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Evaluation of fungicides against *Sclerotium rolfsii* Sacc. Incitant of collar rot of chickpea

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Abstract
The efficacy of fungicides (7 systemic, 4 non-systemic and 6 combo) was tested at different concentrations of 20, 50, 100, 200 and 500 ppm against *S. rolfsii* on PDA by poisoned food technique *in vitro* condition and seed treatment with fungicide under pot experiment. It was concluded that systemic fungicides like, Hexaconazole 5% EC, Propiconazole 25% EC and combo products Tubaconzole 50% + Trifloxystrobin 25% WG, Captan 70% + Hexaconazole 5% WP, Propiconazole 13% + Difenoconazol and Carboxin 37.5% + Thiram 37.5% showed complete inhibition of the pathogen at all the concentrations tested. Whereas, the non-systemic fungicide Mancozeb 75%WP, Thiram 75% WS and Propineb 70% WP was found inhibitive only at higher concentrations (100 ppm) against *S. rolfsii* under *in vitro* condition. Similar results was found in case of seed treatment with fungicide under pot experiment.

Keywords: Fungicides, *Sclerotium rolfsii*, collar rot, chickpea

Introduction
Chickpea (*Cicer arietinum* L.) is the world's third most important food legume after drybean and pea. India is the largest producer of chickpea, contributing more than 70 per cent of the total world production. One of the major constraints limiting agriculture production is difficult in managing disease caused by soil borne pathogens. Among the soil borne diseases of chickpea, collar rot is important disease causing seed rot and seeding mortality in the initial stage of crop growth up to 45 days. Collar rot is a fast spreading and destructive disease of chickpea. Collar rot disease caused by *Sclerotium rolfsii* Sacc., is a serious threat to chickpea that may cause 55-95% mortality of the crop at seedling stage under favourable environmental conditions (Gurha and Dubey, 1982) [8]. Diseases caused due to *S. rolfsii* requires warm climates, occurs more frequently at high moistures and high temperatures (Al-Askar *et al.*, 2013) [1]. *S. rolfsii* control has met with very limited success. This may be due to the prolific growth, extensive host range of the pathogen and having the ability to produce large number of sclerotia that may persist in the soil for several years (Sennoi *et al.*, 2013) [14]. There are no substantial levels of host plant resistance for collar rot in chickpea but the disease can be minimized by fungicides and appropriate crop rotation (Kumar *et al*., 1997 and Azhar *et al*., 2006) [11, 3]. The present study was carried out to assess antifungal potential of fungicides against *S. rolfsii in vitro* and *in vivo* management of collar rot of chickpea.

Material and Methods
Isolation of pathogen *Sclerotium rolfsii* from diseased samples
Isolation was made from the fresh diseased plant samples collected from research farm at seedling and vegetative stage of the crop. The roots of diseased plant showing symptoms were washed thoroughly with water, small pieces of infected roots were cut with the help of sterilized blade. These pieces were surface sterilized with 1:1000 mercuric chloride ($HgCl_2$) solution for one minute followed by three washings with sterilized distilled water to remove traces of $HgCl_2$. The pieces were then transferred aseptically to Petri plates containing sterilized PDA and incubated at 25± 2^0C for three to five days and examined at frequent intervals to see the growth of the fungus developing from different pieces. As and when fungal colony appears they were transferred to PDA slant for purification of culture.

In vitro evaluation of fungicides against *S. rolfsii* by poison food technique
The efficacy of seven systemic fungicides (Carbendazim 50% WP, Tricyclozole 75% WP, Hexaconazole 5% EC Propiconazole 25% EC, Azoxystrobin 35% EC,

Benomyl 50% WP and Thiophanate Methyl 70% WP); four non-systemic fungicides (Mancozeb 75% WP, Thiram 75% WS, Copper oxychloride 50WP and Propineb 70% WP) and six combo fungicides (Metalaxyl 8% + Mancozeb 64%, Tubaconzole 50%+Trifloxystrobin 25% WG,Captan 70%+Hexaconazole 5% WP, Propiconazole 13.9% + Difenoconazol 13.9%,Carboxin 37.5% + Thiram 37.5% and Carbendazim 12% + Mancozeb 63% WP) was evaluated *in vitro* at different concentrations of 20, 50, 100,200 and 500 ppm on the growth of *Sclerotium rolfsii* on Potato dextrose agar (PDA) medium using poisoned food technique (Nene and Thapliyal, 1982) [13].

