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In vitro Evaluation of Fungicides and Bioagents against Root Rot of Chilli Caused by *Sclerotium rolfsii* Sacc.

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ABSTRACT

Root rot caused by Sclerotium rolfsii Sacc. has been observed to cause rapid mortality in chilli plantations. Among nine fungicides and two bio control agents tested in vitro against S. rolfsii the result revealed that the fungicides Carbendazim(0.1 %)+Mancozeb (0.2%), Thiram (0.2 %) and Mancozeb (0.2 %) recorded 100 % growth inhibition and were significantly superior over rest of the fungicidal treatments, it was followed by T. viride (65.55), T. harzianum (64.44%), Captan (55.55), Hexaconazole (38.88%), Bordeaux mixture (33.33%), Benomyl (25.55%), Copper Oxychloride (11.11%) and Carbendazim (3.33%).

Key words: *Chilli, Fungicides, Mancozeb, Carbendazim, Hexaconazole*

INTRODUCTION

Chilli (*Capsicum annum* L.) belongs to the family solanaceae is mainly cultivated for its vegetable green fruits and for the dry chilli as the spice of commerce. It is believed to be originated from South America. It is a rich source of Vitamin C, A and B. Chilli is valued for pungency which is imparted by an alkaloid, Capsaicin and the red pigments (Capsanthin, Capsorubin and Capxanthin). Chilies were brought to Asia by Portuguese navigators during the 16 th Century. Worldwide, some 3.8 million hectares (about 9.4 million acres) of land produce 33 million tons of chili peppers (2010 data). India is the world's biggest producer, consumer and exporter of chili peppers[4]. It contains about 8.8 gram carbohydrate, 5.3 gram sugar, 1.9 gram protein and 534 micro gram beta carotein per 100 gram chilli[14].Chilli crop suffers with many fungal, bacterial and viral diseases resulting in huge yield losses. Among the fungal diseases, in recent years stem rot of chilli caused by *Sclerotium rolfsii* is of major concern causing the economic losses in chilli[11]. In the year 2001 stem rot of chilli caused by *S. rolfsii* was first time reported from Rajasthan near Jaipur chilli growing areas.*S. rolfsii* is a soil-borne pathogen that commonly occurs in the tropics, sub-tropics and other warm temperate regions of the world causing root rot, stem rot, wilt and foot rot on more than 500 plant species including almost all the agricultural and horticultural crops.

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The experiments were therefore carried out to study *in vitro* evaluation of fungicides and bio agents against *S. rolfsii* of chilli.

MATERAL AND METHODS

Isolation of fungus:

The root rot fungus was isolated from the roots of the chillies variety Phule Jyoti by standard isolation method under aseptic conditions. The infected tissues of the roots were cut in to small pieces of 1-2 mm size and surface sterilized with one per cent mercuric chloride solution for one minute and washed repeatedly thrice in sterile distilled water and placed in Petri plates containing sterilized PDA and incubated at 28±2ºC. The purified culture thus obtained and identified as *S. rolfsii* based on the morphological description given by Barnett.

***In vitro* evaluation of fungicides**

Nine fungicides *viz.* Benomyl (0.1%), Bordeaux mixture (1.0%), Captan (0.2%), Carbendazim (0.1%), Copper oxychloride (0.3%), Hexaconazole (0.1%), Mancozeb (0.2%), Thiram (0.2%) and Carbendazim (0.1%) + Mancozeb (0.2%), were tested by applying poisoned food technique (Schmitz, 1930) and using potato dextrose agar (PDA) as basal culture media. Two bioagents *T. harzianum* and *T.viridae* were evaluated *in-vitro* against *Sclerotium rolfsii* applying Dual culture Technique[16] and using potato dextrose agar (PDA) as basal culture media.The requisite quantity of each fungicide was calculated and thoroughly mixed with autoclaved and cooled (40-45°C) PDA in conical flasks separately to obtain desired concentrations. Two bioagents, *T. harzianum* and *T. viridae* were also evaluated *in-vitro* applying Dual culture technique.

Poison food technique

Poisoned food technique was adopted in present assay. Nine fungicides were tested against the test fungus. Potato dextrose agar medium (PDA) was used as basal medium and distributed in 100 ml lots in 250 ml Erlenmeyer conical flasks. The media sterilized in autoclave at 15 lbs pressure for 15 min. As per the treatment the quantity of fungicide was calculated for 100 ml quantity of medium separately, amended just before solidification of the medium, and poured into sterilized Petri plates. The mycelial disc of 5 mm diameter of seven days old culture of *Sclerotium rolfsii* was cut with the help of sterile cork borer. Each disc was transferred aseptically to the centre of each Petri plate. The PDA plates without fungicide were also inoculated and maintained as control and incubated at room temperature (27°C). Three replications per treatment were maintained. The observations on colony growth and sclertia formation were recorded periodically until petri plate of control treatment was fully covered with mycelial growth[15].

