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Evaluation of biocontrol agents, fungicides and organic amendments against *sclerotium* wilt (*Sclerotium rolfsii* Sacc) of jasmine (*Jasminum sambac* (L.) Aiton)

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Abstract
Sclerotium wilt of Jasmine is an important fungal disease known to cause serious yield loss in Tamil Nadu. Twelve isolates of *S. rolfsii* collected from various areas of Coimbatore and Erode districts were studied for the cultural, morphological and biochemical variability. The colony characteristics, mycelial and sclerotial characters and oxalic acid production were investigated in all the twelve isolates. Significant variations were observed in the mycelial type, number of sclerotia and production of oxalic acid. The virulence of the isolates were positively correlated with oxalic acid production. Twelve bacterial and fungal isolates were screened *in vitro* for their antagonism against *S. rolfsii*. Among the various isolates tested, *Bacillus subtilis* (EPCo8) and *Trichoderma viride1* inhibited the mycelial *growth of S. rolfsii* to an extent of 42.22 per cent and 73.33 per cent respectively. *In vitro* screening of various fungicides and organic amendments indicated that 100 per cent inhibition of the pathogen with Trifloxystrobin+Tebuconazole 0.15% and Mahua oilcake extract showed 83.07 per cent inhibition.

Keywords: *Sclerotium rolfsii,* mycelial and sclerotial characters, biocontrol agents, organic amendments

Introduction
Jasmine (*Jasminum sambac* (L.) Aiton) pertaining to the family (Oleaceae) is cultivated throughout India and Asia. Intensive cultivation of Jasmine is amenable for both biotic and abiotic stress. Among the biotic constraints the wilt disease incited by the *Sclerotium rolfsii* is the most devastating one which inflict severe yield loss. *Sclerotium rolfsii* Sacc. a common soil borne fungus is known to be pathogenic on nearly 500 plant species. Although, extreme variations in morphological characteristics have been noticed in world wide collections of the pathogen (Koech *et al*., 1994 and Kumar *et al*. 1995) not much is known about the variations in the jasmine isolates collected from different location of Tamil Nadu. Keeping the above facts in view, investigations were undertaken with an objective to evaluate the efficacy of various fungicides, biocontrol agents and oil cakes against *Sclerotium rolfsii* causing Sclerotium wilt of Jasmine.

Materials and methods
Survey and Collection of *S. rolfsii* isolates
A field surveys were undertaken in different Jasmine growing districts of Coimbatore and Erode districts of Tamil Nadu during 2015-16 to collect the samples of Jasmine wilt. The collections were made from 12 locations in two districts of Tamil Nadu (Table1). The infected roots portions of diseased plants collected from different areas were cut into small pieces of 1 to1.5 cm separately using sterilized scalped knife and these were surface sterilized with 0.1 per cent mercuric chloride for one min and then washed in sterile distilled water thrice and then placed in a Petri plate at equidistance onto potato dextrose agar (PDA) medium. The plates were incubated at room temperature (27 ± 2^0 C) for five days and observed for the growth of the fungus. The pathogen was purified by single hyphal tip method and maintained in PDA slants at 4ºC throughout the study. The pathogen was identified as *Sclerotium rolfsii* based on the mycelial and sclerotial characters (Barnett and Hunter, 1972).

Cultural and Morphological Variability
Different isolates of *S. rolfsii* isolated from Coimbatore and Erode districts of Tamil Nadu were studied for their cultural, morphological characters, growth rate and sclerotia formation etc using solid and liquid media. All isolates of *S. rolfsii* were grown on PDA and CDA medium in Petri plates. The mycelial disc of 5 mm diameter of each isolate was inoculated at the centre of plate and replicated thrice.

The inoculated plates were incubated at 27±2^0 C for 15 days. Radial growth of each colony in two directions at right angles was measured. Visual observations on sclerotial formation were recorded. A total of 8 morphological characters based on mycelial (mycelial growth, colony colour, mycelial weight and characters) and sclerotial parameters (sclerotial colour, weight and shape, number of sclerotia and their arrangement on surface of media) were recorded at 7 and 15 days of incubation, respectively for each isolate.

