IN VITRO EVALUATION OF FUNGICIDES AGAINST STEM ROT (*Sclerotium rolfsii* Sacc.) CAUSING OF GROUNDNUT

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ABSTRACT

An experiment was conducted to determine the effect of different fungicide on radial colony growth of Sclerotium rolfsii Sacc. The poison food technique in potato dextrose agar medium was used at various concentration in vitro. Seven non-systemic viz., mancozeb 75% WP, copper hydroxide 77% WP, thiram 75% WP, chlorothalonil 75% WP, propineb 70% WP, copper oxychloride 50% WP and captan 75% WP; seven systemic viz., carbendazim 50% WP, thiophenate methyl 70% WP, azoxystrobin 23% SC, pyraclostrobin 20% WG, hexaconazole 5% SC, tebuconazole 25.9% EC and propiconazole 25% EC and six ready mix fungicides viz., carbendazim 12% + mancozeb 63% WP, carboxin 37.5% + thiram 37.5% DS, metalaxyl 8% + mancozeb 64% WP, captan 70% + hexaconazole 5% WP, azoxystrobin 11% + tebuconazole 18.3% SC and zineb 68% WP + hexconazole 4% WP were evaluated against S. rolfsii in laboratory. Results revealed that, maximum growth inhibition of 99.96% was recorded in mancozeb as well as captan, non systemic fungicides at lower concentration of 500 ppm concentration. Similar results were also obtained in systemic fungicides propiconazole (99.96%) and ready mix fungicides, carboxin + thiram (99.96%) at lower concentration of 100 ppm concentration for growth inhibition of S. rolfsii, causal agent of stem rot in groundnut.

KEY WORDS: Groundnut, In vitro, Fungicides, Stem rot, Sclerotium rolfsii

INTRODUCTION

Groundnut is regarded as "King of oilseed crops". In India, it is cultivated in an area of 41.52 million ha with 70.77 lakh tones production and yield of 1704 kg/ha. In Gujarat, it is cultivated in an area 16.25 lakh ha with production of 30.54 lakh tones and productivity of 1879 kg/ha (Anon., 2018). Among the soil-borne fungal diseases of groundnut, stem rot caused by *S. rolfsii* (Doidge and Bottomly, 1931) is throughout groundnut producing areas of the world and causes the severe damage during any stage of the crop growth with yield losses up to 80 per cent in severe conditions (Saraswathi and Ravuri, 2015). The fungus is characterized by white fluffy, branched, septate mycelium and spherical or irregular shaped brown sclerotia, which range from 0.5-2.0 mm in diameter and at maturity, resemble mustard seed. It is necessary to manage the disease by chemicals *in vitro* condition which may provide new information for its management. In future, this information can be utilized for management of disease in the crop.

MATERIALS AND METHODS

An *in vitro* trial was conducted at the P. G. laboratory, Department of Plant Pathology, College of Agriculture, J.A.U., Junagadh. Efficacy of different fungicides against groundnut stem rot pathogen was evaluated by poisoned food technique (Nene and Thapliyal, 1993). Seven non- systemic *viz*., mancozeb 75% WP, copper hydroxide 77% WP, thiram 75% WP, chlorothalonil 75% WP, propineb 70% WP, copper oxychloride 50% WP and captan 75% WP; seven systemic *viz*., carbendazim 50% WP, thiophenate methyl 70% WP, azoxystrobin 23% SC, pyraclostrobin 20% WG, hexaconazole 5% SC, tebuconazole 25.9% EC and propiconazole 25% EC and six ready mix fungicides *viz*., carbendazim 12% + mancozeb 63% WP, carboxin 37.5% + thiram 37.5% DS, metalaxyl 8% + mancozeb 64% WP, captan 70% + hexaconazole 5% WP, azoxystrobin 11% + tebuconazole 18.3% SC and zineb 68% WP + hexconazole 4% WP were evaluated against *S. rolfsii*. Required quantity of fungicide was added in 100 ml of luke warm PDA media and mixed thoroughly. This solution was poured into Petriplates about 20 ml in each. After solidification of media 5 mm discs of four days old culture of test pathogen were inoculated at the centre of Petriplates and then incubated at 28 ± 1° C. The completely randomized design (Factorial concept) with three repetitions was adopted. Medium without fungicide was kept as control. Mycelial 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 completely covered.