The pathogen *S. rolfsii* was grown on PDA medium for 7 days prior to setting up the experiment. The PDA medium was prepared and melted. The required quantity of fungicide was added to the melted medium to obtain the required concentrations. Twenty ml of poisoned medium was poured in each sterilized petriplates and suitable check was maintained without addition of fungicides. To avoid bacterial contamination, a pinch of streptomycin sulphate was added to the medium at the time of pouring. A five mm mycelial disc was taken from the periphery of 7 days old colony of *S. rolfsii* and placed in the centre of petriplate. The inoculated plates were incubated at 25 + 2 ^{0}C and four replications were maintained for each treatment. Diameter of the colony was measured when maximum growth of the *S. rolfsii* was reached in any of the treatments and the observations were recorded and percent inhibition was calculated by using the formula of Vincent (1947).

$$I = \frac{C- T}{C} \times 100$$

Where,
I = per cent inhibition
C = growth in control
T = growth in treatment

***In vivo* efficacy of fungicides under glass house condition**

Pot experiments (CRD) was carried out under glass house conditions. The plastic pots (15 cm diameter) filled with sterilized sandy loam soil, were further inoculated with two-week old culture of *S. rofsii* (prepared on wheat grain medium) @ 25g/kg soil and allowed to stabilize for five days. Seeds of chickpea were surface sterilized with 2 per cent sodium hypochlorite for three minutes, rinsed thoroughly in sterilized distilled water and dried aseptically. The seeds were coated with fungicide as par recommended dose. Ten seeds per pot were sown in 15 cm diameter plastic pots, each containing 2 kg of soil. Three replication of each treatment were maintained. Pots without fungicide seed treatment (untreated) were served as control. Collar rot incidence was recorded up to 45 days after sowing. Germination was recorded after ten days after sowing. The per cent mortality was observed after 15 days of sowing. Then plants were uprooted for measurement of root length and shoot length. Percent mortality was calculated by using the following formula:

$$\text{Per cent mortality} = \frac{\text{Number of plants affected}}{\text{Total number of plants observed}} \times 100$$

Results

The data presented in Table 1 revealed that among the seven systemic fungicides tested, Hexaconazole 5% EC and Propiconazole 25% EC were found highly effective at all concentrations with 100 per cent inhibited mycelial growth of *S. rolfsii.* Azoxystrobin 35% EC also inhibited the mycelial growth 60.83 per cent at 20 ppm, 78.46 per cent at 50 ppm and 100 per cent at 100, 200 and 500 ppm while, Tricyclozole 75% WP inhibited mycelial growth 68.88 per cent at 50 ppm, 70.27 per cent at 100 ppm and 100 per cent at 200 and 500 ppm. The other fungicides namely Carbendazim 50% WP (66.24 per cent) and Benomyl 50% WP (72.21 per cent) were found to inhibited mycelial growth at 500 ppm. Thiophanate Methyl 70% WP was found to be least effective in inhibiting mycelial growth of pathogen (37.49 per cent) at 500 ppm concentration. These results were supported by several previous workers namely Chowdhury *et al.* (1998) [5]; Virupaksha Prabhu and Hiremath (2003) [17] and Arunasri *et al*. (2011) [2]; who reported that the Triazoles (Hexaconazole, Propiconazole, Difenconazole) were highly effective to inhibit the growth of *S. rolfsii*. Whereas, Johnson and Subramanyam (2000) [9] found carbendazim least effective against *S. rolfsii*. Manu *et al.* (2012) [12] reported that Hexaconazole, Tebuconazole & Propiconazole were found to be having strong inhibitory effect on the growth of *S. rolfsii* isolated from finger millet at lower concentration. Das *et al.* (2014) [6] reported that Hexaconazole & Tebuconazole were highly effective at all the concentrations against *S. rolfsii* followed by Propiconazole and Mycobutnil. Least inhibition was observed in Thiophanate methyl and Bavistin.

