dithane M-45 and Maneb completely suppressed formation. The highest

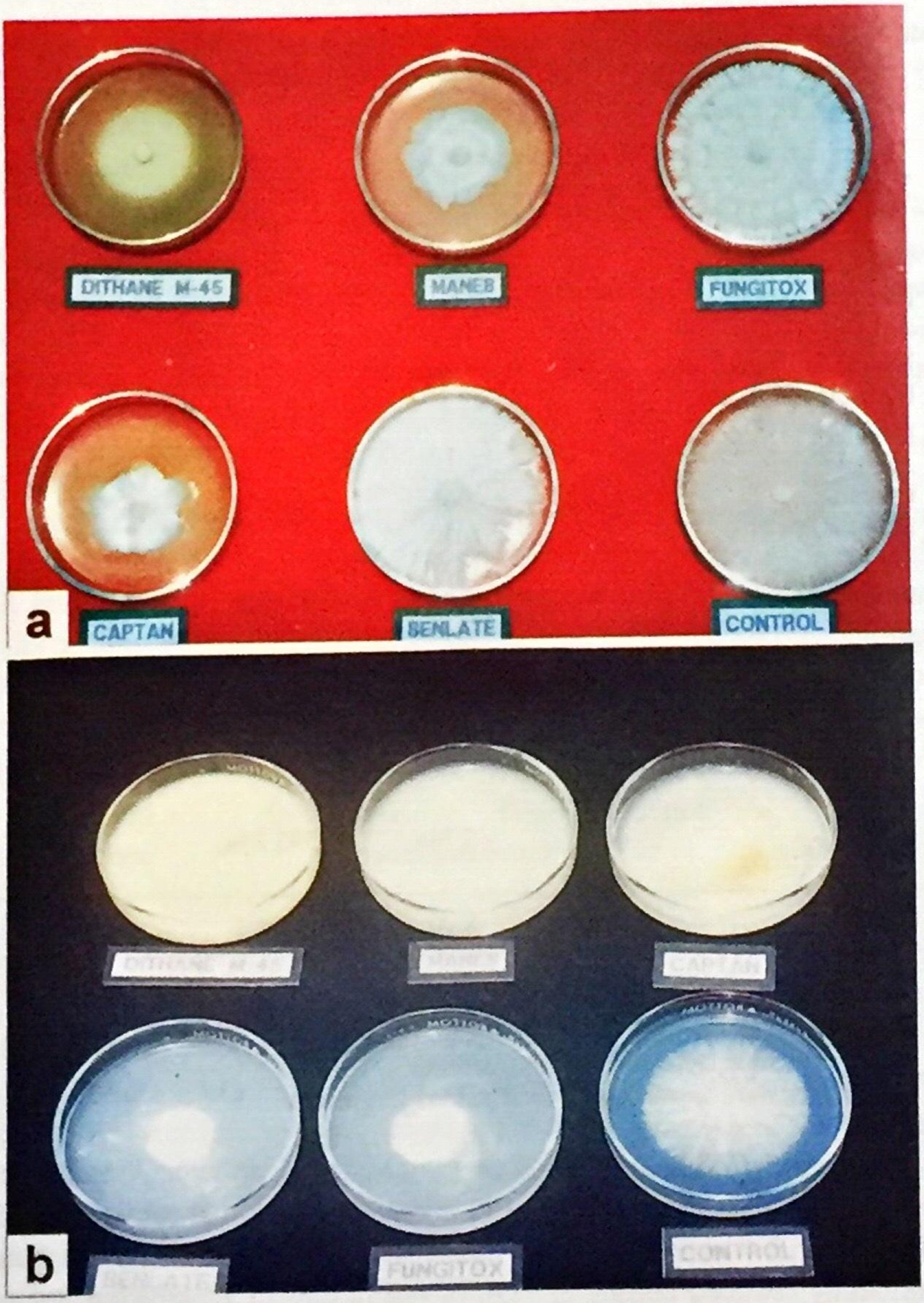

Figure 1. Colony growth of *S. rolfsii* in PDA as affected by five fungicides; a) Fungicides were sterilized with the medium, b) Fungicides were not sterilized.

number of sclerotia formed was in the untreated plates (595.25). Captan, Benlate and Fungitox produced 44.5, 73.0 and 218.25 sclerotia per plate, respectively.

It took only 2 days for the sclerotia to be formed in the untreated plates and longer in the fungicide treated plates (8 days for Captan, 6 days for Benlate, and 5 days for Fungitox).

Field evaluation

Results of the field evaluation of fungicides are shown in Table 2. In the field experiment, three fungicides significantly lowered sclerotium wilt incidence. During the wet season experiment, plants applied with Maneb had the lowest disease incidence (24.2%) followed by those treated with Dithane M-45 (33.3%) and Fungitox (39.3%) compared to 64.2% incidence for the control. Maneb also gave the highest percent protection of 62.3%, followed by Dithane M-45 (48.1%) and Fungitox (38.8%). During the dry season, however, Dithane M-45 was the most effective with an incidence of only 11.1% and percent protection of 82.4% followed by Maneb with an incidence of 23.3% and percent protection of 63.1% and Fungitox with an incidence of 24.2% and percent protection of 61.6%. Benlate and Captan also produced lower disease incidence which, however, did not significantly differ from the control, indicating the ineffectiveness of these two fungicides in controlling sclerotium wilt of tomato in vivo.

With regards to marketable yield, no significant differences were observed among the treatments in both the wet and dry season experiments. During the dry season experiment, however, the yield in the fungicide-treated plots were generally higher than in the untreated plots. The non-significant differences in the yield among the treatments could be due to the occurrence of other diseases during the conduct of the experiment especially the bacterial leaf spot caused by *Xanthomonas campestris* pv. *vesicatoria* (more prevalent during the rainy season) which also infects the fruits but not controlled by the fungicides applied.

Table 2. Corrected sclerotium wilt incidence, percent pr otection and yield of tomato as affected by five fungicides during the wet season and dry season experiments[1].

Treatment	Wet season incidence	% Prot [2]	Marketable yield (kg)	Dry season incidence	% Prot.[2]	Marketable yield (kg)
Mancozeb *(Dithane M-45)*	33.3cd	48.1	1.0	11.1c	82.4	10. 3
Manganese ethylene bisdithiocarbamate *(Maneb)*	24.2d	62.3	2.0	23.3bc	63.1	10 .8
Thiophanate methyl *(Fungitox)*	39.3bcd	38.8	1.5	24.2bc	61.6	9 .7
Benomyl *(Benlate)*	46.7abc	27.3	2.2	37.3ab	40.9	10.4
Captan *(Captan)*	55.6ab	13.4	1.6	46.7ab	26.0	11.2
Control	64.2a	—	1.7	63.1a	—	7.7
CV	5.0	—	38.1	9.6	—	11. 3

[1]Means within a column followed by a common letter are not significantly different at 5% level (DMRT).

[2]Computed based on the formula:
[(control data - treatment data) ÷ control data] × 100

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