

Original Research Article

<https://doi.org/10.20546/ijcmas.2018.707.154>

Screening of Herbicides against Sclerotial Viability of the *Rhizoctonia solani* in vitro and in Soil

Y. Sandhya^{1*}, C.P.D. Rajan², M. Reddi Kumar¹ and A. Ranga Rani¹

¹Department of Plant pathology, S.V.Agricultural College, Tirupati, Chittoor (Dt) PIN: 517
502, India

²Agricultural Research Station, Nellore (Pin:524003), A.P., India

*Corresponding author

ABSTRACT

Keywords

Sheath blight,
Sclerotia,
Rhizoctonia solani

Article Info

Accepted:
10 June 2018
Available Online:
10 July 2018

Among the ten herbicides viz., Glyphosate, 2,4-D Sodium salt, Butachlor, Pretilachlor, Oxadiargyl, Pyrazosulfuron ethyl, Bensulfuron methyl 0.6% + Pretilachlor 6%, Cyhalofop-butyl, Bispyribac sodium and Ethoxy sulfuron tested against sclerotial viability only two, viz., Butachlor and Pretilachlor were found to be effective in inhibiting sclerotial germination even at lower incubation period of 5 min. both in soil application and *in vitro*. Glyphosate inhibited sclerotial germination at higher incubation periods *i.e.*, 18 h and 24 h. Rest of the herbicides tested were ineffective in inhibiting sclerotial germination.

Introduction

Rice Sheath blight is caused by *Rhizoctonia solani* (Kuhn). This disease was first recorded from Japan (Miyake, 1910). The fungus produces brown sclerotia depending upon the environmental conditions. Sclerotia are superficial, more or less globose but flattened, white when young and becomes brown. Individual sclerotium measures upto 5mm but may unite to form large mass in culture (Ou, 1985). The fungus survives in the soil for years as hard, resistant structures. The sclerotial bodies float on the surface of the water in rice fields and when come in contact with the plant, initiates infection. The sclerotia

survives for long periods and tend to accumulate in the soil (Lee and Rush, 1983). Therefore, the sclerotia of *R. solani* play an important role in the pathogen survival in rice fields. Besides the disease management, practice through cultural methods, chemical control, is the net promising method. Herbicides also have shown to increase or decrease some plant diseases especially those caused by soil borne pathogens (Kathan and Eshel, 1973; Papavizas and Lewis, 1979). Herbicides are mostly used to control the weeds (non crop plants) but they also have role in management of plant pathogens present in the soil. There was decrease in the reduction of sclerotial viability of *R. solani* by

the herbicide Paraquat (Pathak *et al.*, 1996). The biological activity of herbicides extends beyond their effect on target organisms and herbicides may influence plant pathogen interactions through their effect on the pathogen.

Hence, in the present study herbicides were used to evaluate their effect in controlling the germination of sclerotia.

Materials and Methods

The present experiments were carried out in the Department of Plant Pathology, S.V. Agricultural College, Tirupati, and Agricultural Research Station, Nellore, of Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh. The test pathogen *R. solani* was isolated from sclerotial bodies attached to the diseased portion of rice plants.

Herbicidal effect on the sclerotial viability of *R. solani* in vitro

For each treatment, herbicidal solution was prepared according to the concentrations given in the Table1 using distilled water. Ten sclerotia of the test pathogen were taken for each replication and dipped into the respective herbicidal solution for 5 min, 30 min, 6 h, 18 h, 24 h. Control was maintained by dipping sclerotial bodies in distilled water. Then the sclerotia were retrieved and placed on the PDA medium for testing their viability.

Experimental design used was CRD and three replications were maintained per treatment.

Herbicidal effect on the viability of sclerotia of *R. Solani* mixed with the soil

Dry soil of paddy field was used in this experiment. 10 g of soil was taken into plastic cups and ten sclerotia of the sheath blight pathogen were mixed with the soil. This is a unit representing a replication of a treatment.

The herbicides which were found effective in the previous experiments were chosen for evaluation. The respective herbicidal solution was added to the plastic cup containing sclerotia and soil mixture upto saturation and incubated for 10 days. In control distilled water was added to the plastic cup containing sclerotia and soil mixture upto saturation. After 10 days the sclerotia were retrieved and placed on PDA medium for testing their viability. Treatment details as given in the paragraph 3.8.1. Per cent inhibition of sclerotial germination was calculated (Harikrishnan and Yang, 2001).

