RESEARCH ARTICLE

IN VITRO STUDIES ON EFFICACY OF VARIOUS BOTANICAL AGAINST COLLAR ROT OF TOMATO CAUSED BY *SCLEROTIUM ROLFSII* SACC. IN MANIPUR

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Abstract: *Sclerotium rolfsii* is a soil inhabitant, non-target, polyphagous, and a ubiquitous facultative parasite. Its geographic distribution, profuse mycelial growth, persistent sclerotia and large number of hosts attacked by it indicate that, economic losses are substantial every year due to infection. The present study was carried out to understand about the *in vitro* efficacy of various locally available plant extracts against collar rot pathogen. Three commonly available plant extracts were selected and three concentrations of each was evaluated. Percent inhibition was observed and recorded, it was ranged from 16 to 100% among various extracts under study. Cent percent inhibition had shown by *ocimum* at 5 and 10 % and onion at 10% as the best, whereas *Parthenium* at 2.5% had shown the least inhibition of 16.6%.

Keywords: *Sclerotium rolfsii*, Tomato, *Trichoderma*

INTRODUCTION

Sclerotium rolfsii is a soil inhabitant, polyphagous, non-target, and a ubiquitous facultative parasite it is widely distributed in tropics, subtropics and warmer part of temperate zone of the world. In India, it is wide spread in almost all the states and causing economic losses in many crops, every year. *S. rolfsii* was first reported by Rolfs (1892) later pathogen was named as *S. rolfsii* by Saccardo (1911). In India the root rot caused by pathogen was first time reported by Shaw and Ajrekar (1915) who had isolated the pathogen from rotting of potatoes and identified as *Rhizactonia destruens* Tassi. Later studies convinced Ajrekar that fungus was *S. rolfsii* but not *Rhizactonia destruens.* It has wide host range infecting cultivated crops,It is documented that fungus can infect more than 500 plant species. Among soil borne diseases, collar rot caused by *S. rolfsii* is gaining a serious status. This disease also referred as sclerotium blight, sclerotium wilt southern blight, southern stem rot and white mold. This fungus is distributed throughout the world and is particularly prevalent in warmer climate and significant yield losses can be seen in monoculture or short rotation with other crops which are susceptible to this pathogen. *S. rolfsii* preferentially infects on stem, but it can also infect any parts of the plant including root, leaf, flower, and fruit. On erect plant, yellowing wilting symptoms are usually preceded by light to dark brown lesions at collar region of the plant adjacent to the ground. Drying or shrivelling of the foliage and ultimately death of plants occur after wilting. Sclerotia are at first white later, become brown to black which are produced on mats of mycelium on the plant or soil. It is very difficult to manage the pathogen because of its diverse nature of survival, large number of sclerotia produced and their ability to persist in the soil for several years.Among the crops viz., ground nut, soybean, pepper, tomato, sugar beet and potato suffer maximum losses, whereas sorghum, tobacco, sun hemp, chrysanthemum and other ornamental species suffer minor damage. Garren (1961) has estimated the losses due to *S. rolfsii to* the extent of 10 - 20 million dollars annually in southern USA. The yield loss up to 75-80 percent has been reported in New Mexico (Aycock, 1966). In India, stem rot caused by *S. rolfsii* is a major problem in most of the states accounting for 10-11 per cent yield loss (Prasad *et al*., 2012).

Tomato is an excellent source of lycopene, and numerous studies have confirmed that people who consume increased amounts of tomato products experience marked reduction in cancer risk (Giovaanucci et al. 1995). Because of the health benefits associated with tomato in the diet, it is ranked as the 13th among all fruits and vegetables as a source of vitamin C and 16thin vitamin A. Also, it has been ranked as the single most important fruit or vegetable of western diet in terms of overall source of vitamins and minerals (Jones 1999). Major methods employed to manage S. rolfsii are fungicide applications, soil solarization, and use of antagonistic microbes, deep summer ploughing, regular crop rotation and application of various organic and inorganic residues (Punja 1986). Fungicides such as hexaconazole and tricyclazole have been used (Dinesh *et al.* 2018). Chemicals such as methyl bromide and Chloropicrin as soil fumigants for the control of this pathogen. Moreover, these chemicals are hazardous to environment and therefore difficult to adopt in subsistence agriculture (Okereke and

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Wokocha 2007). The inherent hazardous effect involved conventional, chemical management couple with inclination of farmer towards organic farming and non-chemical, bio-pesticides etc. for plant protection measures are gaining importance.There is therefore the need to search for the use of environmentally friendly and readily available alternatives such as plant extracts for the control of *S. rolfsii*. In view of this, this in vitro evaluation has been carried out by using regular available plant materials like *parthenium spp.*, onion and *ocimum spp*.