The data presented in Table 2 revealed that among the four non-systemic fungicides Thiram75%WS was highly effective at higher concentration as it inhibited the *S. rolfsii* by 55.55 per cent at 20 ppm, 86.80 per cent at 50 ppm and 100 per cent at 100, 200 and 500 ppm concentrations. Mancozeb75%WP also inhibited the mycelial growth of pathogen (100 per cent) at 100, 200 and 500 ppm, while Propineb70%WP inhibited (75.41 per cent) at 100 ppm and 100 per cent at 200 as well as 500 ppm concentrations. Copper oxychloride 50 WP was found to be least effective in inhibiting the growth of *S. rolfsii* as it inhibited only 5.83 per cent at 500 ppm concentration.These results were in accordance with the results of Sujatha (1991) [15] and Johnson and Subramanyam (2000) [9]. Das *et al.* (2014) [6] reported that Mancozeb75%WP and Captan showed higher inhibitory effect as compared to Copper oxychloride. Dutta and Das (2002) [7] studied the efficacy of Thiram and Mancozeb at 0.1 per cent concentration against tomato isolate of *S. rolfsii in vitro* and reported that Thiram inhibited 70.3 per cent mycelial growth and 96.5 per cent sclerotial production of *S. rolfsii*. Khan and Javaid (2015) [10] reported that Mancozeb fungicide significantly declined the *S. rolfsii* growth at various concentrations by 99-100% over control.

The data presented in Table 3 revealed that out of the six combo fungicides, four *viz.*, Tubaconzole 50% + Trifloxystrobin 25% WG, Captan 70%+ Hexaconazole 5% WP, Propiconazole 13% + Difenoconazol and Carboxin 37.5% + Thiram 37.5%were found to be highly effective at all the concentrations with 100 per cent inhibition in mycelial growth of *S. rolfsii.* Metalaxyl 8% + Mancozeb 64% also inhibited the mycelial growth of pathogen 48.88 percent at 20 ppm, 53.86 per cent at 50 ppm and 100 per cent at 100, 200, 500 ppm concentrations. Carbendazim 12% + Mancozeb 63% was found to be least effective in lower concentrations but at

higher concentration (500 ppm), showed 100 per cent inhibition of mycelial growth of *S. rolfsii.* These results are in agreement with the findings of Virupaksha Prabhu and Hiremath (2003) [17] and Arunasri *et al.* (2011) [2] who reported that the combo products containing triazoles *viz.*, Avatar, Merger and Nativo were highly inhibitive to the growth of *S. rolfsii*. Vyas and Joshi (1977) [18], Sujatha (1991) [15] and Manu *et al.* (2012) [12] reported that Carboxin was highly effective against *S. rolfsii.* Das *et al.* (2014) [6] also reported that Carboxin 37.5% + Thiram 37.5% is found to be highly inhibitory on the growth of *S. rolfsii.*

***In vivo* efficacy of fungicides as seed treatment against collar rot of chickpea under glass house condition**

All the treatments were significantly superior in decreasing the incidence of collar rot in chickpea over control. Seed treatment with Hexaconazole 5% EC (T3), Propiconazole 25% EC (T4) and Azoxystrobin 35% EC (T5) exhibited zero mortality and 100 per cent decrease in disease incidence over control. Whereas, the seed treatment with Benomyl 50% WP (mortality 20.37 per cent) and Thiophanate Methyl 70% WP (mortality 36.94 per cent) showed 75.20 and 55.03 per cent decrease in disease incidence, respectively over control. Maximum mortality was observed in treatment with Carbendazim 50% WP(T1) that is 69.84 per cent followed by Tricyclazole 75% WP (57.97 per cent) as compared to control (82.14 per cent). The influence of seed treatment with systemic fungicides, the highest germination per cent was observed in Propiconazole 25% EC (T4) and Azoxystrobin 35% EC (T5) that is 100 per cent followed by Benomyl (T6) (96.66 per cent). Seed treatment with Hexaconazole 5% EC (T3) was found best in increasing vigour index (3330) followed by Benomyl (3286.78) and Propiconazole 25% EC (3220).(Table 4 and Table 5)