Quantification and Estimation of Oxalic acid Production

All the twelve isolates were tested for oxalic acid production in culture filtrates. For this purpose, each isolate was grown separately in Potato Dextrose Agar broth. Fifty ml of Potato Dextrose Agar broth was poured into 250 ml flasks and sterilized at 121° C for 20 min. Each flask was inoculated individually with 5mm mycelial mat of seven day old culture grown on PDA plates and incubated at 27±1° C for 10 days. The mycelial mat was removed by filtering the broth through pre-weighted Whatman No.1 filter paper and the aliquot was centrifuged at 5000 rpm for 10 min to remove the mycelial fragments. Then, 10 ml cell free culture filtrate, 8 ml of calcium chloride acetate buffer (pH 4.5) was added and mixed thoroughly. The mixture was allowed to stand overnight and then centrifuged at 5000 rpm for 10 min. Supernatant was discarded and the residue was washed with 10 ml of 50 per cent acetic acid saturated with calcium oxalate and centrifuged. The residue was dissolved in
10ml of 4N H_2SO4. The solution was transferred to 100 ml flask and heated at 80°C on water bath. While hot, it was titrated with 0.02 N potassium permanganate until a faint pink colour persisted. The amount of oxalic acid present in the culture filtrate was calculated as 1 ml of 0.02N potassium permanganate reacted with 1.265mg of oxalic acid (Mahadevan and Sridhar, 1986). Three replications were maintained for each isolate.

***In vitro* screening of *Pseudomonas* and *Bacillus* isolates**

Pseudomonas fluorescens (Pf1 &PfUl(A)) and *Bacillus subtilis* (Bs 1,3,5,18, EPCo6, EPCo8, EPC5, EPCo26, EPCo96, Bs (OP)2) received from the Department of Plant Pathology, TNAU, Coimbatore were screened in the study. The bacterial cultures were streaked in a one cm away from the edge of the plate on each PDA medium. A nine mm mycelial disc of *S. rolfsii* was placed to the most distal point of the Petriplate perpendicular to the bacterial streak (Vidhyasekaran *et al.,* 1997). The plates were incubated at room temperature for four days and mycelial growth of the pathogen and inhibition zone were measured.

***In vitro* screening of *Trichoderma* isolates**

Trichoderma viride isolates (Tv1, Tv6, Tv18, Tv5, Tv2, Tv22 Tv27(s), Tvcot2, TvT9, Tv NGk4 and Tv27(T)) received from the Department of Plant Pathology, TNAU, Coimbatore were tested for the inhibitory action against *S. rolfsii*. Seven day old culture of these fungal bioagents and pathogen were employed were inoculated on one side of the Petri plate (each containing 20 ml PDA) and the pathogen was then inoculated opposite to antagonists. The radial growth of the test antagonistic and the pathogen was measured and the per cent growth inhibition was calculated (Latha *et al*., 2009) [9].

Effect of oilcakes on mycelial growth of *S. rolfsii*

The efficacy of following oilcakes *viz*., Neem (*Azadirachta indica* L.) cake, Sesamum (*Sesamum indicum* L.) cake, Groundnut (*Arachis hypogea* L.) cake, Mahua (*Madhuca indica* L.) cake, Jatropha (*Jatropha curcas* L.) and Castor (*Ricinus communis* L.) at 10 per cent concentration was tested on the mycelial growth of *S. rolfsii* by poisoned food technique (Latha *et al*., 2013) [9]. The PDA medium containing 10 per cent concentration of oilcake extract was poured individually in sterile Petridish at the rate of 20 ml, rotated clockwise and anticlockwise and allowed to solidify. Nine mm of mycelial disc of *S. rolfsii* was kept in the centre and incubated at room temperature (28±2º C). Control plates were maintained without oilcakes. Three replications were maintained. The difference in colony diameter between poisoned medium and control was used to calculate the per cent inhibition (Latha *et al*., 2013) [9].

