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In vitro evaluation of fungicides and botanicals against stem rot of chilli caused by *Sclerotium rolfsii*

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ABSTRACT

Stem rot caused by *Sclerotium rolfsii* Sacc. has been observed to cause rapid mortality in chilli plantations. Among eight fungicides and eight botanicals tested *in vitro* against *S. rolfsii*, the result revealed that maximum (100%) inhibition was observed in carboxin, propiconazole, hexaconazole, difenconazole and carbendazim at all three concentrations *viz.*, 500, 1000 and 1500 ppm followed by captan (79.30, 82.76 and 85.23%) and triadimenfon (49.13, 60.23 and 65.33%) over control. Minimum per cent of inhibition was observed in the plates poisoned with copper oxychloride (47.26, 51.63 and 54.40%), respectively at all three concentrations. Among botanicals, at 5 and 10 per cent concentrations, significantly highest average inhibition was recorded with neem (74.81%), followed by tulsi (67.10%) and nirgudi (65.81%). Significantly least average inhibition was recorded with sorghum (47.23 %). The rest of the botanicals recorded more than 50.00 per cent average inhibition of mycelial growth over untreated control (00.00%).

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INTRODUCTION

Chilli (*Capsicum annuum* L.) belonging to the family Solanaceae is an important spice-cum-vegetable crop of the world. It is mainly cultivated for its vegetable green fruits and for the dry chilli as the spice of commerce. It is a rich source of vitamin C, A and B.

In India chilli is grown in almost all the states throughout the length and breadth of country. Andhra Pradesh is the largest producer of chilli occupying 27 per cent chilli hectarage, followed by Karnataka (19%) and Maharashtra (12%). The World's hottest chilli "Naga Jalokia" is cultivated in the hilly terrain of Assam in a small town, Tezpur in India (Chandra Nayak *et al.*, 2009). In India it is an important cash crop, which is grown for the both domestic and export markets. 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 (Kalmesh and Gurjar, 2001). 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* Sacc., 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 (Farr *et al.,* 1989). Experiments were therefore carried out to study *in vitro* evaluation of fungicides against *S. rolfsii* of chilli.

MATERIAL AND METHODS

Isolation of fungus :

The stem rot fungus was isolated from the roots of the chillies variety Parbhani Tejas 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 (1960).

***In vitro* evaluation of fungicides :**

Eight fungicides *i.e.*, Carboxin, Propiconazole, Hexaconazole, Difenconazole, Triadimenfon, Captan, Copper oxychloride and Carbendazim, were tested *in vitro* by using poisoned food technique and PDA as the basal medium. Three concentrations of 500, 1000 and 1500 ppm were used for testing the efficacy of different fungicides against *S. rolfsii*, the causal organism of chilli stem rot.

Poisoned food technique :

Three concentrations of fungicide was added to the molted PDA just before pouring in to the plate. 20 ml of medium with desired concentration of fungicide was poured in each sterilized Petri plate. Suitable checks were kept for comparison. 05 mm mycelial disc of *S. rolfsii* was taken from the periphery of one week old culture and was placed at the centre of the separate plates and incubated at 28±2ºC. Growth of the fungus was measured by taking the diameter in two directions and the average was recorded. Final growth reading was recorded when the growth of the fungus in control plate was full. Per cent inhibition of growth was calculated by using the formula given by Vincent (1927) :

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

where,

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

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

***In vitro* evaluation of plant extracts :**

Plant leaf extract of eight botanicals *viz.*, Parthenium, Neem, Tulsi, Bougainvilea, Beshram, Ruchki, Sorghum and Nirgudi, were tested *in vitro* by using poisoned food technique and PDA as basal medium. 5 and 10 per cent concentrations were used for testing the efficacy of different botanicals against *S. rolfsii*, the causal organism of chilli stem rot. All the treatments were replicated thrice and suitable control was maintained.

Two concentrations of botanicals were added to the molted PDA just before pouring in to the plate. Rest of the procedure was the same as adopted in case of evaluation of fungicides *in vitro*.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under the following heads :

Table 1 : Efficacy of fungicides on inhibition of radial growth of *S. rolfsii*

Fungicides	Radial mycelial growth (mm)* at ppm			Av. radial mycelial growth (mm)	Per cent Inhibition at ppm			Av. per cent inhibition
	500	1000	1500		500	1000	1500	
Carboxin	00.00	00.00	00.00	00.00	100 (89.98)**	100 (89.98)	100 (89.98)	100
Propiconazole	00.00	00.00	00.00	00.00	100 (89.98)	100 (89.98)	100 (89.98)	100
Hexaconazole	00.00	00.00	00.00	00.00	100 (89.98)	100 (89.98)	100 (89.98)	100
Difenconazole	00.00	00.00	00.00	00.00	100 (89.98)	100 (89.98)	100 (89.98)	100
Triadimenfon	45.83	35.83	31.66	37.77	49.13 (44.44)	60.23 (50.85)	65.33 (53.92)	58.23
Captan	18.66	15.50	13.33	15.83	79.30 (62.90)	82.76 (65.45)	85.23 (67.32)	82.43
Copper oxy chloride	47.50	43.50	41.00	44.00	47.26 (43.37)	51.63 (45.93)	54.40 (47.52)	51.09
Carbendazim	00.00	00.00	00.00	00.00	100 (89.98)	100 (89.98)	100 (89.98)	100
Control	90.00	90.00	90.00	90.00	00.00 (00.00)	00.00 (00.00)	00.00 (00.00)	00.00
S.E.±	0.79	0.77	0.53	-	0.57	0.51	0.37	-
C.D (P=0.05)	2.36	2.30	1.58	-	1.69	1.53	1.10	-

* Average of three replications, ** Figures in the parentheses are angular transformed values.