Seed treatment with non-systemic fungicide Propineb 70% WP (T4) exhibited significant minimum mortality 10.37 per cent (87.99 per cent decreased over control) followed by seed treatment with Mancozeb 75%WP(mortality 16.66 per cent) and Thiram 75%WS (mortaliy 20 per cent) with 79.71 and 75.65 per cent mortality, respectively over control. Whereas maximum mortality was observed in seed treatment with Copper oxychloride (T3) that is 73.21 per cent as compared to control (82.14 per cent). The influence of seed treatment with fungicides highest germination per cent was observed in Propineb 70%WP (T4) and Mancozeb 75%WP (T1) that is 96.66 per cent. The seed treatment with Propineb 70%WP (T4) found best in increasing vigour index (3712.1) followed by Mancozeb 75%WP (3586.53).(Table 6 and Table 7).

Seed treatment combo fungicides with Tubaconzole 50%+Trifloxystrobin 25% WG (T2), Captan 70%+ Hexaconazole 5% WP (T3), Propiconazole 13% + Difenoconazol (T4) and Carboxin 37.5% + Thiram 37.5% (T5) exhibited zero mortality that is 100 per cent decrease over control. Whereas, the seed treatment with Metalaxyl 8% +Mancozeb 64% (T1) (mortality 29.81 per cent) and Carbendazim 12% + Mancozeb 63% WP (T6) (mortality 38.42 per cent) showed 63.71 and 53.21 per cent decrease, respectively over control. The influence of seed treatment with combo fungicides, the highest germination per cent was observed in seed treatment with Tubaconzole 50% + Trifloxystrobin 25% WG (T2), Captan 70%+ Hexaconazole 5% WP (T3), and Carboxin 37.5% + Thiram 37.5% (T5)that is 100 per cent followed by Propiconazole 13% + Difenoconazol (T4) (96.66 per cent). Seed treatment with Carboxin 37.5% + Thiram 37.5% (T5) and Tubaconzole 50%+Trifloxystrobin 25% WG (T2) found best in increasing vigour index that is 3710 and 3700 respectively.(Table 8 and Table 9)

Charde *et al.* (2002) [4] reported that seed treatment with Propiconazole and Hexaconazole were superior in checking stem rot of groundnut caused by *S. rolfsii* and increasing the shoot and root length. Seedling root dip in Mancozeb (0.1%) and Thiram (0.1%) effectively reduced the collar rot of tomato caused by *S. rolfsii* (Dutta and Das, 2002) [7]. Seed treatment of soybean with Hexaconazole and Propiconazole inhibited *S. rolfsii*. These fungicides were found to be absorbed by roots and translocated to shoot and leaf length. (Tajane *et al.*, 2002) [16].

Table 1: Effect of systemic fungicides on per cent inhibition of radial growth of *S. rolfsii* at different concentrations (ppm).

Fungicide/ Treatments	Per cent inhibition of mycelial growth of *S. rolfsii* *					Mean
	20	50	100	200	500	
T1:Carbendazim 50%WP	0.00 (2.97)	0.00 (2.97)	9.72 (17.25)	16.24 (23.73)	66.24 (54.48)	18.44
T2:Tricyclazole 75%WP	11.11 (19.46)	68.88 (56.08)	70.27 (56.95)	100.00 (86.93)	100.00 (86.93)	70.00
T3:Hexaconazole 5%EC	100.00 (86.93)	100.00 (86.93)	100.00 (86.93)	100.00 (86.93)	100.00 (86.93)	100.00
T4:Propiconazole 25%EC	100.00 (86.93)	100.00 (86.93)	100.00 (86.93)	100.0 (86.93)	100.0 (86.93)	100.00
T5: Azoxystrobin 35% EC	60.83 (51.27)	78.46 (62.37)	100.00 (86.93)	100.00 (86.93)	100.00 (86.93)	87.85
T6: Benomyl 50% WP	5.82 (13.95)	7.08 (15.34)	27.91 (31.79)	33.33 (35.24)	72.21 (58.45)	29.27
T7:Thiophanate methyl 70%WP	3.88 (10.59)	8.05 (16.34)	17.77 (24.74)	28.05 (31.96)	37.49 (37.73)	19.05
T8: Control	0.00	0.00	0.00	0.00	0.00	
Mean	40.23	51.74	60.69	68.23	82.28	
		Fungicide	Concentration	F × C		
SEm±		0.527	0.445	1.178		
C.D at 5%		1.480	1.251	3.309		
*Average of four replication						
Figures in parentheses are angular transformation						