MATERIAL AND METHODS

In-vitro evaluation of botanicals for their effect on the growth of fungus was done by the Poison food technique (Nene and Thapliyal, 1973). Required quantity of extract was added into sterilized molten and cooled potato dextrose agar to get the desired concentrations. For extraction of botanicals, the leaves of the botanicals collected were washed in tap water and finally passed through sterile distilled water. Hundred grams of the sample was crushed in pestle and mortar by adding 100 ml of sterile distilled water (1:1 w/v). The extracts were strained through two layers of muslin cloth. Later, these extracts were centrifuged for 15 minutes at 500 revolutions per minute to separate the plant debris and to get clear supernatant of plant extract. The supernatant thus obtained was used as the standard stock extract (100per cent). The stock extract was finally made up to required concentrations, viz., 5.0 and 10 per cent by adding 5.0 and 10 ml of stock extract to 95.0 and 90.0 ml of potato dextrose agar medium respectively. The plant extracts were added to the potato dextrose agar medium at molten state after sterilization. The medium was shaken thoroughly for uniform mixing of test extract. Mycelial discs of 5 mm size of five day old culture of the fungus were cut by using sterile cork borer and one such disc was placed at the centre of each agar plate. Control treatment was maintained without adding any chemical or botanical to the medium. Three replications were maintained for each concentration of the fungicide, insecticide, herbicide and botanicals. Then such plates were incubated in BOD at temperature 25 ± 1°C for six days and radial growth was measured when fungus attained maximum growth in the control plates. The per cent inhibition of mycelial growth over control which was calculated by using the formula given by Vincent (1927) given below:

Percent inhibition = (C-T)/C x100

Where C= linear growth of the fungus in control.
T=linear growth of the fungus in treatment.

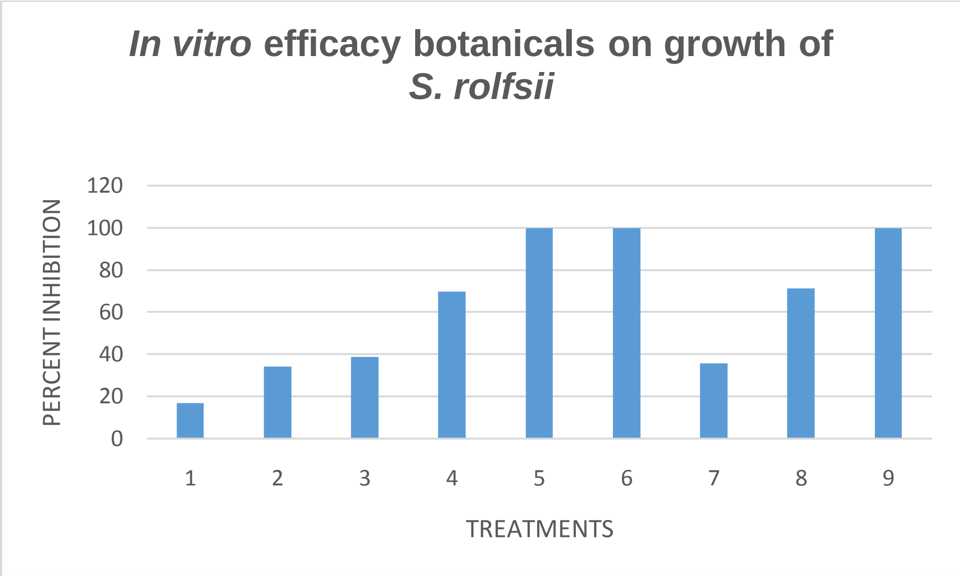
Table 1. *In vitro* efficacy botanicals on growth of *S. rolfsii*

Botanical	Plant part used	Treatment	Concentration (%)	Inhibition (%)
Parthenium sp.	Leaf	T1	2.5	16.66* (4.06)**
		T2	5	34.06 (5.89)
		T3	10	38.75 (6.24)
Ocimum sp.	Leaf	T4	2.5	69.76 (8.36)
		T5	5	100 (10.02)
		T6	10	100 (10.02)
Allium cepa	Bulb	T7	2.5	35.65 (5.99)
		T8	5	71.12 (8.49)
		T9	10	100 (10.02)
SE(d)				0.040
$CD_{(P=0.05)}$				0.084