Dual culture technique

Bioagents were evaluated for their efficacy by dual culture technique. A 5 mm disc of *Sclerotium rolfsii* was placed at the center of a petriplates containing solidified PDA medium and 5mm disc of 7 days old culture of *Trichoderma harzianum* was placed at opposite from center[16]. Petri plates containing plain PDA without any fungicide, bioagents were inoculated with 5.0 mm disc of the test pathogen and maintained as suitable untreated control. All the treatment (inoculated) and control petri plates where then incubated at 27 °C in BOD incubator till the control plates were fully covered with mycelial growth of the test pathogen. Observations on radial mycelial growth of *Sclerotium rolfsii* were recorded in each treatment and replication and per cent growth inhibition of the test pathogen over control was worked out as follows.

$$\text{Per cent inhibition} = \frac{C - T}{C} \times 100$$

Where,

C=growth of the fungus in untreated control plates

T= growth of the fungus in treated plates

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below:

***In vitro* evaluation of fungicides**

The results presented in Table-1 revealed that the treatment of fungicides, Carbendazim +Mancozeb, Thiram, Mancozeb found totally free from the fungal colony and recorded maximum growth inhibition (100 %) and also found significantly superior over rest of the treatments. Moreover, all the said treatments were found at par. The treatment *Trichoderma viride* and *T. harzianum* which showed the inhibition 65.55% and 64.44% and colony diameter 2.2 cm and 2.3 cm respectively followed by Captan (55.55), Hexaconazole (38.88%), Bordeaux mixture (33.33), Benomyl (25.55), Copperoxy chloride (11.11) and Carbendazim (3.33) with mean colony diameter 4.0 cm, 5.0cm, 4.6 cm, 6.7 cm, and 8 and 8.7 cm, respectively .From the results it was concluded that, the fungicides Carbendazim (0.1%) + Mancozeb (0.2 %), Thiram (0.2 %) and Mancozeb (0.2 %) were most effective for inhibiting the growth of *Sclerotium rolfsii as* compared to other fungicides tested.

Table 1: Effect of fungicides and bioagents on growth of *Sclerotium rolfsii* Sacc. *in vitro*

Tr. No.	Fungicides	Concentration %	Mean colony Diameter (cm)*	Inhibition %
T_1	Benomyl	0.1	6.7	25.55
T_2	Bordeaux mixture	1.0	6.0	33.33
T_3	Captan	0.2	4.0	55.55
T_4	Carbendazim	0.1	8.7	3.33
T_5	Copper Oxychloride	0.3	8.0	11.11
T_6	Hexaconazole	0.1	5.5	38.88
T_7	Mancozeb	0.2	0.0	100.00
T_8	Thiram	0.2	0.0	100.00
T_9	Carbendazim+Mancozeb	0.1+0.2	0.0	100.00
T_{10}	*T. harzianum*	0.5 cm disc	3.2	64.44
T_{11}	*T. viride*	0.5 cm disc	3.1	65.55
T_{12}	Untreated Control	-	9.0	0.00
	S.E. +		0.06	
	C.D. at 5%		0.19	

* Mean of three replications.

Plate 1: Effect of fungicides and bioagents on growth of *Scerotium rolfsii* Sacc. *in vitro*

T_1 Benomyl
T_2 Bordeaux mixture
T_3 Captan
T_4 Carbendazim
T_5 Copper oxychloride
T_6 Hexaconazole
T_7 Mancozeb
T_8 Thiram
T_9 Carbendazim +Mancozeb
T_{10} *Trichoderma harzianum*
T_{11} *Trichoderma viride*
T_{12} control

CONCLUSION

Studies on evaluation of fungicides against pathogen showed that all the fungicides under study inhibited the growth of the test fungus to varying extent at different concentrations. Among nine different fungicides tested, Carbendazim @ (0.1%) +Mancozeb @ (0.2%), Thiram @ (0.2%) and Mancozeb @ (0.2%) recorded maximum growth inhibition 100 % and were followed by, Captan @ (0.2%), Hexaconazole (0.1 %), Bordeaux mixture (1%), Benomyl (0.1 %), Copper Oxychloride (0.1 %) and Carbendazim (0.1 %) which were recorded 55.55 38.88, 33.33, 25.55, 11.11, 3.33 percent growth inhibition.

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