Table 2: Effect of Non-systemic fungicide on per cent inhibition of radial growth of *S. rolfsii* at different concentrations (ppm).

Fungicide/ Treatments	Per cent inhibition of mycelial growth of *S. rolfsii* *					Mean
	20	50	100	200	500	
T1: Mancozeb 75%WP	33.32 (35.16)	39.85 (39.09)	100.0(86.93)	100.0 (86.93)	100.0 (86.93)	74.63
T2:Thiram 75%WS	55.55 (48.59)	86.80 (73.00)	100.0(86.93)	100.0 (86.93)	100.0 (86.93)	88.47
T3:Copper oxychloride 50 WP	0.00 (2.97)	0.00 (2.97)	0.00 (2.97)	0.00 (2.97)	5.83 (13.95)	1.16
T4:Propineb 70%WP	20.82 (26.80)	34.44 (35.87)	75.41 (60.26)	100.0 (86.93)	100.00 (86.93)	66.13
T5:Control	0.00	0.00	0.00	0.00	0.00	
Mean	27.42	40.27	68.85	75.00	76.45	
		Fungicide	Concentration	F × C		
SEm±		1.104	1.235	2.470		
C.D at 5%		3.132	3.502	7.004		
*Average of four replication						
Figures in parentheses are angular transformation						

Table 3: Effect of combo fungicides on per cent inhibition of radial growth of *S. rolfsii* at different concentrations (ppm).

Fungicide/ Treatments	Per cent inhibition of mycelial growth of *S. rolfsii* *					Mean
	20	50	100	200	500	
T1: Metalaxyl 8%+ Mancozeb 64% WP	48.88 (44.35)	53.86 (47.21)	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	80.55
T2:Tebuconzole 50%+Trifloxystrobin 25% WG	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0
T3:Captan 70% + Hexaconazole 5%	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0
T4:Propiconazole13.9%+Difenoconazole13.9%	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0
T5:Carboxin 37.5%+Thiram 37.5%	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0 (86.93)	100.0
T6:Carbendazim 12% + Mancozeb 63%	15.69 (23.27)	31.10 (33.87)	39.16 (38.72)	52.77 (46.57)	100.0 (86.93)	47.74
T7:Control	0.00	0.00	0.00	0.00	0.00	
Mean	77.42	80.82	89.86	92.12	100.0	
		Fungicide	Concentration	F × C		
SEm±		0.303	0.277	0.678		
C.D at 5%		0.853	0.779	1.908		
*Average of four replication						
Figures in parentheses are angular transformation						

Table 4: Effect of seed treatment with systemic fungicides against collar rot of chickpea.

S. No.	Treatment	Percent mortality*	Per cent decrease over control
1	T1: Carbendazim 50% WP	69.84 (57.18)	14.97
2	T2: Tricyclazole75% WP	57.97 (49.70)	29.41
3	T3: Hexaconazole 5% EC	0.00 (0.906)	100.00
4	T4: Propiconazole 25% EC	0.00 (0.906)	100.00
5	T5: Azoxystrobin 35% EC	0.00 (0.906)	100.00
6	T6: Benomyl50% WP	20.37 (7.091)	75.20
7	T7: Thiophanate methyl 70%WP	36.94 (13.34)	55.03
8	T8: Control (Untreated)	82.14 (65.16)	0.00
	SEm±	4.882	
	C.D at 5%	14.76	
*Average of three replication			
Figures in parentheses are angular transformation			

Table 5: Effect of seed treatment with systemic fungicides on vigour index of chickpea.