*Mean of three replications

**Figures in parenthesis are square root transformed values

Graph 1. *In vitro* efficacy botanicals on growth of *S. rolfsii*



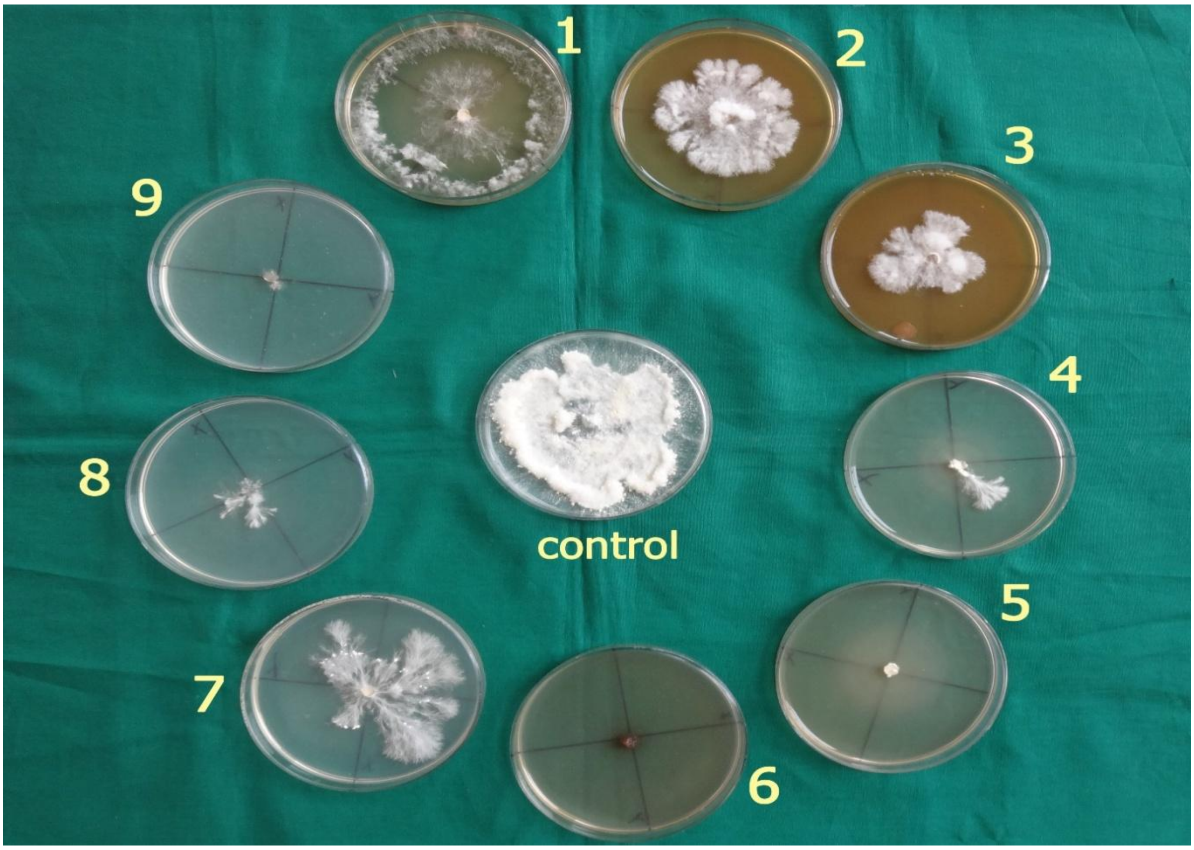


Plate 1. *In vitro* efficacy of botanicals on the growth of *S. rolfsii*.C. Control, 1.*Parthenium* (2.5 %), 2. *Parthenium* (5 %), 3. *Parthenium* (10 %), 4. *Ocimum* (2.5 %), 5. *Ocimum* (5 %), 6. *Ocimum* (10 %), 7. Onion (2.5 %), 8. Onion (5 %), 9. Onion (10 %).

RESULTS AND DISCUSSION

4.5.4 *In vitro* efficacy of botanicals on growth of *S. rolfsii.*

The antifungal effectiveness of these plant extracts depends on the concentration and the solvent of extraction. Effectiveness of aqueous extract of *C. citratus* has been reported by Somda *et al*. (2007) and Suleiman *et al.* (2008) on *Fusarium spp.* So aqueous extraction method was selected for the study, three botanicals were used at concentrations of 2.5, 5 and 10 % each against *S. rolfsii* and percent inhibition was recorded (table 1, plate 1 graph 1). Cent percent inhibition had shown by *ocimum* at 5 and 10 % and onion at 10%. At 2.5% concentration *Parthenium*, onion and *ocimum* had shown 16.6, 35.6

and 69.7 percent inhibition respectively. *Parthenium* at 5 and 10 % had shown 34.06 and 38.75 percent inhibition respectively. Onion at 5% had shown 71.12% inhibition. The aqueous plant extracts under *in vitro* revealed that higher doses were relatively more efficient than the lower doses. The present findings are in agreement with the findings of Darvin 2013 and islam and Faruq, 2012 who reported inhibitory effects of *Ocimum* and Onion on growth of *S. rolfsii* respectively. Anti-fungal activity of *Ocimum* may be due to the metabolites present in their leaf (saponins, tannins, volatile oil alkaloids, glycosides, and ascorbic acid), leaf wax (n-alkenes), essential oils (the general composition will be camphor, caryophyllene, eugenol, caryophyllene methyl chavicol pinene etc.). The results obtained In this study are in accordance with those of Derbalah *et al*. (2011) who reported the antifungal activity of crude extracts of seven plant species (*Cassia senna, Caesalpinia gilliesii, Thespesia populnea var. acutiloba, Chrysanthemum frutescens, Euonymus japonicus, Bauhinia purpurea and Cassia fistula*) against *A. solani*, the causal organism of early blight of tomato, at 150 and 200 ppm. Plant extracts are effective antimicrobial agents against soil-borne fungi and do not produce any residual effects, cost effective, non-hazardous to environment, easily available and do not disturb the ecological balance (Babu *et al*. 2008).

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