Results and Discussion

Herbicidal effect on the sclerotial viability of *R. solani* in vitro

Among all the treatments, Butachlor and Pretilachlor showed 100 % inhibition of sclerotial germination at all the incubation periods. Glyphosate showed 100 % inhibition at 18h and 24 h of incubation followed by 93.43 % at 6 h and however was ineffective in inhibiting the sclerotial germination at 5 min (6.66 %) and 30 min (20 %) incubation. Cyhalofop-butyl showed 100 % inhibition at 24 h incubation followed by (89.43 %) inhibition at 18 h incubation and however in effective in inhibiting at 5 min (56.66 %), 30 min (0 %) and 6 h (26.67%) incubation. Increase in incubation period increased inhibition in Glyphosate and cyhalofop- butyl.

2,4-D Sodium salt, Bispyribac – sodium, Bensulfuron methyl 0.6% + Pretilachlor 6%, Pyrazosulfuron ethyl, Ethoxy sulfuron and Oxadiargyl are ineffective in inhibiting the sclerotial germination at all the incubation periods.

Inspite of being effective in inhibiting mycelial growth of *R. solani*, Bispyribac – sodium (89.27 %), Bensulfuron methyl 0.6% + Pretilachlor 6% (84.90 %), 2,4-D (41.83 %)

failed to inhibit the sclerotial germination. However Ethoxy sulfuron, Pyrazosulfuron ethyl and Oxadiargyl are least effective in inhibiting sclerotial germination. The results are presented in the Table 2, Graph 1 and Figure 1 and 2.

Effect of different herbicides on the sclerotial viability of *R. solani* in soil

The effective herbicides found in the previous experiment *i.e.*, Butachlor, Pretilachlor, Glyphosate and cyhalofop - butyl were selected for this experiment. Dried paddy soil

was taken in plastic cups and ten sclerotia of *R. solani* were mixed in the soil, herbicidal solution was added to the soil upto saturation. After ten days the sclerotia were retrieved and subjected to germination test on PDA. The results are presented in the Table 3, Graph 2, and Figure 3. Among all the treatments Butachlor and Pretilachlor showed 100% inhibition which are significantly superior over other treatments followed by Glyphosate (73.33 %). Where as cyhalofop butyl inhibited the sclerotial germination only to the extent of 23.33 %.

Graph.1 *In vitro* efficacy of herbicides on the sclerotial viability of *Rhizoctonia solani* at 24 h incubation