S. No.	Treatment	Germination (%)*	Root Length (cm)**	Shoot length (cm)**	Vigour index
1	T1: Carbendazim 50% WP	63.33 (8.0)	16.20	17.66	2144.35
2	T2: Tricyclazole 75% WP	83.33 (9.1)	17.90	17.16	2921.55
3	T3: Hexaconazole 5% EC	100.0 (10.0)	15.00	18.30	3330.0
4	T4: Propiconazole 25% EC	100.0 (10.0)	16.10	16.10	3220.0
5	T5: Azoxystrobin 35% EC	100.0 (10.0)	14.60	15.70	3030.0
6	T6: Benomyl 50%WP	96.66 (9.8)	15.00	19.00	3286.78
7	T7:Thiophanate methyl 70%WP	90.00 (9.5)	16.20	16.40	2934.0
8	T8: Control (Untreated)	73.33 (8.6)	14.00	16.00	2199.9
	SEm±	0.231	0.579	0.497	
	C.D at 5%	0.697	1.679	1.438	
* Average of three replication					
** Average of five replication Figures in parentheses are square root transformation					

Table 6: Effect of seed treatment with non-systemic fungicides against collar rot of chickpea.

S. No.	Treatment	Percent mortality *	Per cent decrease over control
1	T1: Mancozeb 75%WP	16.66 (23.84)	79.71
2	T2: Thiram 75%WS	20.00 (25.62)	75.65
3	T3: Copper oxychloride 50%WP	73.21 (59.21)	10.87
4	T4: Propineb 70%WP	10.37 (18.77)	87.38
5	Control (Untreated)	82.14 (65.16)	0.00
	SEm±	3.797	
	C.D at 5%	12.12	
*Average of three replication			
Figures in parentheses are angular transformation			

Table 7: Effect of seed treatment with non-systemic fungicides on vigour index of chickpea.

S. No.	Treatment	Germination (%)*	Root Length (cm)**	Shoot length (cm)**	Vigour index
1	T1: Mancozeb 75%WP	96.66 (9.8)	17.10	20.40	3586.5
2	T2: Thiram 75%WP	86.66 (9.3)	14.40	18.80	2877.4
3	T3:Copper oxychloride 50%WP	73.33 (8.6)	19.60	19.60	2874.5
4	T4: Propineb 70%WP	96.66 (9.8)	18.20	20.20	3712.1
5	Control (Untreated)	73.33 (8.6)	14.00	16.00	2199.9
	SEm±	0.225	0.651	0.590	
	C.D at 5%	0.719	1.934	1.753	
* Average of three replication					
** Average of five replication					
Figures in parentheses are square root transformation					

Table 8: Effect of seed treatment with combo fungicides against collar rot of chickpea.

S. No.	Treatment	Percent mortality*	Per cent decrease over control
1	T1: Metalaxyl 8%+ Mancozeb 64%	29.81 (32.77)	63.71
2	T2:Tebuconzole 50%+Trifloxystrobin 25%	0.025 (0.906)	100.0
3	T3: Captan 70%+ Hexaconazole 5%	0.025 (0.906)	100.0
4	T4:Propiconazole 13.9% +Difenoconazole 13.9%	0.025 (0.906)	100.0
5	T5: Carboxin 37.5%+Thiram 37.5%	0.025 (0.906)	100.0
6	T6: Carbendazim 12%+ Mancozeb 63%	38.42 (38.26)	53.21
7	T7: Control (Untreated)	82.14 (65.16)	
	SEm±	2.127	
	C.D at 5%	6.513	
*Average of three replication			
Figures in parentheses are angular transformation			

Table 9: Effect of seed treatment with combo fungicides on vigour index of chickpea.

