



## ANTIFUNGAL EFFECT OF ORGANIC AMENDMENTS ON THE MYCELIAL GROWTH AND SCLEROTIA VIABILITY OF *Rhizoctonia solani* Kuhn.

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ABSTRACT

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A shift towards organic farming suggests the amalgamation of organic resources against soil borne plant pathogens. In the present study, efforts were made to explore the efficacy of organic amendment extracts against *Rhizoctonia solani*. Efficacy of six oil free cakes viz., neem, karanj, castor, groundnut, sunflower and gingelly at 5, 10 and 15 per cent concentrations were evaluated by using poisoned food technique. All the amendments tested were significantly superior to control in checking the mycelial growth of the fungus. Among the tested amendments groundnut cake showed (100 %) inhibition at 15 per cent concentration followed by neem cake (86.66 %) inhibition. The least inhibition was recorded with castor cake (44.44 %). Among the six organic amendments tested against sclerotial viability only two viz., neem and groundnut cakes were found to be effective in inhibiting the sclerotial germination at higher incubation periods of 24 hrs. Rest of the amendments tested were ineffective in inhibiting sclerotial germination even though they were effective in inhibiting the mycelial growth. Neem cake and groundnut cake were also effective in inhibiting sclerotial germination when applied to soil.

**KEY WORDS:** Amendment, inhibition, *Rhizoctonia solani*, sclerotia

### 1. INTRODUCTION

The indiscriminate and disproportionate use of pesticides might lead to residues in food chain exerting harmful effects in humans and animals (Chalal *et al.*, 2016). Hence the development of novel and safe plant protectants which interfere with the fungal pathogenicity factors is the need of the hour (Srivastava and Singh, 2011). A change in the line of research has been oriented to find out the alternate means like inclusion of organic amendment, use of plant products, natural preparations and bio-control agents including the use of agro chemicals under the umbrella of integrated disease management (IDM) to minimize the chemical load. Control of sheath blight disease through soil amendment with oil cakes has been reported by several workers (Srinivas Prasad *et al.*, 1997; Meena and Muthuswami, 1999; Meena *et al.*, 2000; Sarkar *et al.*, 2000).

Hence, in the present study organic amendments viz., Neem cake, Pongamia cake, Castor cake, Gingelly cake, Sunflower cake and Groundnut cake were used to evaluate their efficacy in management of sheath blight.

### 2. MATERIAL AND METHODS

The present experiments were carried out in the Department of Plant Pathology, S.V. Agricultural College, Tirupati

#### 2.1. 2.1 PREPARATION OF ORGANIC AMENDMENT EXTRACTS

For the preparation of organic amendment extracts (cold water extract), required quantity of amendment was taken and made into powder. It was soaked overnight in sterile distilled water at the rate of 1g/ml. The material was then filtered with double layered muslin cloth. This formed the standard amendment extract solution of 100 per cent concentration.

#### 2.2 EFFECT OF ORGANIC AMENDMENTS ON THE GROWTH OF *RHIZOCTONIA SOLANI*

The efficacy of each amendment was tested at three concentrations (5, 10 and 15 per cent) by poisoned food technique (Nene and Thapliyal, 1986) by measuring the radial growth of the fungus.

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The Petri plate containing Potato Dextrose Agar medium inoculated with *R. solani* alone served as control. The Petri plates were incubated at room temperature (27±1°C). Three replications were maintained for each treatment. The fungal growth inhibition was calculated by using the formula given below by Vincent (1927)

Where, I = Per cent reduction in growth of test pathogen, C = Radial growth (cm) in control, T = Radial growth (cm) in treatments.

### 2.3 EFFECT OF ORGANIC AMENDMENTS ON THE SCLEROTIAL VIABILITY OF *R. SOLANI* IN VITRO

For each treatment, amendment solution were prepared at 5, 10 & 15 per cent concentrations given using sterile distilled water. Ten sclerotia of the test pathogen were taken for each replication and soaked in the respective amendment solution for substantiate timings (Regular interval should be there in timings) 30 min, 6 h, 18 h and 24 h. Control was maintained by soaking sclerotial bodies in distilled water. Then the sclerotia were retrieved and placed on the PDA medium for testing their viability. Per cent inhibition of sclerotial germination was calculated (Harikrishnan and Yang, 2001).