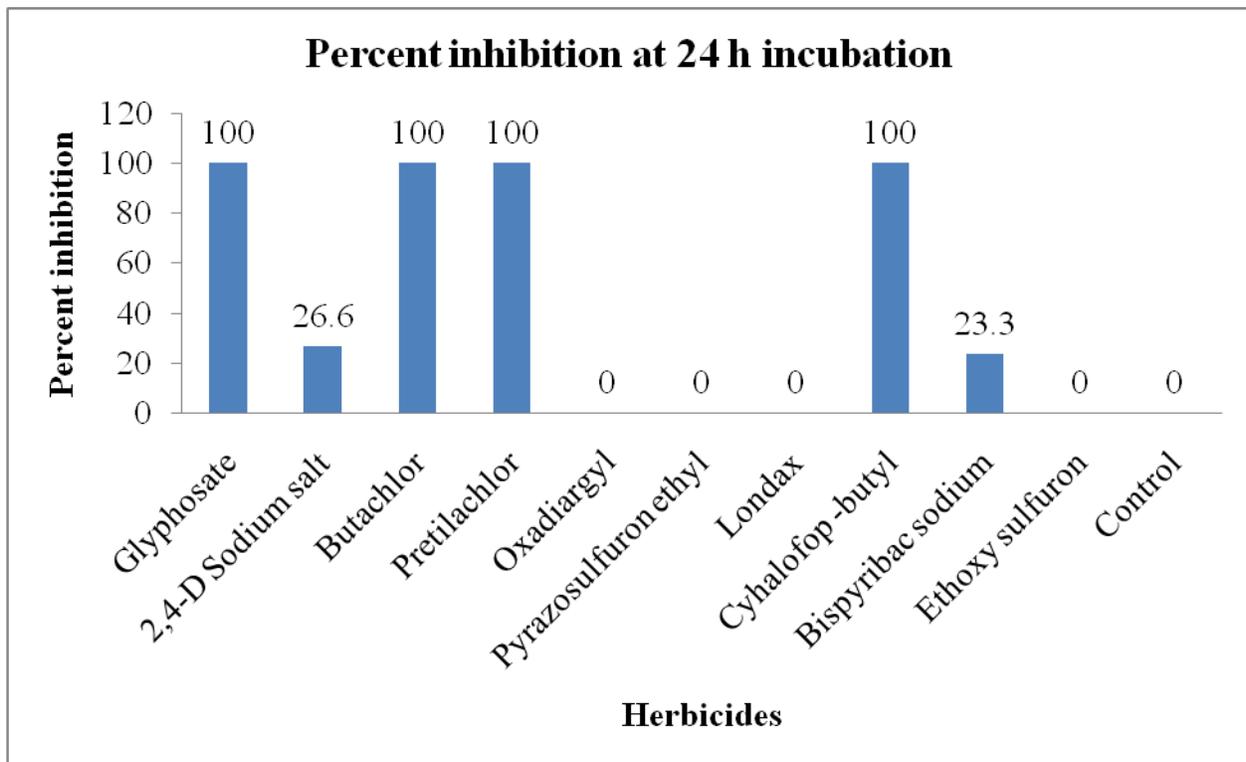


Table.1 List of the herbicides and their concentrations tested

TREATMENT NUMBER	HERBICIDE	DOSAGE
1	Glyphosate 41SL	10 ml /l
2	2,4-D Sodium Salt 80WP	2 g /l
3	Butachlor 60EC	6.25ml/l
4	Pretilachlor 50EC	2.5 ml /l
5	Oxadiargyl 80WP	0.2g /l
6	Pyrazosulfuron ethyl 75WDG	4 g /l
7	Bensulfuron methyl 0.6% + Pretilachlor 6% GR (Londax)	20g /l
8	Cyhalofop- butyl 10EC	2 ml /l
9	Bispyribac- sodium 10SC	0.6 ml /l
10	Ethoxysulfuron 15WDG	0.25 g /l
11	Untreated control	-

Graph.2 Efficacy of soil application of herbicides on the sclerotial viability of *Rhizoctonia solani*

