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In vitro effect of fungicides and essential oils on growth and germination of sclerotia of *Sclerotium rolfsii* Sacc

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Both fungicides and essential oils and one biocontrol agent played an important role in the growth inhibition and germination of *sclerotia* of *Sclerotium (Corticium) rolfsii* Saac *in vitro*. Fungicide mixture like carbendazim (0.01%) + Difenconazole (25% EC) (0.01%) gave the highest result on percent inhibition of sclerotial germination (97.8%) as compared to other fungicides. Among the essential oils, lemongrass oil, citronella oil, neem oil, pamorosa oil were statistically at par in sclerotial germination at a concentration of 0.01 per cent which varied from 89.09 to 94.36 % as compared to others treatments and bioantagonist like *Trich oderma viride*. Growth inhibition was also highest in carbendazim + difenconazole mixture among the fungicides and pamarosa oil among the essential oils.

Key words : *Sclerotium rolfsii*, fungicides, biocontrol agents, essential oils, growth inhibition, sclerotial germination

INTRODUCTION

Sclerotium rolfsii (Sacc), a highly competitive saprophyte with wide host range was reported to considerably reduce yield in different crops by producing disease (Aycoch, 1966, Sengupta and Roy, 1971). In groundnut, it causes collar and stem rot symptoms. It infects foliage and causes leaf spot symptoms resulting considerable damage upto 59.61% and loss of production (Ray, 1994). The small sclerotia are probably dispersed from the soil to the leaf sufrace through the rain splashes (Aycock, 1966). Application of fungicide like pentachloronitrobenzene in soil @ 15-20 kg ha^{1} (Sharma *et al.*, 1990), carboxin or tolclofosmethyl @ 5 kg ha^{-1} in sugarbeet root rot (Das and Raj, 1995) and biocontrol agent like *Trichoderma harzianum* in sugarbeet root rot (Upadhyay and Mukhopadhyay, 1986) and other management practices like use of nitrogenous fertilizers (Maity and Sen, 1985) can reduce this disease. Heavy use of fungicide in soil usually proves uneconomical and causes soil health problem by disturbing soil ecological balance. So the present study was undertaken to find out some effective management of this pathogen by using essential oils (plant product), bio antagonists and some fungicides for their comparison under *in vitro* condition in farms of growth and dermination of resting structure sclerotia.

MATERIALS AND METHODS

S. rolfsii was isolated from infected plants of groundnut (*Arachis hypogea* L.) and maintained on a medium of potato dextrose agar (PDA). Different fungicides, like difenconazole (25% EC), mancozeb, carbendazim in different concentrations (0.01 to 0.03%) and their mixture, the essential oil, like lemon oil (*Cymbopogon martini*), neem oil (*Azadirechta indica*) karanja oil (*Pongamia pinnata*), Jara oil (*Crojophera plicata*) at different concentration (0.01%) and *Trichoderma viride* were evaluated by employing poisoned food technique. Test fungicide (in 25% ethanol) were added to potato-dextrose agar (PDA) medium to obtain the desired concentration. The different essential oils were first disolved in Tween 20 (0.012%) and then

added to PDA medium to obtain the desired concentration. The medium without fungitoxicants or oils served as control. Each treatment was replicated thrice. The fungicides were purchased from the market and the essential oils were collected from Department of Agricultural Chemicals, Bidhan Chandra Krishi Viswavidyalaya and bioantagonist was isolated from the native soil. The treated petriplates were kept in B.O.D incubator at 28 ± 2°C in a complete randomized block design.

The doses of different fungicides used were in terms of active ingredient. Method of inoculation and measurement of redial growth was done following Singh *et al.* (1974).

Large qualities of sclerotia were obtained by culturing the fungus on PDA medium for 20 days at 25 ± 2°C. The sclerotia were separatedby blending followed by floatation in water, washed on muslin cloth to remove hyphal fragements, air dried and stored at 10°C. The sclerotia (500) were mixed with 100 g soil having different concentrations of fungicides, essential oils and bio antagonist (100 g/ kg / soil). After 7 days, sclerotia were recorvered by washing off the soil over a 0.25 mm sieve. Germination of sclerotia was recovered on filter paper impregnated with 1% glucose and 50 ppm dicrysticin. On this medium colonies of *S. rolfsii* appeared. The ANOVA analysis was done to find out the effectiveness of different fungicides, essential oils bioantagonist in reducing the growth and germination of sclerotia *S. rolfsii* under *in vitro* condition.