Per cent inhibition

$$\frac{\text{Total number of sclerotia} - \text{number of germinated sclerotia}}{\text{Total number of sclerotia}} \times 100$$

### 2.4 EFFECT OF ORGANIC AMENDMENTS ON THE VIABILITY OF SCLEROTIA OF *R. SOLANI* MIXED IN SOIL.

Soil was collected from paddy cultivated field and was dried and used in this experiment. Ten grams of soil was taken into plastic cups and ten sclerotia of the sheath blight pathogen were mixed with the soil. The organic amendments which were found effective in the previous experiments were chosen for evaluation of sclerotial viability. The respective amendment solution was added to the plastic cup containing sclerotia and soil mixture up to saturation and incubated for 10 days. In control, distilled water was added to the plastic cup containing sclerotia and soil mixture up to saturation. After 10 days the sclerotia were retrieved and placed on PDA medium for testing their viability. The data was analysed in CRD with SPSS statistical package.

## 3. RESULTS AND DISCUSSION

### 3.1 EFFECT OF DIFFERENT ORGANIC AMENDMENTS ON THE MYCELIAL GROWTH OF *R. SOLANI* IN VITRO.

The organic amendments viz., neem, groundnut, karanj, sunflower, gingelly and castor cakes were screened against *R. solani* by poisoned food technique. The data presented in Table 1 revealed that all the amendments tested at 5, 10 and 15 per cent concentrations were significantly superior to control in checking the mycelial growth of the fungus.

When five per cent concentration of different organic amendments was tested against *R. solani*, highest percentage inhibition (77.03%) was observed with groundnut cake followed by neem cake (68.88%), gingelly cake (53.33%), sunflower cake (52.59%), karanj cake (48.88%) and castor cake (31.85%). Groundnut cake significantly differed with all other treatments in inhibiting the radial growth (Plate 1). All the treatments were significantly superior to control.

When 10 per cent concentration of different organic amendments was tested against *R. solani*, highest percentage inhibition (82.96%) was observed with groundnut cake followed by neem cake (75.55%), sunflower cake (71.85%), gingelly cake (74.81%), and karanj cake (74.81%) and castor cake (36.29%). Groundnut cake significantly differed with all other -

treatments, here also. All the treatments were significantly superior to control in inhibition of radial growth.

When 15 per cent concentration of different organic amendments was tested against *R. solani* highest percentage inhibition (100%) was observed with groundnut cake followed by neem cake (86.66%), gingelly cake (82.96%), sunflower cake (77.03%), and karanj cake (81.48%) and castor cake (44.44%). Groundnut cake significantly differed with all other treatments. Among six organic amendments tested the highest mean percent inhibition was observed with groundnut cake at 15 per cent concentration followed by neem cake, gingelly cake, karanj cake, sunflower cake and castor cake. No sclerotial production was observed in all the treatments.

Many workers have reported that extracts of oil cakes had great impact on inhibition of the radial growth and sclerotial production of *R. solani* under *in vitro* (Lenka *et al.*, 2014, Meena *et al.*, 2014, Vibha, 2010, Dubey *et al.*, 2009). Aparna and Girija (2018) reported that oil cakes of neem and groundnut evaluated by poisoned food technique exhibited the highest inhibition on radial growth of *R. solani*. Dubey and Patel (2000) observed maximum suppression of the pathogen with groundnut oil cake at 10 per cent concentration.

In the present study, it was observed that among oil cakes, neem and groundnut cakes showed maximum inhibition on the mycelial growth.

### 3.2 EFFECT OF DIFFERENT ORGANIC AMENDMENTS ON THE SCLEROTIAL VIABILITY OF *R. SOLANI* IN VITRO.

In order to find out the effect of organic amendments on the survival and viability of sclerotia, ten sclerotia of the fungus were taken for each replication and soaked in the respective solution for 30 min, 6 h, 18 h and 24 h. Control was maintained by soaking sclerotial bodies in distilled water. Sclerotia were retrieved and subjected to germination test on PDA. The results are presented in the Table 2.

Among all the treatments, neem cake (76.66%) and groundnut cake (73.33%) were found to be effective in inhibiting sclerotial germination at the higher incubation period *i. e.* 24 h. Rest of the amendments tested were ineffective in inhibiting sclerotial germination even at the higher incubation periods though they were effective in inhibiting the mycelial growth (Plate 2, 3, 4, 5).

Inhibition of sclerotial germination and sclerotia formation by extracts of oil cakes and plant extracts was reported by Dubey *et al.* 2009; Lenka *et al.* 2014 and Kumar *et al.* 2017.