Per cent inhibition of mycelial growth of test pathogen was calculated by the following formula (Bella *et al.,* 1982):

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

Where,

I = Per cent reduction in growth of test pathogen

C = Radial growth (mm)^2 in control

T = Radial growth (mm)^2 in treatments

RESULTS AND DISCUSSION

Efficacy of different fungicides was tested at various concentrations using poisoned food technique. The results presented in Table 1 revealed that, 99.96 per cent inhibition of *S. rolfsii* was observed in mancozeb 70% WP. Similar growth inhibition also recorded in captan (99.96 %). They were statistically at par. Non-systemic fungicides *viz.* copper hydroxide 77% WP, thiram 75% WP and propineb 70% were found better in growth inhibition with 87.64, 68.93 and 57.58 per cent inhibition. Copper oxycloride 50% WP (21.39%) noted inferior for growth inhibition. The minimum 3.62 per cent growth inhibition was recorded in chlorothalonil 75% WP. The positive correlation was found between concentration and growth inhibition of pathogen. It was observed that with increasing concentration with all fungicides, growth inhibition of pathogen also increased. Cent per cent growth inhibition was recorded in all concentration of mancozeb 75% WP and captan 75% WP. Within the concentrations, except all concentration of mancozeb 75% WP, captan 75% WP and copper oxycloride and chlorothalonil at 500 and 1000 ppm concentrations were significantly differ from each other in growth inhibition of *S. rolfsii* (Table 1). Similar results were recorded by Rakholiya (2015) for mancozeb *in vitro* against *S. rolfsii*, at all concentrations tested *in vitro*.

The results presented in Table 2 revealed that, 99.96 per cent inhibition of *S. rolfsii* was observed in propiconazole at all concentrations (100, 250, 500 and 1000

ppm) and tebuconazole at 500 and 1000 ppm concentrations. It was remain significantly superior in growth inhibition then rest of fungicides. More than 75 per cent mean growth inhibition was recorded in tebuconazole 25.9% EC, hexaconazole 5% EC, pyraclostrobin 20% WG and azoxystrobin 25% SC. The minimum mean growth inhibition was found in carbendazim 50% WP (16.81%). The positive correlation was found between concentration and growth inhibition of pathogen. It was observed that with increasing concentration of all fungicides, inhibition of growth of pathogen also increased. The maximum mean inhibition (99.96%) of *S. rolfsii* was observed in propiconazole 25% EC. The results are agreement with effectiveness of systemic fungicide on growth inhibition against *S. rolfsii* of propiconazole reported by Waterfield and Sisler (1989) and Bhat and Srivastava (2003). These results are also agreement with work carried out by Das *et al*. (2014), while working with systemic fungicide, haxaconazole, tebuconazole and propiconazole for radial growth inhibition *in vitro* against *S. rolfsii* of brinjal.

The perusal of data presented in Table 3 revealed that, 99.96 per cent inhibition of *S. rolfsii* was observed in carboxin 37.5 DS + thiram 37.5 DS at all concentrations (100, 250, 500 and 1000 ppm). Captan 70% + hexaconazole 5% WP at 250, 500 and 1000 ppm concentrations and azoxystrobin 11% + tebuconazole 18.3% SC at 500 and 1000 ppm concentrations remained at par with carboxin 37.5 DS + thiram 37.5 DS. The maximum mean inhibition of 99.96 per cent was recorded in carboxin 37.5 DS + thiram 37.5 DS closely followed by Captan 70% + hexaconazole 5% WP and azoxystrobin 11% + tebuconazole 18.3% SC with 98.35 and 97.29 per cent growth inhibition. Rest of ready mix fungicides *viz*. metalaxyl 8% + mancozeb 64% WP (23.94%) and carbendazim 12% + mancozeb 63% WP (16.90%) were found inferior in growth inhibition. The minimum growth inhibition of 16.76 per cent was recorded in zineb 68% WP + hexconazole 4% WP. It was also observed that with increasing concentration of all fungicides, inhibition of growth of pathogen also increased. Present results are accordance with the works of Akgul *et al*. (2011) and Mahato *et al*. (2014), they reported carboxin + thiram, the most effective fungicides prevented the mycelial growth of *S. rolfsii*.

CONCLUSION

Among all the fungicides tested *in vitro*, non-systemic fungicides, mancozeb 75% WP as well as captan 75% WP recorded the maximum (99.96%) growth inhibition of *S. rolfsii*. In systemic fungicides, the highest growth inhibition (99.96%) was performed in propiconazole 25% EC. In ready mix fungicides, combination of carboxin + thiram showed 99.96 per cent mycelial inhibition test fungus.

