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EFFICACY OF FUNGICIDES AGAINST SCLEROTIUM ROLFSII OF CHILLI

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ABSTRACT:
Chilli (*Capsicum annuum L.*), is an important solanaceous vegetable-cum-spice crop. Chillies are widely used as a spices, condiments, culinary, supplements, medicines, and vegetables and for flavoring many vegetarian and non-vegetarian food products. Chilli requires hot and humid conditions for growth and development and its cultivation is mainly confined to the tropical regions of the world. Chilli crop is suffered from many fungal, bacterial and viral diseases. Therefore, present in vitro study was conducted to assess Efficacy of Fungicides against Sclerotium rolfsii of Chilli. Infected chilli plants showing typical root rot symptoms were collected from the fields and isolated on PDA. Pathogenicity of the test fungi were proved by sick soil (*S. rolfsii*) method in earthen pots, under screen house conditions. Seven systemic (each @500 and 1000 ppm) were evaluated in vitro against the test fungi S. rolfsii, by applying Poisoned food technique (Nene and Thapliyal, 1993) and using potato dextrose agar (PDA) as basal culture medium. Observations on radial mycelial / growth colony diameter (mm) of the test fungi at an interval of 24 hrs of incubation were recorded and continued up to seven days or till the untreated PDA plates were covered fully with mycelial growth of the test fungi. All the seven systemic fungicides evaluated in vitro (each @ 500 and 1000 ppm), were found fungistatic against S. rolfsii and significantly inhibited its mycelial growth over untreated control. However, highest mycelial growth inhibition recorded with Propiconazole 25% EC, Difenoconazole 25% EC, Tebuconazole 25.9 % EC and Hexaconazole 5% EC (each @ 500 and 1000 ppm) resulted with cent per cent (100 %) mycelial growth inhibition, followed by Azoxystrobin 23% SC (55.00 and 66.11 %) whereas, Thiophanate methyl 70% WP and Carbendazim 50% WP were ineffective, respectively @ 500 and 1000 ppm.

Keywords: - Chilli, phytopthora, *S. rolfsii*, chemical treatment

INTRODUCTION :

Chilli (*Capsicum annuum* L.), is an important solanaceous vegetable-cum-spice crop. Chilli is the native of new world tropics and sub-tropics which was introduced in India from Brazil in 16th century by Portuguese. It is a good source of vitamin A (292 I.U per 100 g), C (111 mg per 100g) and thiamine (0.19 mg per 100 gm). Pungency, one of the important quality attributes of Capsicum species is due to presence of alkaloid 'Capsaicin' in the fruit and also contain capsanthin and oleoresin. Chillies are widely used as a spices, condiments, culinary, supplements, medicines, and vegetables and for flavoring many vegetarian and non-vegetarian food products. Chilli requires hot and humid conditions for growth and development and its cultivation is mainly confined to the tropical regions of the world. Asian countries produces about 65.5 % of the world green chillies and pepper and stands at the top, European countries ranks second with production of 12.1 % chilli and African countries ranks third with production of 9.5 % of the total world chilli production.

Chilli crop is suffered from many fungal, bacterial and viral diseases and its major diseases are: damping off (*Pythium* spp, *Phyptopthora spp.*) anthracnose or fruit rot or dieback (*Colletotrichum capsici*), wilt (*Fusarium oxysporum* f.sp. *capsici),* bacterial leaf spot (*Xanthomonas campestris* p.v. *vesicatoria)*, fungal leaf spots (*Alternaria alternata, Cercospora capsici*), powdery mildew (*Leveillula tourica*), root rot (*Sclerotium rolfsii*) and leaf curl mosaic (virus). During recent years the root rot complex disease has been attaining serious proportion, causing severe yield losses in chilli crop. The pathogens commonly associated with chilli root rot complex *viz.*, *S. rolfsii, Fusarium* spp, *Phytopthora* spp. and *Rhizoctonia.* Were reported to cause yield losses to the tunes of 60.80 %, 34-65 %, 50 to 60% and 35 to 50%.

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(Kalmesh and Gurjar, 2001; Madhavi *et al.*, 2006; Muthukumar *et al.*, 2010).