In the present study extracts of oil cakes at 15 per cent concentration exhibited different inhibition effects on *R. solani*. However, soaking of sclerotial bodies for longer period had certainly resulted in increased inhibitory effect and thus exposure of sclerotia to the extracts for longer periods may be attributed for the reduction of sclerotial viability. This is in agreement with the studies conducted by Dubey *et al.* 2009 on the extracts of neem cake, leaves and bark against *M. phaseolina* where maximum inhibition of sclerotial germination was noticed after 96 hrs of incubation

### 3.3 EFFECT OF DIFFERENT ORGANIX AMENDMENTS ON THE SCLEROTIAL VIABILITY OF *R.SOLANI* IN SOIL

The effective organic amendments found in the previous experiment *i. e.* groundnut, neem, sunflower and gingelly cakes were selected for this experiment. Dried paddy soil was taken in plastic cups and ten sclerotia of *R. solani* were mixed in the soil, organic amendment extract was added to the soil up to saturation. After 10 days the sclerotia were retrieved and subjected to germination test on PDA. The results are presented in the Table 4 and Plate 6.

All the treatments were significantly superior over control in recording low germination percentage of sclerotia of *R. solani* in soil. Neem cake was significantly superior to all other treatments by recording the lowest sclerotial germination (23.33%) followed by groundnut (30%), gingelly (40%) and sunflower (50%) at 15 per cent concentration.

Per cent inhibition of sclerotial germination was recorded in the following order.

$$T_5 < T_3 < T_2 < T_4 < T_1$$

The maximum inhibition of sclerotial germination of *R. solani* was reported by extracts of pinnai cake, *Prosopis juliflora*, and *Thevetia peruviana* (Ezhilan *et al.*, 1994) while gingelly cake and *Caesalpinia pulcherima* did not have much effect on sclerotial germination. Prasad *et al.* (1998) in a study on the efficacy

of neem cake and calotropis green leaves reported reduction of viability of sclerotia while combined effect of calotropis with groundnut cake reduced sclerotial viability by 94.7 per cent.

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## 6. REFERENCES:

- Aparna, K. P. and Girija, V. K. 2018. Efficacy of plant oils and oil cakes against *Rhizoctonia solani* Kuhn causing collar rot and web blight of cowpea under *in vitro* conditions. *International Journal of Current Microbiology and Applied Sciences*. 7 (1): 2091- 2098.
- Chalal, K. K., Kumar, A., Kataria, D., Singh, T., Kaur, B. and Chadha. 2016. Dynamics of demand and consumption of pesticides in agriculture – an overview. *Indian Journal of Economic Development*. 12(1): 171-177.
- Dubey, R. C., Harish Kumar and Pandey, R. R. 2009. Fungitoxic effect of neem extracts on growth and sclerotial survival of *Macrophomina phaseolina* *in vitro*. *Journal of American Science*. 5 (5): 17-24.
- Dubey, S. C. and Patel, B. 2000. *In vitro* evaluation of some oil cakes and plant extracts against *Thanatephorus cucumeris*, *Gliocladium virens* and *Trichoderma viride*. *Journal of Mycology and Plant Pathology*. 30: 411-413.
- Ezhilan, G., Chandrasekar, V and Kurucheve, V. 1994. Effect of six selected plant products and oil cakes on the sclerotial production and germination of *Rhizoctonia solani*. *Indian Phytopathology*. 183-185.
- Harikrishnan, R and Yang, X.B. 2001. Influence of herbicides on growth and sclerotia production in *Rhizoctonia solani*. *Weed Science*. 49(2): 241-247.
- Kumar, M., Kudada, N., Saurabh, A., and Zeeshan, N. 2017. *In vitro* evaluation of plant leaf and oil cake extracts against *Rhizoctonia solani* causing French bean root rot disease. *International Journal of Agricultural Science and Research*. 7(3): 447-460.
- Lenka, S and Pun, K. B. 2014. *In vitro* effect of organic amendment through oil cakes on *Rhizoctonia solani* Kuhn causing sheath blight disease in rice. 11(2): 88-90.
- Meena, B and Muthusamy, M. 1999. Effect of organic soil amendments against rice sheath blight. *Indian Phytopathology*. 52(1): 92-93.
- Meena, B., Ramanamoorthy, V. and Muthuswamy, M. 2000. Control of rice sheath blight using oils, oil cakes bulb and seed extracts. *Journal of Ecobiology*. 12(2): 87-91.
- Meena, P. N., Tripathi, A. N., Gotyal, B. S and Satpathy, S. 2014. Bio – efficacy of phyto extracts and oil cakes on *Macrophomina phaseolina* (Tassi) causing stem rot disease of jute, *Corchorus* spp. *Journal of Applied and Natural Science*. 6(2): 530-533.
- Prasad, M. S., Lakshmi, B. S., Shaik Mohiddin and Mohiddin, S. 1998. Survival of sclerotia of *Rhizoctonia solani* in soils amended with oil cakes and green leaf manures. *Annals of Agricultural Research*. 19: 44-48.
- Sarkar, M. K., Sharma, B. D. and Sengupta, P. K. 2000. Pathotypes in rice sheath blight organism, *Rhizoctonia solani*. *Annals of Plant Pathology Sciences*. 8(1): 109-111.
- Srinivas Prasad, M., Santha Lakshmi, B. and Mohiddin, S. 1997. Application of oil cake powder with green leaf extract on the growth of *Rhizoctonia solani*. *Oryza*. 34(4): 393-395.