S. No.	Treatment	Germination (%)*	Root Length (cm)**	Shoot length (cm)**	Vigour index
1	T1: Metalaxyl 8%+ Mancozeb 64%	90.0 (9.5)	18.00	22.20	3618.0
2	T2:Tebuconzole 50%+Trifloxystrobin 25%	100.0 (10.0)	18.20	18.80	3700.0
3	T3: Captan 70%+ Hexaconazole 5%	100.0 (10.0)	15.40	18.60	3400.0
4	T4:Propiconazole 13.9%+Difenoconazole 13.9%	96.67 (9.8)	16.20	18.80	3383.5
5	T5: Carboxin 37.5%+Thiram 37.5%	100.0 (10.0)	17.30	19.80	3710.0
6	T6: Carbendazim 12%+ Mancozeb 63%	86.67 (9.3)	16.40	18.40	3016.1
7	T7: Control (Untreated)	73.33 (8.6)	14.00	16.00	2199.9
	SEm±	0.165	0.366	0.619	
	C.D at 5%	0.504	1.067	1.802	
* Average of three replication					
** Average of five replication					

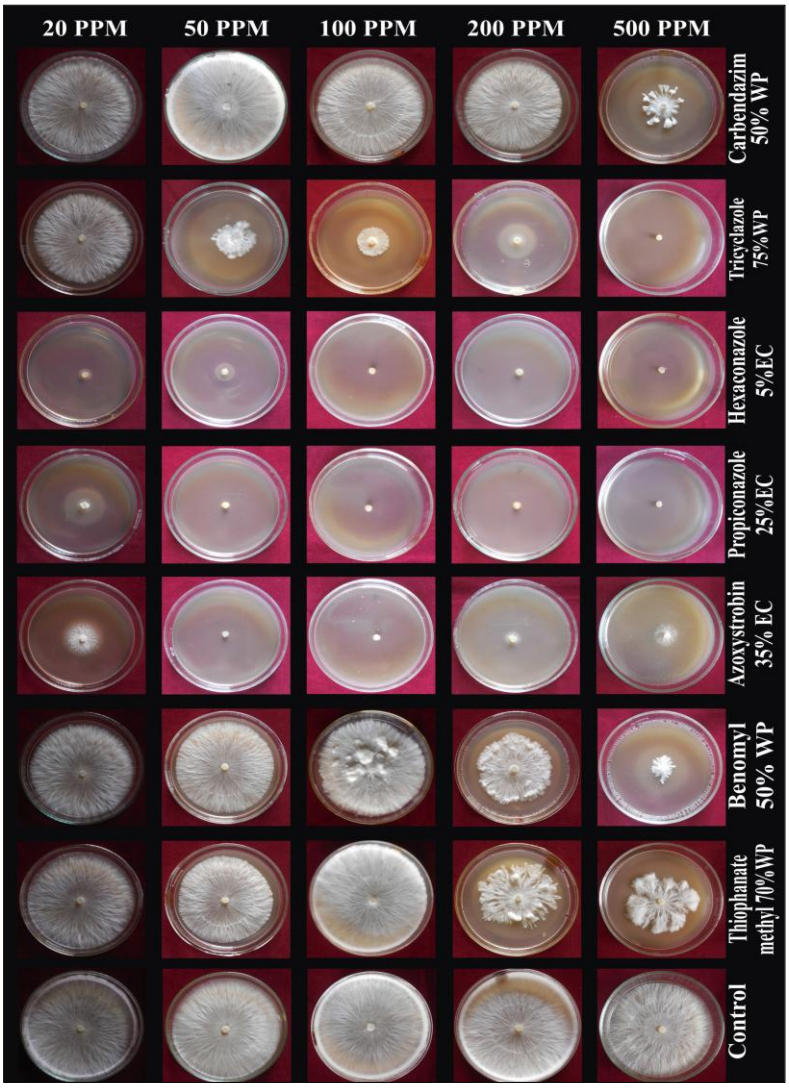

Fig 1: *In vitro* evaluation of systemic fungicides at different concentration against S. rolfsii