RESULTS AND DISCUSSION

The result showed that all the fungicides, essential oil and bioantagonist (*Trihoderma viride*) reduced the radial growth of mycelium and sclerotial germination significantly as compared to untreated

Table 1 : Efficacy of fungicides, essential oils and biocontrol agent against *Sclerotium (Corticium) rolfsii*

Treatments	Concentration (Percent)	Radial growth (mm)	Percent inhibition of radial growth over control	Percentage germination of sclerotia	Percent inhibition of sclerotial germination over control
Score (Difenconazole 25% EC)	0.01	10.0	88.89	6.5	92.67
Score (Difenconazole 25% EC)	0.015	8.25	90.83	5.5	93.79
Score (Difenconazole 25% EC)	0.02	8.0	91.11	6.8	92.33
Score (Difenconazole 25% EC)	0.03	5.5	93.89	6.0	93.23
Dithane-M-45 (Mancozeb)	0.015	16.0	82.22	14.67	83.45
Bavistin (Carbendazim)	0.01	70.0	22.22	61.67	30.44
Bavistin (Carbendazim)	0.015	62.0	31.11	66.17	25.37
Bavistin (Carbendazim)	0.02	45.0	50.00	8.5	90.41
Bavistin + Score (Carbendazim + Difenconazole 25% EC)	0.01 + 0.015	5.0	94.44	2.5	97.18
Bavistin + Dithan-M-45 (Carbendazim + Mancozeb)	0.01 + 0.015	28.0	68.89	19.0	78.57
Lemon oil (*Cymbopogon flexuosus*)	0.01	5.0	94.44	5.33	93.98
Citronella oil (*Cymbopogon winterianus*)	0.01	6.5	92.78	9.67	89.09
Karanja oil (*Pongamia pinnata*)	0.01	16.5	81.67	20.0	77.44
Neem oil (*Azardirechta indica*)	0.01	9.0	90.0	5.0	94.36
Pamarosa oil (*Cymbopogon martini*)	0.01	4.5	95.5	5.17	94.16
Jara oil (*Crojophera plicata*)	0.01	56.5	37.22	48.33	45.49
Tyrichodema viride		25.0	72.22	35.0	60.52
Control		90.0	—	88.67	—
SEM (±)		2.12	—	35.0	—
CD (P = 0.05)		4.32		3.98	

control. Highest reduction of radial growth ws obtained in pamorosa oil (95.5%) followed by lemon oil and carbendazim + difenconazole mixture (0.01 + 0.01), difenconazole (0.03%) alone and citronella oil. It was also observed that the difference of radial growth of the above mentioned treatments were statistically non significant. The reduction of radial growth (mm) was statistically at par with citronella oil (0.01%) and difenconazole 0.02%, 0.015% and 0.01%. Bioantagonist *Trichoderma viride* also reduced the radial growth of *S. rolfsii* significantly as compared to untreated control.

Differential concentrations of fungicides, essential oils and bioantagonist also inhibited germination of the sclerotia significantly as compared to untreated control. Lowest germination was also observed in carbendazim + difenconazole mixture (0.01% + 0.01%) followed by neem oil (0.01%), lemon oil (0.01%) and difenconazole (0.025%) alone. The difference in germination of the above treatments were statistically not significant. All the fungicides alone slowed no significant difference among themeselves in sclerotia germination. The different concentration of difenconazole (25% EC) were also showed no significant difference among themeselves in sclerotial germination through reduced the sclerotial germination greatly as compared to the fungicides as well as control. Lowest reduction in germination ws observed in carbendazim treated media at 0.01% and 0.015%. whereas 0.02% concentration showed good result in reducing the sclerotial germination. Spraying of 0.2% carbendazim was effective in reducing the disease incidence caused by *Sclerotium oryzae* significantly (Sharma and Mehrotra, 1985). The percent reduction of colony diameter of *Sclerotium rolfsii* was significantly more with *Trichoderma harzianum* as compared to *Trichoderma viride* (Pushpavti and Rao, 1998).

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