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Srivastava, D. and Singh, P. 2011. Antifugal potential of two common weeds against plant pathogenic fungi – *Alternaria* sps. *Asian Journal of Experimental Biological Sciences*. 2(3): 525-528.

Vibha. 2010. Effect of fungal metabolites and amendments on mycelia growth of *Rhizoctonia solani*. *Journal of Plant Protection Research*. 50(1): 93-97.

Vincent, J. M. 1927. Distortion of fungal hyphae in presence of certain inhibitors. *Nature* 159: 850.

**Table 1: *In vitro* evaluation of organic amendments on the mycelial growth of *Rhizoctonia solani*.**

S. No.	Organic Amendment	Radial growth (cm)*			Percent Inhibition		
		Concentration of organic amendment					
		5%	10%	15%	5%	10%	15%
1.	Neem	1.40	1.10	0.60	68.88 (56.07) **	75.55 (60.33)	86.66 (68.53)
2.	Karanj	2.36	1.13	0.83	48.88 (44.31)	74.81 (59.87)	81.48 (64.45)
3.	Castor	3.06	2.86	2.50	31.85 (34.33)	36.29 (36.99)	44.44 (41.78)
4.	Gingelly	2.10	1.13	0.76	53.33 (46.89)	74.81 (59.87)	82.96 (65.63)
5.	Sunflower	2.13	1.26	1.03	52.59 (46.43)	71.85 (57.92)	77.03 (61.34)
6.	Groundnut	1.03	0.76	0.00	77.03 (61.34)	82.96 (65.63)	100 (90.00)
7.	Control	4.50	4.50	4.50	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	CD				0.92	2.36	1.37
	SEm±				0.30	0.77	0.44
	CV				1.26	2.75	1.39

\*Mean of three replications. \*\* Figures in parentheses are angular transformed values.

**Table 2: *In vitro* efficacy of organic amendments on the sclerotial viability of *R. solani*.**

S.No	Organic amendment	Conc.	Per cent inhibition of sclerotia			
			30 min	6 h	18 h	24 h
1	Neem	15%	23.33 (28.76) **	23.33 (28.76)	33.33 (35.20)	76.66 (61.19)
2	Karanj	15%	0.00 (0.00)	0.00 (0.00)	10.00 (18.42)	30.00 (33.19)
3	Castor	15%	3.33 (6.14)	10.00 (18.42)	13.33 (21.13)	36.66 (37.21)
4	Gingelly	15%	10.00 (18.42)	0.00 (0.00)	16.66 (23.84)	66.66 (54.76)
5	Sunflower	15%	16.66 (23.84)	20.00 (26.59)	26.66 (30.98)	60.66 (50.74)
6	Groundnut	15%	20.00 (26.06)	30.00 (32.98)	36.66 (37.21)	73.33 (58.98)
7	Control	-	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	CD		9.56	4.94	6.08	4.89
	SEm±		3.12	1.61	1.98	1.59
	CV%		11.65	9.35	7.44	6.54

\*\* Figures in parentheses are angular transformed values.

**Table: 3 Efficacy of organic amendments on the sclerotial viability of *R. solani* in soil.**

S. No.	Organic amendments	Concentration	Percent germination of sclerotia	Per cent inhibition of sclerotia
1	Neem	15%	23.33 (28.76)**	76.66 (61.19)
2	Gingelly	15%	40.00 (39.21)	60.00 (50.74)
3	Sunflower	15%	50.00 (44.98)	50.00 (44.98)
4	Groundnut	15%	30.00 (33.19)	70.00 (56.76)
5	Control	-	100.00 (90.00)	0.00 (0.00)
	<b>CD</b>		3.16	3.16
	<b>SEm±</b>		0.99	0.99
	<b>CV%</b>		3.63	4.01

\*\* Figures in parentheses are angular transformed values.