Results and discussion

A field survey was conducted during December 2015 to March 2016 in jasmine growing areas. The results revealed that the Jasmine *Sclerotium* wilt disease incidence ranged from 5.27 to 17.00 per cent. The disease was maximum in Sathyamangalam (Pavuthampalayam) (17.00 per cent) followed by Dhandapalayam (15.65 per cent) and Sultanpet (14.66 per cent). The minimum incidence of 5.27 per cent was observed in Coimbatore (Sithanaickenpalayam) district (Table 1).

Table 1: Survey for the occurrence of *Sclerotium* wilt disease in Jasmine

S. No.	Location	Per cent disease incidence (%)
	Coimbatore district	
1	Thimmampalayam	10.66
2	Pungampalayam	5.43
3	Maruthur	12.61
4	Sultanpet	14.66
5	Sithanaickenpalayam	5.27
6	Akkanaickenpalayam	11.65
	Erode district	
7	Kankkarasampalayam	12.65
8	Kodappalayam	6.28
9	Thottampalayam	8.60
10	Dhandampalayam	15.65
11	Sathyamangalam	17.00
12	Erode	13.32

Cultural and morphological variation

The isolated pathogen was identified as *Sclerotium rolfsii* Sacc. based on mycological characters, the fungal mycelium was first silky white in color later turned to pure white with radial spreading given fan like appearance. Similar, reports were given by Mirza and Aslam (1993) [13] and Mohan *et al*. (2000) [14]. Different morphological and cultural characters of 12 isolates of *S.rolfsii* were studied based on mycelial and sclerotial characters. From the results, it was evident that, the isolates showed significant differences with reference to growth rate and growth pattern on culture media. The two isolates Sr-7 and Sr-8 were very fast growing, isolated from Dhandapalayam and Sathyamangalam areas of Erode district which covered entire Petriplate (9.0cm) within 96 hrs of incubation. The isolates Sr-1, Sr-9, Sr-10 and Sr-12 (Thin mycelial strands, sparsely, Cottony, fluffy mycelial and very, very thin mycelial sparsely strands -8.0cm) were considered to be fast growing isolated from Thimmampalyam, Erode and Sultanpet of Coimbatore and Erode districts. While, the isolates Sr-3, Sr-4, Sr-5 and Sr-6 were considered to be

moderately growing (Cottony Sparsely mycelial, Sparsely, thin mycelial strands, Cottony, fluffy mycelial dense at margins and Sparsely, thin mycelial strands - 4.8-5.4cm), isolated from Maruthur, Kankkarasampalayam, Kodappapalayam and Thottampalayam of Coimbatore district. On the other hand, the isolate Sr-2 and Sr-11 (Cottony, thin mycelial strands and Very very thin mycelial strands, sparsely-2.8 cm) from Pungampalayam and Sithanaickenpalayam villages of Coimbatore district were recorded to be slow growing.

All the isolates of *S.rolfsii* produced dull and pure white on solid and liquid media. All isolates showed dispersed growth all over the plate to aggregated fashion and their appearance was loose to dense cottony with sparse or fluffy mycelium (Table. 2). Similar result was observed by Rakholiya *et al*. (2011) [20]. They studied the variability of 30 isolates of *S.rolfsii* and reported considerable variability in mycelial and sclerotial dimensions. Sclerotial formation followed by mycelial aggregation within 7 to 15 days. Sclerotia were light brown to dark brown in colour. The sclerotia of isolates Sr-5, 9, 10 and Sr-12 were light/dull brown, whereas Sr-1, 2, 3, 4, 6, 7, 8 and 11 produced dark brown on both media. The number of sclerotia formed was differed in all the isolates on solid media. The sclerotial weight also varied across isolates ranging from 0.02 to 0.35 mg/100 sclerotia on PDA medium. The sclerotia were scattered all over the plate singly or joined together, preferably at the periphery and/or margin of the Petri plate. Sclerotia maturity on PDA media ranged between 7 to 15 days. Variations in sclerotial colour, shape and size and their ability to infect plants have been well documented on various hosts and media (Sharma *et al.*, 2002; Palaiah and Adiver, 2006) [23, 17].