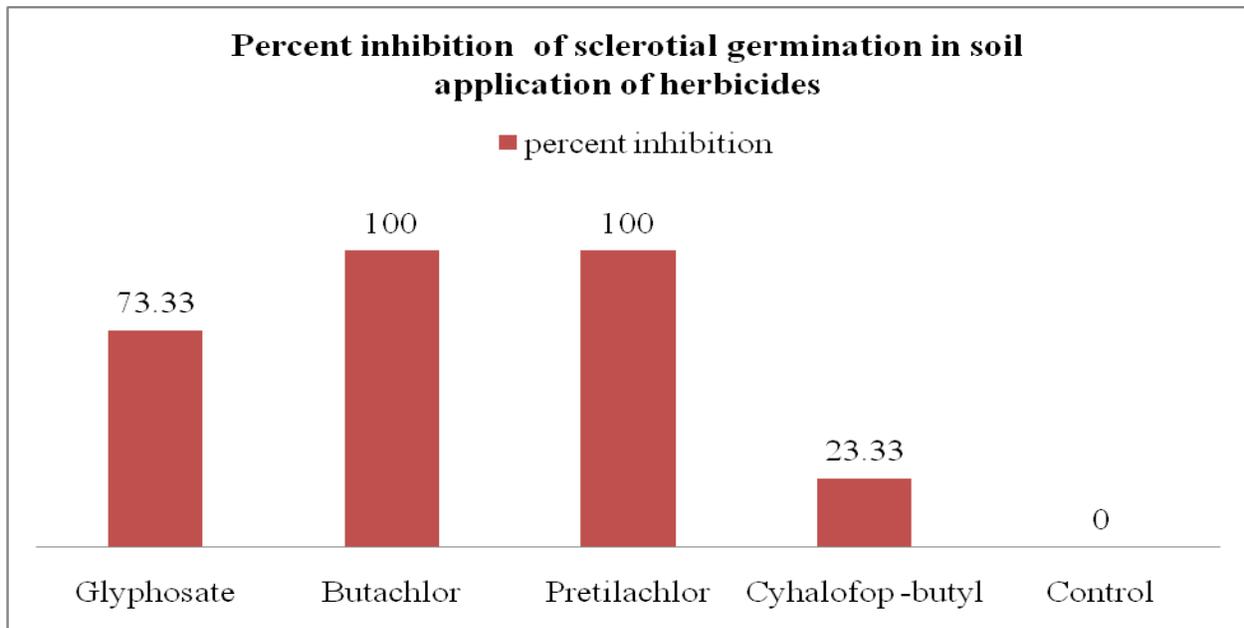


Table.2 *In vitro* efficacy of herbicides on the sclerotial viability of *Rhizoctonia solani*

S.No	Herbicides	Conc.	Per cent inhibition of sclerotia				
			5min	30min	6h	18h	24h
1	Glyphosate	10.00 ml/l	6.66 (12.29)	20.00 (26.55)	16.66 (23.85)	100.00 (90.00)	100.00 (90.00)
2	2,4-D Sodium salt	2.00 g /l	0.00 (0.00)	0.00 (0.00)	16.66 (23.85)	30.00 (33.19)	26.67 (30.98)
3	Butachlor	6.25 ml/l	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
4	Pretilachlor	2.50 ml/l	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)	100.00 (90.00)
5	Oxadiargyl	0.20 g/l	13.33 (21.14)	0.00 (0.00)	20.00 (26.55)	0.00 (0.00)	0.00 (0.00)
6	Pyrazosulfuron ethyl	4.00 g/l	46.67 (43.06)	0.00 (0.00)	30.00 (33.19)	43.33 (41.13)	0.00 (0.00)
7	Bensulfuronethyl 0.6% + Pretilachlor 6%	20.00g/l	3.33 (6.14)	10.00 (11.06)	20.00 (26.06)	0.00 (0.00)	0.00 (0.00)
8	Cyhalofop-butyl	2.00 ml/l	56.67 (48.83)	0.00 (0.00)	26.66 (30.98)	89.33 (70.92)	100.00 (90.00)
9	Bispyribac – sodium	0.60 ml/l	13.33 (21.13)	63.33 (52.75)	33.33 (34.91)	0.00 (0.00)	23.33 (28.76)
10	Ethoxysulfuron	0.25 ml/l	10.00 (18.43)	0.00 (0.00)	13.33 (21.13)	10.00 (18.42)	0.00 (0.00)
11	Control	-	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
	CD (P=0.01)		8.78	10.00	8.49	1.79	2.78
	SEm±		2.9	3.39	2.87	0.60	0.94
	SEd±		4.2	4.79	4.07	0.86	1.33
	CV%		16.6	13.8	13.7	2.6	4.28

** Figures in parentheses are angular transformed values

Fig.1 Mature sclerotia of *R. solani* *in vitro*



Table.3 Efficacy of herbicides on the sclerotial viability of *Rhizoctonia solani* in soil

S. No.	Herbicides	Concentration	Per cent germination of Sclerotia	Per cent inhibition of sclerotia
1	Glyphosate	10.00 ml/l	26.67 (30.98)	73.33 (58.98)**
2	Butachlor	6.25 ml/l	0.00 (0.00)	100.00 (90.00)
3	Pretilachlor	2.50ml/l	0.00 (0.00)	100.00 (90.00)
4	Cyhalofop-butyl	2.00 ml/l	76.67 (61.69)	23.33 (28.27)
5	Control	-	100.00 (90.00)	0.00 (0.00)
	CD (P=0.01)		7.71	7.706
	SEm±		2.41	2.414
	SEd±		3.41	3.414
	CV%		11.45	7.8

** Figures in parentheses are angular transformed values

Fig.2 *In vitro* efficacy of herbicides on sclerotial viability at 24 h incubation period