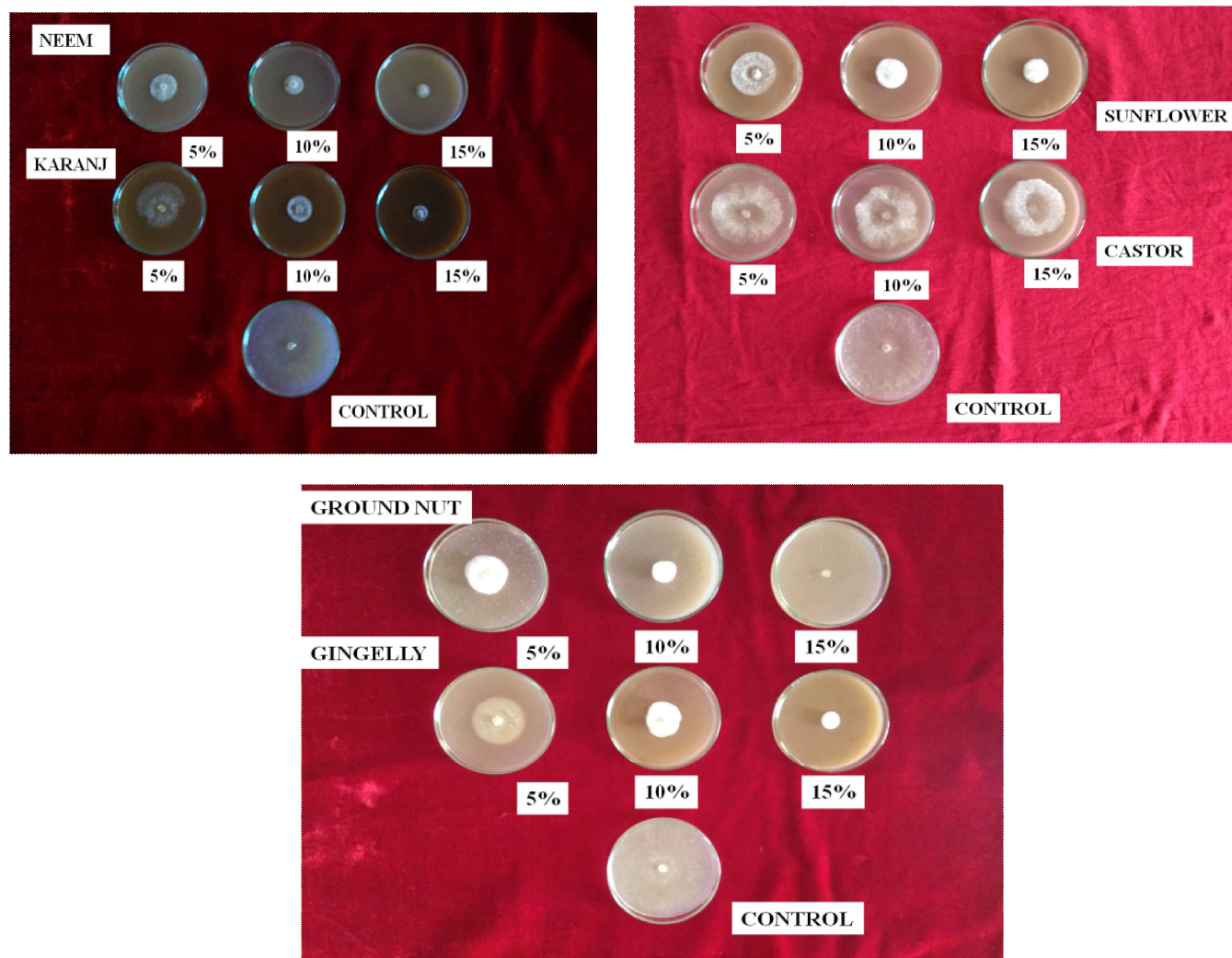
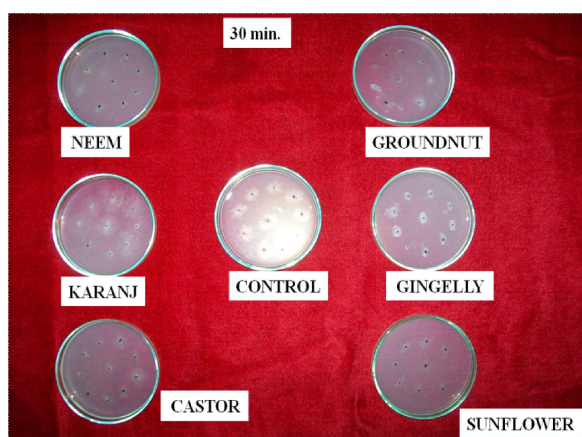