The morphological characters of *S.rolfsii* isolates tested were highly variable. The variability among isolates observed in the present study could be attributed to physio-metabolic differences among isolates arising from different crop production systems and also some biochemical variability to adapt to their ecological and environmental conditions. Geographical variability among *S.rolfsii* populations was demonstrated by earlier workers (Harlton *et al*. 1995; Okabe *et al*. 1998). In India, Sharma *et al*. (2002) [23] studied variability among 26 isolates of *S.rolfsii* collected from various hosts/soil samples and localities. Studies of variability within the population in a geographical region are important because it helps to document the changes occurring in the population. The significant variation in culture characteristics, mycelial morphology and pathogenicity amongst test isolates indicated that *S.rolfsii* can best be characterized by a combination of culture characteristics, morphology and virulence on host plants. The differences in sclerotial forming capacity among isolates could be a useful parameter for characterizing isolates, due to the fact that number of sclerotia formed among fungal isolates was significant (Table. 3).

Table 2: Morphological characters of different isolates of *S. rolfsii* Mycelial Growth Characters (*)

S. No.	Isolate No.	Mycelial Characters (*)	Colony colour	Mycelial growth	Fresh weight (g)	Dry weight(g)
1	Sr1	Sparsely, thin mycelial strands	Dull white	Fast	5.20	0.80
2	Sr2	Cottony, fluffy mycelial dense at centre aggregated	Pure white	Very slow	3.98	0.45
3	Sr3	Cottony mycelial, Sparsely	Dull white	Moderate	3.0	0.48
4	Sr4	Sparsely, thin mycelial strands	Dull white	Moderate	3.14	0.39
5	Sr5	Cottony, fluffy mycelial dense at margins	Pure white	Moderate	1.22	0.17
6	Sr6	Sparsely, thin mycelial strands	Dull white	Moderate	4.42	0.30
7	Sr7	Cottony, thin mycelial strands	Dull white	Very Fast	3.0	0.35
8	Sr8	Very very thin mycelial strands, sparsely	Dull white	Very Fast	3.94	0.49
9	Sr9	Thin mycelial strands, sparsely	Pure White	Fast	2.8	0.30
10	Sr10	Cottony, fluffy mycelial	Pure White	Fast	3.7	0.36
11	Sr11	Very thin mycelial strands, sparsely	Dull white	Very slow	4.18	0.60
12	Sr12	Very, very thin mycelial strands, sparsely	Dull white	Fast	4.37	0.57

*Mean of three replications

Table 3: Formation of Sclerotial Characters (*)

S. No.	Isolate No.	Sclerotial Characters (*)	Colour of sclerotia	No. of sclerotia	Maturity (days)	Weight of sclerotia (100nos.)
1	Sr1	Round, medium, spread in the plate leaving periphery	Dark brown	373	10	0.031
2	Sr2	Globose, small, more in periphery, absent in centre	Dark brown	398	12	0.020
3	Sr3	Round, small, more in periphery, centre-1 or 2	Dark brown	342	9	0.023
4	Sr4	Round, small spread all over the plate	Dark brown	670	10	0.037
5	Sr5	Spherical, large	Light brown	459	15	0.041
6	Sr6	Round, small spread all over the plates	Dark brown	395	10	0.020
7	Sr7	Round, small 1 or 2 sclerotia formed in the centre	Dark brown	390	10	0.350
8	Sr8	Round, medium	Dark brown	635	7	0.340
9	Sr9	Round, very small	Light brown	482	7	0.018
10	Sr10	Globose, large	Light brown	57	10	0.035
11	Sr11	Round, very very small	Dark brown	437	15	0.040
12	Sr12	Round, small	Light brown	411	12	0.090