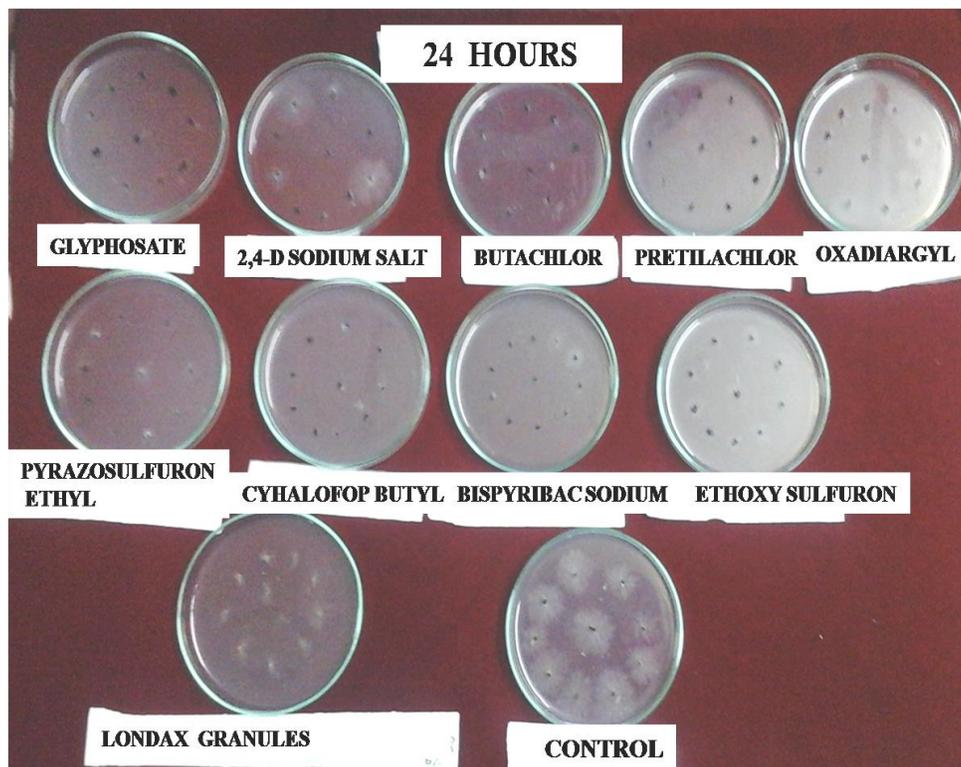
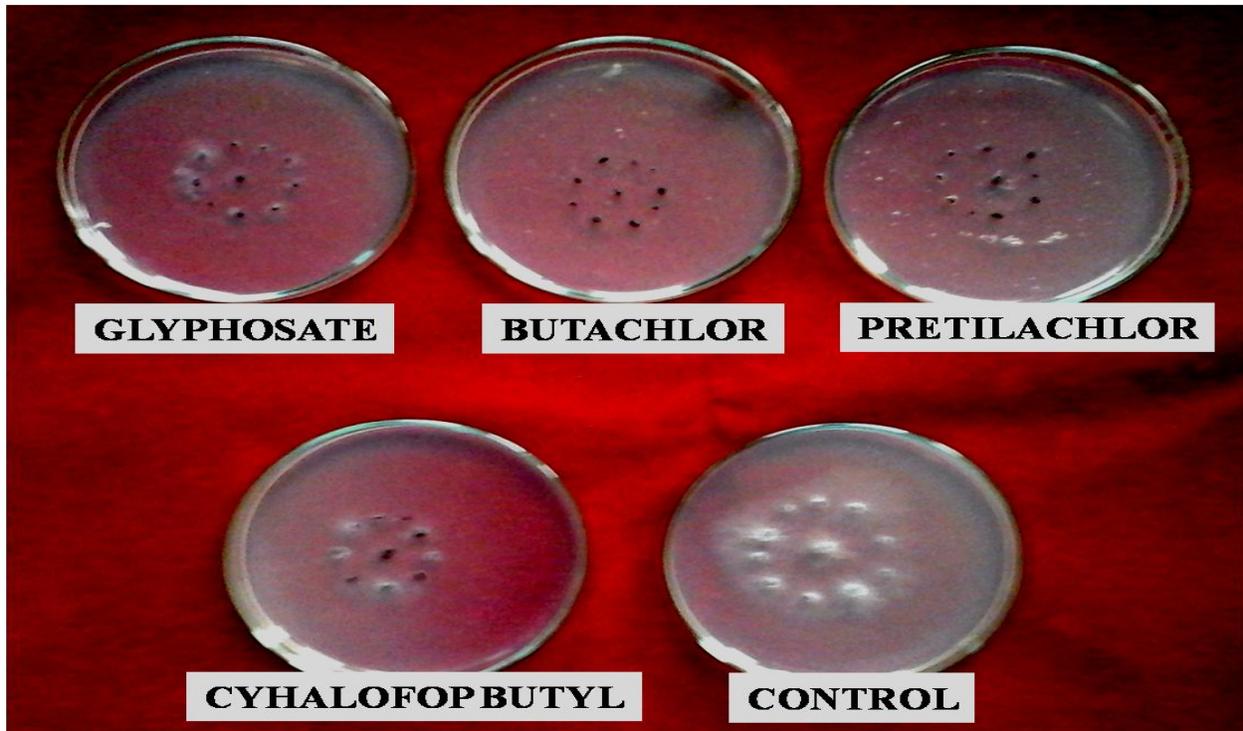