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Table 1: Effect of different non systemic fungicides on growth inhibition of *S. rolfsii in vitro*

Fungicides	Mycelial Growth Inhibition (%)@ Concentration (ppm)				Mean Inhibition (%)
	500	1000	1500	2000	
Mancozeb 75% WP	88.85[a](99.96)*	88.85[a] (99.96)	88.85[a] (99.96)	88.85[a] (99.96)	88.85 (99.96)
Captan 75% WP	88.85[a] (99.96)	88.85[a] (99.96)	88.85[a] (99.96)	88.85[a] (99.96)	88.85 (99.96)
Copper hydroxide 77%WP	58.55[e] (72.78)	71.23[c] (89.63)	75.29[b] (93.52)	76.63[b] (94.63)	70.42 (87.64)
Thiram 75% WP	39.99[h] (41.30)	54.51[f] (66.30)	65.67[d] (82.96)	67.35[d] (85.17)	56.88 (68.93)
Propineb70% WP	25.89[k] (19.07)	31.80[j] (27.78)	71.74[c] (90.19)	75.16[b] (93.27)	51.15 (57.58)
Copper oxychloride 50WP	2.19[n] (0.21)	10.50[m] (3.33)	35.26[i] (33.33)	44.25[g] (48.69)	23.05 (21.39)
Chlorothalonil 75% WP	2.78[n] (0.40)	10.50[m] (3.33)	12.05[m] (4.44)	14.53[l] (6.30)	9.96 (3.62)
	Fungicide (F)		Concentration (C)		F x C
S. Em ±	0.33		0.25		0.65
C.D at 5 %	0.92		0.70		1.85
CV %	2.03				

@ Average of three replication
**** Numerals in parentheses are arcsine re-transformed value***
Figures with the same letter are not significantly different at 5 % level as per DNMRT

Table 2: Effect of different systemic fungicides on growth inhibition of *S. rolfsii in vitro*

Fungicides	Mycelial Growth Inhibition (%)@ Concentration (ppm)				Mean Inhibition (%)
	100	250	500	1000	
Carbendazim 50% WP	2.06[k] (0.19)*	14.83[j] (6.67)	24.51[i] (17.22)	41.06[h] (43.15)	20.62 (16.81)
Thiophenate methyl 70%WP	2.06[k] (0.19)	14.96[j] (6.67)	25.46[i] (18.52)	55.99[g] (68.70)	20.62 (16.81)
Azoxystrobin 23% SC	57.61[fg] (71.30)	59.64[ef] (74.44)	66.37[cd] (83.89)	70.55[b] (88.89)	63.54 (79.63)
Hexaconazole 5% SC	69.56[b] (87.78)	70.54[b] (88.89)	71.22[b] (89.63)	86.38[a] (99.23)	74.43 (91.38)
Pyraclostrobin 20% WG	60.63[e] (75.93)	64.25[d] (81.11)	68.75[bc] (86.85)	70.56[b] (88.89)	66.05 (83.19)
Tebuconazole 25.9% EC	68.90[bc] (87.04)	69.88[b] (88.15)	88.85[a] (99.96)	88.85[a] (99.96)	79.12 (93.78)
Propiconazole 25% EC	88.85[a] (99.96)	88.85[a] (99.96)	88.85[a] (99.96)	88.85[a] (99.96)	88.85 (99.96)
	Fungicide (F)		Concentration (C)		F x C
S. Em ±	0.41		0.31		0.81
C.D at 5 %	1.15		0.87		2.30
CV %	2.36				

@ Average of three replication
**** Numerals in parentheses are arcsine re-transformed value***
Figures with the same letter are not significantly different at 5 % level as per DNMRT

Table 3: Effect of different ready mix fungicides on growth inhibition of *S. rolfsii in vitro*

Fungicides	Mycelial Growth Inhibition (%)@ Concentration (ppm)				Mean Inhibition (%)
	100	250	500	1000	
Carbendazim 12% + Mancozeb 63% WP	2.19^{h} (0.21)*	14.69^{g} (6.48)	25.20^{f} (18.15)	40.85^{e} (42.78)	20.73 (16.90)
Carboxin 37.5% + Thiram 37.5% DS	88.85^{a} (99.96)	88.85^{a} (99.96)	88.85^{a} (99.96)	88.85^{a} (99.96)	88.85 (99.96)
Metalaxyl 8% + Mancozeb 64% WP	2.19^{h} (0.21)	16.38^{g} (7.96)	25.48^{f} (18.52)	56.22^{d} (69.07)	25.07 (23.94)
Captan 70% + Hexaconazole 5% WP	75.31^{c} (93.52)	88.85^{a} (99.96)	88.85^{a} (99.96)	88.85^{a} (99.96)	85.47 (98.35)
Azoxystrobin 11% + Tebuconazole 18.3% SC	72.88^{c} (91.30)	82.91^{b} (97.95)	88.85^{a} (99.96)	88.85^{a} (99.96)	83.37 (97.29)
Zineb 68% WP + Hexconazole 4% WP	3.82^{h} (0.57)	15.56^{g} (7.22)	23.37^{f} (15.74)	41.28^{e} (43.52)	21.01 (16.76)
	Fungicide (F)		**Concentration(C)**		**F x C**
S. Em ±	0.43		0.35		0.85
C.D at 5 %	1.22		0.99		2.43
CV %	2.74				

@ Average of three replication
**** Numerals in parentheses are arcsine re-transformed value***
Figures with the same letter are not significantly different at 5 % level as per DNMRT

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