*Mean of three replications

Oxalic acid production

Twelve isolates tested for oxalic acid production in culture filtrates and wide variation was observed between these isolates. The result revealed the production of more oxalic acid (0.61mg/ml) by the isolate Sr8. Few isolates found to produced less quantity 0.22 mg/ml), in the culture filtrate. On

the basis of quantity of oxalic acid produced in culture filterate they were grouped into 4 groups (Table 4). Punja and Jenkins (1984) [19] have reported that the isolates varied in oxalic acid production in the culture. Sellman *et al*. (1982) have found that the isolates varied in the production of phosphatidase in culture as well as in soybean stem. Oxalic acid is one of the impediments responsible for degrading the host tissue. It clearly indicates that the if the oxalic acid production is less the isolate degrade the plant tissue slowly for its establishment, whereas the more producer establish faster and cause more damage.

Table 4: Production of oxalic acid by *S. rolfsii* isolates

S. No.	Isolates	Production of Oxalic acid (mg/ml)*
1.	*Sclerotium rolfsii* - Sr1	0.46
2.	*Sclerotium rolfsii* - Sr2	0.24
3.	*Sclerotium rolfsii* - Sr3	0.40
4.	*Sclerotium rolfsii* - Sr4	0.43
5.	*Sclerotium rolfsii* - Sr5	0.32
6.	*Sclerotium rolfsii* - Sr6	0.36
7.	*Sclerotium rolfsii* - Sr7	0.53
8.	*Sclerotium rolfsii* - Sr8	0.61
9.	*Sclerotium rolfsii* - Sr9	0.50
10.	*Sclerotium rolfsii* - Sr10	0.45
11.	*Sclerotium rolfsii* - Sr11	0.22
12.	*Sclerotium rolfsii* - Sr12	0.48
SEd		0.0160
CD(.05)		0.033
CV(%)		4.62

*Mean of three replications

In vitro* screening of *Pseudomonas* and *Bacillus

Pseudomonas fluorescens (Pf1 &PfUl(A)) and *Bacillus subtilis* (Bs 1,3,5,18,EPCo6, EPCo8, EPCs, EPCo26, EPCo96, Bs (OP)2) received from the Department of Plant Pathology, TNAU, Coimbatore were tested for the inhibitory action against *S. rolfsii*. Among these, EPCo8 recorded the least mycelial growth (5.2cm) with 42.22 per cent inhibition over control (Table 1). Several reports have shown the potential of *Pseudomonas* species as BCAs for controlling plant and fruit diseases (Jayaraj *et al*., 2007; Trivedi *et al*., 2008) [6, 25]. *Pseudomonas* sp. PCI2 showed *in vitro* inhibition of three fungal phytopathogens. In addition, PCI2 showed promise to control tomato damping-off caused by *S. rolfsii* by increasing plant stand in growth chamber assays by 29 per cent.

Table 5: Efficacy of Biocontrol agents against the growth of *S. rolfsii in vitro*

S. No.	Biocontrol agents	Mycelial growth (cm)	Percentage of inhibition over control
1	***Bacillus subtilis* - EPCo8**	**5.2**	**42.22**
2	*Bacillus subtilis* -Bs3	5.7	36.66
3	*Bacillus subtilis* -Bs5	6.3	30.00
4	*Bacillus subtilis* -Bs1	6.5	27.77
5	*Bacillus subtilis* -EPCo26	7.4	17.77
6	*Pseudomonas fluorescens* -Pf1	8.0	11.11
7	*Bacillus subtilis* -EPCo96	7.8	13.33
8	*Pseudomonas fluorescens* - PfUl(A)	8.0	11.11
9	*Bacillus subtilis* - EPC5	6.6	26.66
10	*Bacillus subtilis* -Bs(OP2)	6.5	27.77
11	*Bacillus subtilis* -EPCo6	6.7	25.55
12	*Bacillus subtilis* -Bs18	7.9	12.22
13	Control	9.0	00.00
SEd			0.1782
CD(.05)			0.3662
CV(%)			3.11