MATERIAL AND METHODS

Isolation, Identification and Pathogenicity

Those fungi associated with fungal root rot complex of chilli were isolated by applying tissue isolation technique (Tuite, 1969). Naturally infected chilli plants showing typical root rot symptoms were collected from the fields, thoroughly washed the root system with distilled water, blot dried and cut with sharp sterilized blade into small bits (5 mm). Plant root / stem pieces were taken from the lower hypocotyl and upper tap root were then surface sterilized with 1 per cent aqueous solution of Sodium hypochlorite (NaOCl) for two minutes. Subsequently, these root bits were washed thoroughly by giving three sequential changes with sterile distilled water to remove traces of Sodium hypochlorite if any, blot dried and aseptically transferred on to autoclaved and cooled Potato dextrose agar PDA medium in sterile glass Petri plates (90 mm), under Laminar air-flow cabinet and incubated in BOD incubator at 27 ± 2 ^{0}C temperature. These inoculated PDA plates were observed at regular interval for growth of the pathogenic fungi. After a weak of incubation, typical fungal growths developed on PDA plates were transferred into fresh PDA plates and incubated further. By applying hyphal tip isolation technique (Tutte, 1969), purified, and sub-cultured the cultures and their pure cultures on Agar slant tubes were maintained in refrigerator, for further studies.

Pathogenicity of the test fungi were proved by sick soil (*S. rolfsii*) method in earthen pots, under screen house conditions. Earthen pots (30 cm dia.) disinfected with 5 per cent Copper sulphate solution were filled with autoclaved potting mixture of soil: sand: FYM (2:1:1) and inoculated (@ 50 g / kg soil) separately with mass multiplied (sand: maize) culture of the test fungi *viz., S. rolfsii* mixed thoroughly, watered adequately and incubated in screen house for two weeks. Earthen pots filled with sterilized potting mixture without cultures of the test fungi were maintained as uninoculated control. Surface sterilized (1% Sodium hypochlorite) healthy seeds of chilli. Parbhani Local seeds were sown (@ 20 seeds / pot) in these pots, kept in screen house and watered regularly. Observations on seed germination, pre-emergence seed rot and post-emergence seedling mortality were recorded, respectively at 7 and 30 days after sowing.

In Vitro Evaluation of fungicides:

Seven systemic (each @500 and 1000 ppm) were evaluated *in vitro* against the test fungi *S. rolfsii*, by applying Poisoned food technique (Nene and Thapliyal, 1993) and using potato dextrose agar (PDA) as basal culture medium. Requisite quantity of the test fungicides (treatments) were calculated, dispensed separately and mixed thoroughly with autoclaved and cooled (40^{0}C) PDA medium in glass conical flasks (250 ml capacity) to obtain their desired concentrations. This PDA medium separately amended with the test fungicides was aseptically poured (20 ml/plate) in sterile glass Petri plates (90 mm dia.) and be allowed to solidify at room temperature. For each of the test fungicide and its test concentration, three plates per treatment per replication were maintained. After solidification of PDA medium, these plates were inoculated aseptically by placing in the center a 5 mm culture disc obtained from actively growing 7 days old pure culture of test fungi. The PDA plates (without fungicide) inoculated separately with pure culture disc of the test fungus per treatment per replication were maintained as untreated control. Both treated and untreated PDA plates were incubated in an inverted position at 27±2 ^{0}C in BOD incubator, for a week.

Experimental details

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Design : Completely Randomized Design (CRD)

Replications : Three

Treatments : Nine

Treatment details : **Systemic fungicides (each @ 500 and 1000 ppm)**

Tr. No.	Treatments	Tr. No.	Treatments
T_1	Thiophanate methyl 70% WP	T_5	Difenoconazole 25% EC
T_2	Propiconazole 25% EC	T_6	Tebuconazole 25.9 % EC
T_3	Azoxystrobin 23% SC	T_7	Hexaconazole 5% EC
T_4	Carbendazim 50% WP	T_8	Control (untreated)

Observations on radial mycelial / growth colony diameter (mm) of the test fungi at an interval of 24 hrs of incubation were recorded and continued up to seven days or till the untreated PDA plates were covered fully with mycelial growth of the test fungi. Based on cumulative data, per cent mycelial growth inhibition of the test fungi with the test fungicides, over untreated control was calculated by applying the following formula (Vincent, 1927).

$$\text{Per cent Inhibition (I)} = \frac{C - T}{C} \times 100$$

Where,

C= Growth (mm) of the test fungus in untreated control plates.