Fig.3 Efficacy of soil application of herbicides on sclerotial viability at 10 days incubation period



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

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

Four herbicides Butachlor, thiobencarb, 2,4-D and paraquat were evaluated for their effect on the viability of buried sclerotia of *R. solani*. Similar results were recorded. (Pathak *et al.*, 1996).

Among the tested herbicides against sclerotial viability of test pathogen, in which only butachlor and pretilachlor were found to be effective in inhibiting sclerotial germination even at lower incubation period of 5 min, both in soil application and *in vitro*. While Glyphosate inhibited sclerotial germination at higher incubation periods *i.e.* 18 h and 24 h. Rest of the herbicides tested were ineffective in inhibiting sclerotial germination.

Acknowledgements

Financial support received from Acharya N.G. Ranga Agricultural University, Andhra Pradesh is great fully acknowledged. This work is the part of Thesis submitted to Acharya N.G. Ranga Agricultural University.

References

- Black, D. B., Russin, J.S., Griffin, J.L., and Snow, J.P. 1996. Herbicide effects on *Rhizoctonia solani in vitro* and Rhizoctonia foliar blight of soybean (*Glycine max*). *Weed Science*. 44: 711-716.
- Harikrishnan, R and Yang, X.B. 2001. Influence of herbicides on growth and sclerotia production in *Rhizoctonia solani*. *Weed Science*. 49(2): 241-247.
- Katan, J and Eshel, Y. 1973. Interactions

- between herbicides and plant pathogens. Residue Reviews. 45: 145-147.
- Miyake, I. 1910. Studies uber die pilze der reispflanzen in japan. Journal College of Agriculture, Tokyo 2: 237-276.
- Nene and Thapliyal. 1986. Fungicides in Plant Disease Control. Oxford and IBH Publishing House, New Delhi. 163.
- Ou, S.H. 1985. *Rice Diseases*. CAB International, Leutralsales, Fanham
- Royals Slough, UK. PP: 272-285.
- Papavizas, G.C and Lewis, J.A. 1979. Influence of the herbicides EPTC and Prometryn on cotton Seedling disease caused by *Thielaviopsis basicola*. Canadian Journal Of Plant Pathology. 1: 100-106.
- Pathak, D., Roy, A.K and Deka, S.C. 1996. Effect of herbicides on the growth and sclerotial survival of *Rhizoctonia solani* Kuhn. Annuals Of Biology. 12(2): 245-251.

How to cite this article:

Sandhya, Y., C.P.D. Rajan, M. Reddi Kumar and Ranga Rani, A. 2018. Screening of Herbicides against Sclerotial Viability of the *Rhizoctonia solani in vitro* and in Soil. *Int.J.Curr.Microbiol.App.Sci*. 7(07): 1290-1297. doi: <https://doi.org/10.20546/ijcmas.2018.707.154>