Mean of three replications

Trichoderma viride isolates (Tv1, Tv6, Tv18, Tv5, Tv2, Tv22 Tv27(s), Tvcot2, TvT9, Tv NGk4 and Tv27(T)) received from the Department of Plant Pathology, TNAU, Coimbatore were tested for the inhibitory action against *S. rolfsii*. Among them, Tv1 recorded the least mycelial growth (2.4cm) with 73.33 per cent inhibition over control (Table 2). Thribhuvanamala *et al.* (1999) [24] reported that *B. subtilis* and *P. fluorescens* were highly significant in inhibiting the mycelial growth and sclerotial production of *S. rolfsii* causing stem rot of tomato followed by *T. harzianum* and *T. viride*. Biswas and Sen (2000) [2] reported that T8, T10 and T12 isolates out of 11 isolates of *T. harzianum* overgrew *S. rolfsii* upto 92, 85 and 79 per cent, respectively in dual culture. *T. harzianum* was the most effective in inhibiting the mycelial growth (61.5%) and sclerotial production in dual cultures. Karthikeyan *et al*. (2006) [7] reported that one among the three isolates of *T. viride*, one isolate each of *T. harzianum* and *P. fluorescens* were inhibitory to the growth of *S. rolfsii*, the causal agent of stem rot of groundnut. The isolate 1 of *T. viride* caused 69.40 per cent inhibition on the mycelial growth of the pathogen, followed by *P. fluorescens* recording 64.40 per cent inhibition. Kulkarni (2007) evaluated *T. harzianum*,

T. viride, *Trichoderma virens*, *T. koningii*, *P. fluorescens* and *B. subtilis* (*in vitro*) against *S. rolfsii*, causing potato wilt. *T. harzianum* was the most effective in inhibiting the mycelial growth (59.81%) in dual cultures.

Table 6: Efficacy of Biocontrol agents against the growth of *S. rolfsii in vitro*

S. No.	Biocontrol agents	*Mycelial growth (mm)	Per cent inhibition over control
1.	*Trichoderma viride* -Tv1	24.00	73.33
2.	*Trichoderma viride* - Tv NGk4	41.00	54.44
3.	*Trichoderma viride* - Tv5	47.00	47.00
4.	*Trichoderma viride* - Tv2	34.00	62.00
5.	*Trichoderma viride* - Tv22	43.00	52.00
6.	*Trichoderma viride* - Tv27(s)	52.00	42.00
7.	*Trichoderma viride* - Tvcot2	45.00	50.00
8.	*Trichoderma viride* - TvT9	53.00	41.00
9.	*Trichoderma viride* - Tv6	36.00	60.00
10.	*Trichoderma viride* - Tv18	27.00	70.00
11.	*Trichoderma viride* -Tv27(T)	34.00	62.22
12.	Control	90.00	00.00
	SEd		0.1552
	CD(.05)		0.3202
	CV(%)		4.41

*Mean of three replications

Effect of fungicides on mycelial growth of *S. rolfsii*

The efficacy of chemical fungicides *viz.*, Azoxystrobin (0.05 - 0.1%), Carbendazim (0.1%), Trifloxystrobin (50%) + Tebuconazole (0.1%), Thiophanate methyl (0.1%), Tebuconazole (0.1%) and Propiconazole (0.1%), Copper oxy chloride (0.25%) and Difenaconazole (0.1%) was tested against mycelial growth of *S. rolfsii.* However, Trifloxystrobin + Tebuconazole (0.05-0.1%) was the most effective than others in reducing the mycelial growth (00.00 mm) with 100 percent inhibition over control which was followed by Difenaconazole (0.1%) and Tebuconazole (0.1%) with 00.05mm and 00.10 mm growth respectively (Table 3).

