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Solar heating by polyethylene mulching for the control of collar rot of chilli caused by *Sclerotium rolfsii* Sacc.

J. S. P. RAO AND S. S. MAITY
Department of Plant Pathology, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741252, West Bengal

Irrigated soil in pots were mulched with transparent, white polyethylene sheets with thickness of 0.06 mm during the month of April and soil temperatures were there by increased. Sclerotia of *Sclerotium rolfsii* were buried in mulched and unmulched soil at 5, 10 and 15 cm depths, recovered after 0, 7, 14 and 21 days intervals and their viability were estimated. Sclerotial population were started decreasing their viability slowly in unmulched soil after 7 days and continued to decrease up to 21 days at all depths. On the contrary, in mulched soil, due to increase in soil temperature an abrupt significant decrease in the sclerotial population was observed. It was leading to the total elimination in the viability of scerotial population to the total elimination in the viability of sclerotial population at 5 cm depth after 14 days and at 10 cm depth after 21 days while 56.67% loss in viability was observed at 15 cm depth after 21 days. Highest temperature recorded during the experimentation was 51.4°C, 48.9°C and 45.9°C at 5, 10 and 15 cm depth respectively, while at same days ambient temperature was 37.4°C. It could be concluded that the collar rot disease of chilli may be controlled by reducing the viability of *Sclerotium rolfsii* pathogen by soil solorization.

Key words : Polyethlene mulching, *Sclerotium rolfsii,* viability

INTRODUCTION

Chilli (*Capsicum annum* L.) is an important cash crop and is used as a condiment throughout the world in India chilli is grown all ove the country covering large areas in different states. Chilli is affected by large numbr of diseases and pests. Collar rot is one of the major diseases of chilli caused by soil borne fungus *Sclerotium rolfsii.*

Sclerotium rolfsii is an ubiquitous plant pathogen, attacking more than 500 species belonging to over 100 families of cultivated and wild plant in tropical and subtropical regions (Punja, 1985). The pathogen appears to be a dominant fungal pathogen affecting either seedling or mature plant.

Since the *Sclerotium rolfsii* has a wide host range and can persist on virtually all type of crop debrises (Punja, 1985). Various approaches, such as chemical, biological and cultural are used for the control of collar rot of chilli, however, each has its own limitations. Soil solarization, a relatively new approach, developed by Katan *et al.* (1976) in Israel for control of soil borne pathogens and pests. It is a non-chemical, not hazardous non-toxic to consumer, less expensive and easy to handle technology. Its potentiality were tested by many workers during last decades (Patel, 2001).

Soil solarization has been used to control the of *Sclerotium rolfsii* in groundnut by Maity (1986), in tomato by Kandhar and Bhowmik (1992) and in chickpea by Tiwari *et al.* (1997). Since there is no information regarding effect of soil solarization on management of collar rot of chilli, the present study was conducted to observe the effect of soil solarization on management of collar rot of chilli. In addition to it, efforts were also made to study the effects of soil solarization on soil temperature and sclerotial viability.

MATERIALS AND METHODS

Sandy loam soil having pH 6.9 upto plough depth, collected from Crop Research Farm, Jaguli of this

Viswavidyalaya were mixed with well decomposed FYM in ratio of 2 : 1, and was used for present investingation.

The test fungus *Sclerotium rolfsii* was isolated from a naturally infected plant of the District Seed Farm, Kalyani. Pathogen was purified, tested for pathogenicity befor further use and for sclerotia were aseptically harvested and immediately used for experiment.

To conduct the investigation, 15 × 15 cm earthen pots were used. In such pots 50 sclerotia @ of per pots were mixed in soil to be filled in the pots. Efficacy of soil solarization against collar rot pathogen was evaluated by putting just harvested selerotia @ 50 at 5, 10 and 15 cm depths both in mulched and unmulched pots. To increase the heat sensitivity to pathogen pot soil were irrigated upto field capacity, finally covered by white 0.06 mm thick polyethylene sheets and kept for 21 days in direct exposure to the sunlight.