Table 2 : Effect of different botanicals on mycelial growth of *S. rolfsii*

Botanicals	Radial mycelial growth (mm)*		Av. radial mycelial growth(mm)	(%) Inhibition		Av. inhibition (%)
	5 (%)	10 (%)		5 (%)	10 (%)	
Parthenium (*Parthenium hysterophorus*)	46.16	39.50	42.83	48.73 (44.20)**	56.10 (48.49)	52.41
Neem (*Azadirachta indica*)	32.16	13.16	22.66	64.20 (53.24)	85.43 (67.47)	74.81
Tulsi (*Occimum sanctum*)	41.33	17.93	29.63	54.10 (47.30)	80.10 (63.54)	67.10
Bougainvilea (*Bougainvilea globra*)	45.33	34.16	39.74	50.00 (44.74)	62.10 (51.94)	56.05
Beshram (*Ipomea carnia*)	43.00	40.50	41.75	52.26 (46.23)	55.00 (47.84)	53.63
Ruchki (*Clerodendron aculeatum*)	48.16	37.83	42.99	46.53 (42.94)	58.80 (49.56)	52.66
Sorghum (*Sorghum bicolor*)	49.83	45.16	47.49	44.60 (41.89)	49.86 (44.86)	47.23
Nirgudi (*Vetex negundo*)	40.73	20.83	30.78	54.83 (47.71)	76.80 (61.19)	65.81
Control	90.00	90.00	90.00	00.00 (00.00)	00.00 (00.00)	00.00
S.E.±	1.26	1.21	-	0.80	0.90	-
C.D. (P=0.05)	3.76	3.59	-	2.40	2.68	-

* Average of three replications, **Figures in the parentheses are angular transformed values

***In vitro* evaluation of fungicides :**

Efficacy of eight fungicides was tested at three concentrations by Poisoned food technique. The results (Table 1) revealed that there was significant difference in per cent inhibition of mycelial growth of *S. rolfsii* with all the tested fungicides. The per cent inhibition of mycelial growth of *S. rolfsii* was found highest (100%) in five fungicides *viz.*, carboxin, propiconazole, hexaconazole, difenconazole and carbendazim was cent per cent effective at all three concentrations *viz.*, 500, 1000 and 1500 ppm followed by captan (79.30, 82.76, and 85.23 %), triadimenfon (49.13, 60.23 and 65.33%), respectively over control. Minimum per cent of inhibition was observed in the plates poisoned with copper oxychloride (47.26, 51.63 and 54.40%), respectively at all three concentrations.

Evaluation of some of the fungicides is useful to know their anti-fungal activity against *S. rolfsii*. Therefore, systemic and non-systemic fungicides were evaluated under laboratory condition. This confirms the findings of earlier researcher worked on different fungicides like hexaconazole, difenconazole and propiconazole (Mundhe, 2005; Tiwari and Singh, 2004; Hegde *et al*., 2010; Gour and Sharma, 2010; Prashantkumar *et al.*, 2011 and Ambekar *et al*., 2013).

***In vitro* evaluation of plant extracts :**

Radial mycelial growth :

Results revealed that all botanicals tested (@ 5 and 10% each) significantly inhibited mycelial growth of *S. rolfsii* over untreated control. The average radial mycelial growth recorded in all treatments was ranged from 22.66 to 47.49 mm. However, significantly least average mycelial growth was recorded with neem (22.66 mm) followed by tulsi (29.63 mm) and nirgudi (30.78 mm). The rest of the botanicals recorded less than 50.00 mm average mycelial growth.

Per cent inhibition :

Results also revealed that, average per cent inhibition of mycelial growth was in the range 47.23 to 74.81 per cent. However, significantly highest average inhibition was recorded with neem (74.81 %), followed by tulsi (67.10 %) and nirgudi (65.81 %). Significantly least average inhibition was recorded with sorghum (47.23 %). The rest of the botanicals recorded more than 50.00 per cent average inhibition of mycelial growth over untreated control (00.00 %).

Botanicals control is very important aspects to minimize the cost of cultivation and also to avoid the health hazards. Some of the botanicals were tested for their efficacy against *S. rolfsii*. This in turn may indicate about the use of such botanicals in plant disease control. Meena *et al*. (2000) reported that *Vetex negundo*, *Azadirachta indica* and *Ipomea carnia* as effective against *S. rolfsii* whereas, Dhusia *et al*. (2002) reported that leaf and seed kernel extracts of *Azadirachta indica* (@ 10%) as effective in inhibition of mycelial growth and sclerotial production of *S. rolfsii* followed by *Parthenium hysterophorus*.

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