T= Growth (mm) of the test fungus in treated plates.

RESULT AND DISCUSSION :

All of the seven systemic fungicides evaluated *in vitro* (each @ 500 and 1000 ppm) greatly affected the mycelial growth and corresponding mycelial growth inhibition in *S. rolfsii*, over untreated control.

Effect on mycelial growth

The results (Plate 1, Table1) revealed that the test systemic fungicides exhibited a wide range of *S. rolfsii* mycelial growth, which was found to be decreased steadily with increase in concentrations of systemic fungicides. Azoxystrobin 23% SC showed *S. rolfsii* significantly least mycelial growth of 40.50 and 30.50 mm, respectively @ 500 ppm and 1000 ppm. However, Propiconazole 25% EC, Difenoconazole 25% EC, Tebuconazole 25.9 % EC and Hexaconazole 5% EC (each @ 500 and 1000 ppm) showed none of the mycelial growth of the test pathogen. This was followed by Azoxystrobin 23% SC (40.50 and 30.50 mm), Carbendazim 50% WP (90.00 and 90.00 mm) and Thiophanate methyl 70% WP (90.00 and 90.00 mm) respectively each @ 500 and 1000 ppm, as against maximum mycelial growth (90.00 mm) in untreated control

Average radial mycelial growth recorded with test systemic fungicides, ranged from 0.00 mm to 90.00 mm. However, it was least with Azoxystrobin 23% SC (35.50 mm), followed by Thiophanate methyl 70% WP (90.00 mm) and Carbendazim 50% WP (90.00 mm).

Effect on mycelial growth inhibition

The results (Plate 1, Table 1) revealed that all the systemic fungicides tested (each @ 500 and 1000 ppm) significantly inhibited mycelial growth of *S. rolfsii,* over untreated control and it was directly proportional to concentrations of the test fungicides.

Among systemic fungicides tested, Propiconazole 25% EC, Difenoconazole 25% EC, Tebuconazole 25.9 % EC and Hexaconazole 5% EC (each @ 500 and 1000 ppm) resulted with cent per cent (100 %) mycelial growth inhibition. These were followed by Azoxystrobin 23% SC (55.00 and 66.11 %) whereas, Thiophanate methyl 70% WP and Carbendazim 50% WP showed nil inhibition, respectively @ 500 and 1000 ppm.

Average mycelial growth inhibition recorded with the test systemic fungicides ranged from 0.00 to 90.00 per cent. However, it was numerically highest and cent per cent with Propiconazole 25% EC, Difenoconazole 25% EC, Tebuconazole

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25.9 % EC and Hexaconazole 5% EC (100 %), followed by Azoxystrobin 23% SC (60.55 %) whereas, Thiophanate methyl 70% WP and Carbendazim 50% WP showed none inhibition. These results are in conformity with the findings of several earlier workers. Systemic fungicides *viz.*, Propiconazole 25% EC, Difenoconazole 25% EC, Tebuconazole 25.9 % EC, Hexaconazole 5% EC and Azoxystrobin 23% SC. were reported as potential antifungal compounds with significant maximum mycelial growth inhibition of *S. rolfsii*, causing root rot in chilli and other solanaceous vegetables (Madhavi and Bhattiprolu, 2011; Manu *et al.* 2012; Sekhar *et al.* 2020; Sahana *et al.* 2020;)

CONCLUSIONS :

All the seven systemic fungicides evaluated *in vitro* (each @ 500 and 1000 ppm), were found fungistatic against *S. rolfsii* and significantly inhibited its mycelial growth over untreated control. However, highest mycelial growth inhibition recorded with Propiconazole 25% EC, Difenoconazole 25% EC, Tebuconazole 25.9 % EC and Hexaconazole 5% EC (each @ 500 and 1000 ppm) resulted with cent per cent (100 %) mycelial growth inhibition, followed by Azoxystrobin 23% SC (55.00 and 66.11 %) whereas, Thiophanate methyl 70% WP and Carbendazim 50% WP were ineffective, respectively @ 500 and 1000 ppm.