These results are in agreement with Virupaksha Prabhu and Hiremath (2003) and Arunasri *et al*. (2011) who reported that the combi products containing triazoles *viz*., Avatar, Merger and Nativo were highly inhibitive to the growth of *S. rolfsii*. Sujatha (1991) reported that carboxin was highly effective on *S. rolfsii*. In our studies also carboxin and triazole containing fungicides showed the complete inhibition of mycelial growth of *S. rolfsii*. Manu *et al.* (2012) [12] reported that systemic fungicides *viz*., hexaconazole, propiconazole, difenconazole and combi products, Avatar (Hexaconazole 4% + Zineb 68%), Nativo (Tebuconazole 50% + Trifloxystrobin 25%) and Vitavax power (Thiram 37.5% + Carboxin 37.5%) showed complete inhibition of *S. rolfsii* at all the concentrations tested in finger millet.

Table 7: Evaluation of new fungicide formulations for against *Sclerotium* wilt pathogen

T. No.	Fungicides	Dosage	Mycelial growth (mm)*	Percent reduction over control
T_1	Tebuconazole (25% EC)	0.1%	0.10^{b}	99.88^{a}
T_2	Azoxystrobin (23% SC)	0.05 - 0.1%	44.30^{c}	50.77^{b}
T_3	Propiconazole (25% EC)	0.1%	0.50^{b}	99.44^{a}
T_4	Thiophanate methyl (70% WP)	0.1%	90.00^{f}	0^{e}
T_5	Copper oxychloride (50% WP)	0.25%	86.35^{d}	4.05^{c}
T_6	Trifloxystrobin (50%) + Tebuconazole (25%)	0.05-0.1%	00.00^{a}	100^{a}
T_7	Carbendazim (50% WP)	0.2%	87.15^{e}	3.16^{d}
T_8	Difenaconazole (25% EC)	0.1%	00.05^{a}	99.94^{a}
T_9	Control	-	90.00^{f}	-

*Mean of three replications

Efficacy of organic amendments against the growth of *S. rolfsii in vitro*

The efficacy of oilcakes *viz*., Neem cake, Jatropha cake, Sesamum cake, Mahua cake, Groundnut cake, and Castor cake at 10 per cent concentration was tested against mycelial growth of *S. rolfsii*. All the oilcake extracts at 10 per cent concentration were effective in inhibiting the radial mycelial growth of *S. rolfsii*. However, Mahua oilcake extract more inhibitory effect than others (15.23 mm). This was followed by castor cake (31.70 mm). The other oilcakes were found to be less inhibitory effect (Table 4). Karthikeyan (1996) [8] evaluated organic amendments (mahua cake, neem cake and pongamia cake, alone or in combination with *T. viride* or *P. fluorescens*, each at (5kg/ha), against stem rot of groundnut in greenhouse conditions. Mahua cake with *T. viride* each at 5 g/kg of soil resulted in 3.75 per cent stem rot incidence compared to 39.98 per cent in the control. *T. viride* and *Gliocladium virens* were compatible with 10% concentration of gingelly cake, groundnut cake and neem leaf extracts (Dubey and Patel 2000).

Table 8: Efficacy of organic amendments against the growth of *S. rolfsii in vitro*

S. No.	Oil Cakes (10 per cent)	*Mycelial growth (mm)	Per cent inhibition over control
1	Neem Cake	75.40 [e]	16.22[e]
2	Gingelly Cake	48.15[d]	46.50[d]
3	Groundnut Cake	78.60[f]	12.66[f]
4	Jatropha Cake	45.26[c]	49.71[c]
5	Mahua Cake	15.23[a]	83.07[a]
6	Castor Cake	31.70[b]	64.47[b]
7	Control	90.00[g]	00.00

*Mean of three replications

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