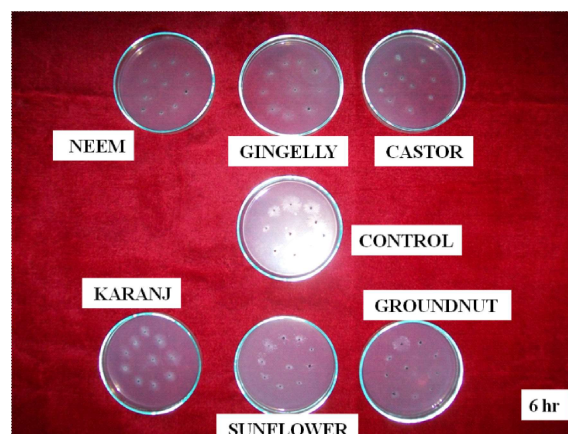
Plate 1. *In vitro* efficacy of organic amendments on mycelial growth of *R. solani* by poisoned food technique



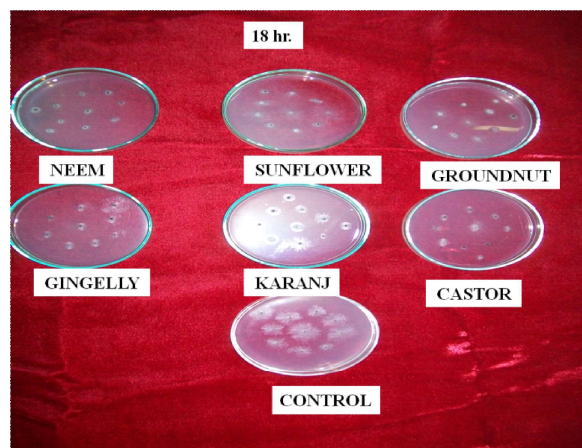
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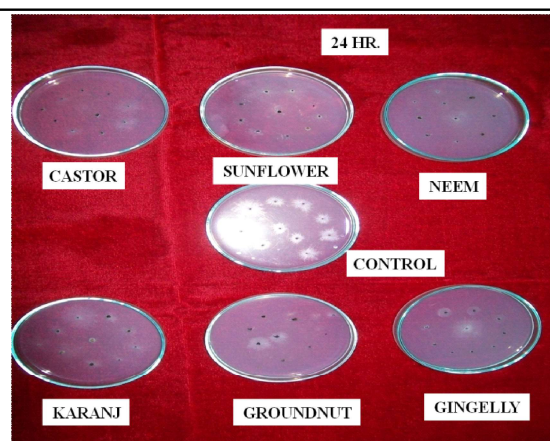
**Plate 2:** *In vitro* efficacy of organic amendments on sclerotial viability at 30 min incubation period



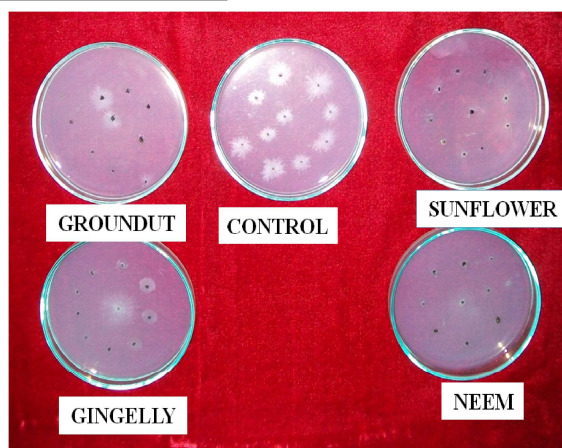
**Plate 3:** *In vitro* efficacy of organic amendments on sclerotial viability at 6 hours incubation period



**Plate 4:** *In vitro* efficacy of organic amendments on sclerotial viability at 18 hours incubation period



**Plate 5:** *In vitro* efficacy of organic amendments on sclerotial viability at 24 hours incubation period



**Plate 6:** *In vitro* efficacy of soil application of organic amendments on sclerotial viability at 10 d incubation period