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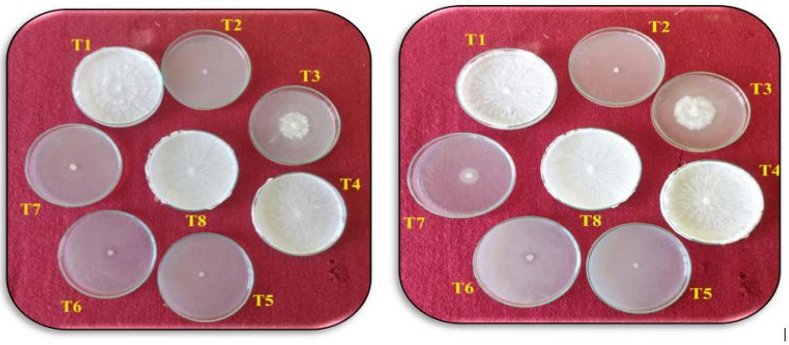
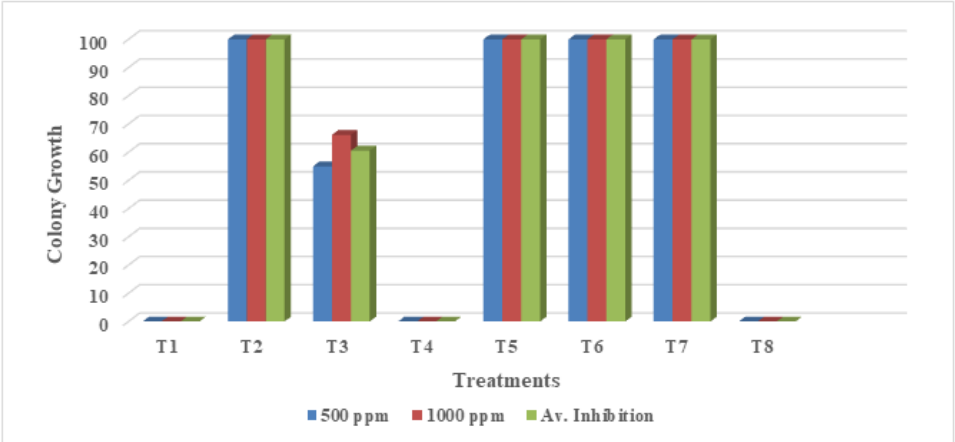
Table 1. *In vitro* efficacy of systemic fungicides against *S. rolfsii*

Tr. No.	Treatments	Colony Dia.*(mm) At ppm		Av. (mm)	% Inhibition* At ppm		Av. Inhibition (%)
		500	1000		500	1000	
T_1	Thiophanate methyl 70% WP	90.00	90.00	90.00	0.00 **(0.00)**	0.00 **(0.00)**	0.00 **(0.00) ****
T_2	Propiconazole 25% EC	0.00	0.00	0.00	100.0 **(90.00)**	100.0 **(90.00)**	100.0 **(90.00)**
T_3	Azoxystrobin 23% SC	40.50	30.50	35.50	55.00 **(47.86)**	66.11 **(54.39)**	60.55 **(51.14)**
T_4	Carbendazim 50% WP	90.00	90.00	90.00	0.00 **(0.00)**	0.00 **(0.00)**	0.00 **(0.00)**
T_5	Difenoconazole 25% EC	0.00	0.00	0.00	100 **(90.00)**	100 **(90.00)**	100 **(90.00)**
T_6	Tebuconazole 25.9 % EC	0.00	0.00	0.00	100 **(90.00)**	100 **(90.00)**	100 **(90.00)**
T_7	Hexaconazole 5% EC	0.00	0.00	0.00	100 **(90.00)**	100 **(90.00)**	100 **(90.00)**
T_8	Control (untreated)	90.00	90.00	90.00	0.00 **(0.00)**	0.00 **(0.00)**	0.00 **(0.00)**
	SE± (M)	**0.27**	**0.36**	-	**0.30**	**0.40**	-
	C.D (P=0.01)	**0.83**	**1.11**	-	**0.92**	**1.23**	-

*Mean of three replications. **Figures in parentheses are arcsine transformed values. Dia.: Diameter, Av.: Average



@ 500 ppm **@ 1000 ppm**



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