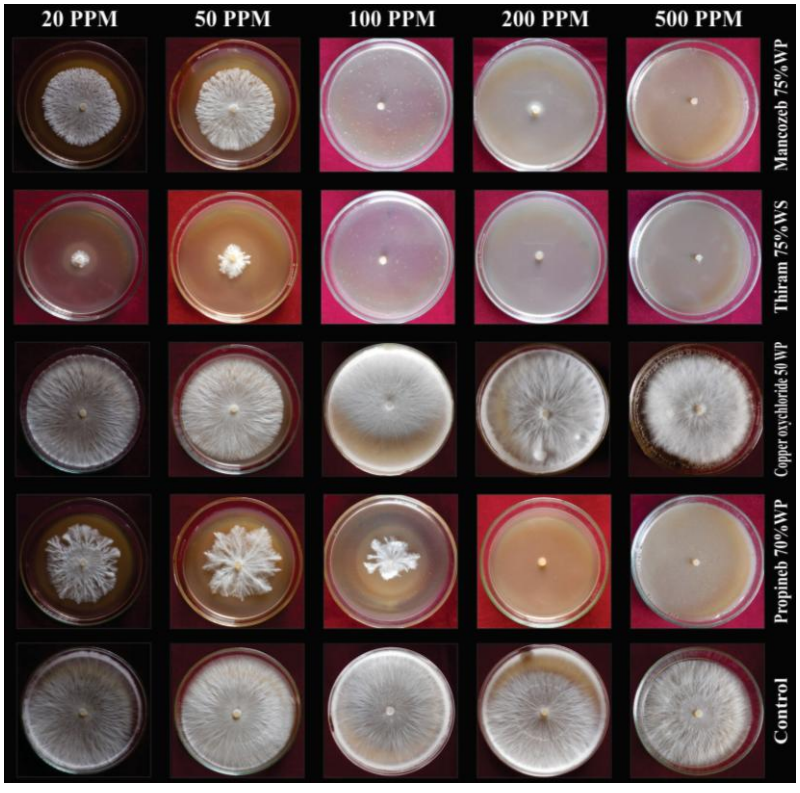

Fig 2: *In vitro* evaluation of non systemic fungicides at different concentration against S. rolfsii

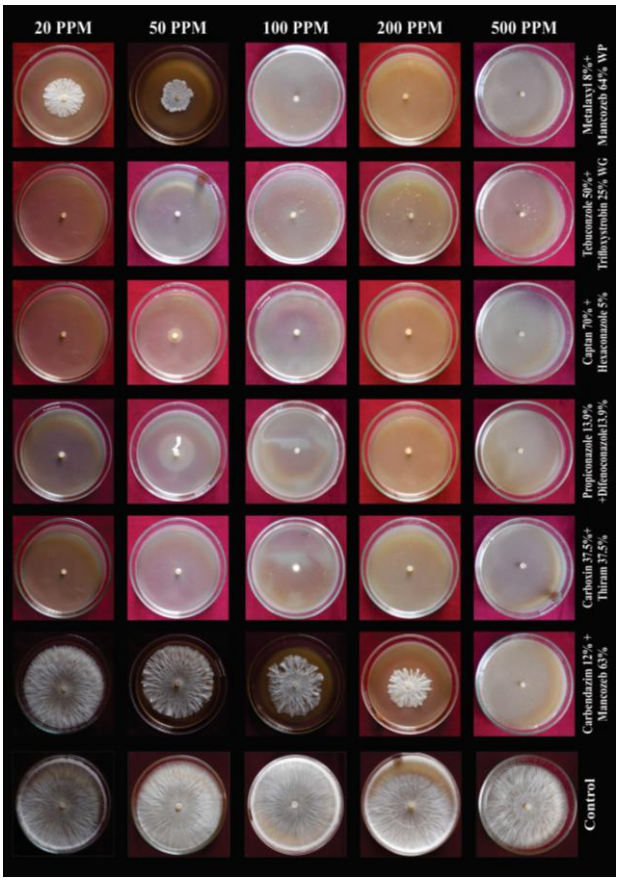

Fig 3: *In vitro* evaluation of combined fungicides at different concentration against S. rolfsii

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