During the trial period of 21 days in month of April soil temperature in mulched and unmulched pots were recorded at 5, 10 and 15 cm depth between 2-3 p.m. by inserting soil thermometer in pot soil. After 0, 7, 144 and 21 days interval 2 pots were selected both from mulched and unmulched and were taken to the laboratory for further studies. Sclerotia were recovered from such pots and after surface steilization with 0.1% $HgCl_2$ viability were tested on PDA medium.

After 21 days of exposure to sunlight, remaining pots were taken in glass house, polyethylene sheets were removed and five chilli seedling were planted. Watering was done as and when required. Mortality of chilli plants were recorded after 15,30,45 and 60 days.

Assessment of disease symptoms were based on the mortality of chilli seeding. Pathogenicity test was conducted and confirmation of infection was made by isolating the pathogen form infected plants on PDA medium.

RESULTS AND DISCUSSION

The range of ambient temperature was 33.0 - 37.4°C of which mean of daily ambient temperature was 35.35°C (Fig. 1). The average of soil temperature in mulched pots at 5, 10 and 15 cm depths were 46.10, 42.99 and 41.49°C respectively, while it was 38.60, 33.25 and 29.62°C at 5, 10 and 15 cm soil depth respectively in unmulched pots.

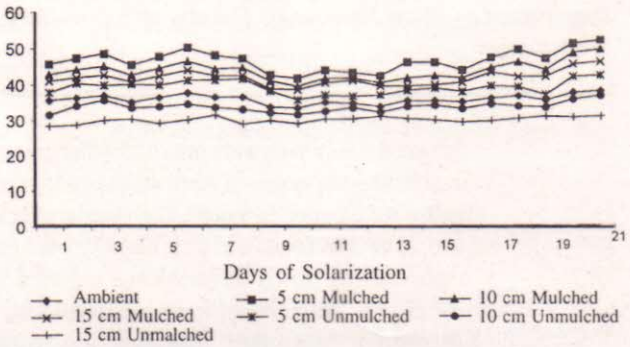

Fig. 1 : Elevation and derpression of soil temperature during solarization

Under mulched condition, an increase in temperature over ambient temperature was 10.83, 7.47 and 6.65°C at 5, 10 and 15 cm depth respectively. Increase in temperature mulched pots over unmulched pots were 7.43, 9.72 and 11.85°C at 5, 10 and 15 cm depth respectively. The variation in temperature showed an increasing trend under mulched over unmulched pots along with increase in depths. The explanation of the reason is that in case of open pots the temperature has been reduced substantially because of the loss of moisture. On the contrary in tarped pots, moisture was maintained.

The sclerotia buried in the soil of the pots at 5, 10 and 15 cm depth were recovered after 0, 7, 14 and 21 days.

Such sclerotia after surface sterilization with 1.0% $HgCl_2$ Solution for germination was placed on PDA medium, as depicted in the Table 1.

A very slow reduction in viability of sclerotial population was observed after 7th day, which increased slowly during 21 days of experimentation. The same trend was observed at much higher rate under mulched condition.An abrupt significant decrease mortality in the sclerotial population was observed. It was leading to the total elimination in the viability of sclerotial population at 5 cm depth after 14 days and 10 cm depth after 21 days, while

Table 1a : Mean table for mulching × duration × depth

Condition	Days	Depth (in cm)	Mortality
Mulched	0	5	90.00
		10	90.00
		15	90.00
	7	5	64.61
		10	69.90
		15	70.54
	14	5	59.01
		10	67.52
		15	62.58
	21	5	47.68
		10	58.09
		15	58.89
Mulched	0	5	90.00
		10	90.00
		15	90.00
	7	5	30.99
		10	69.90
		15	66.01
	14	5	0.00
		10	7.69
		15	65.01
	21	5	0.00
		10	0.00
		15	42.31

Table 1b : Mean table for duration × depth

Depth (in cm)	0 Day	7 Days	14 Days	21 Days	Mean
5	90.00	48.80	29.50	23.84	47.78
10	90.00	69.90	37.60	29.04	56.64
15	90.00	68.277	63.80	50.60	68.17
Mean	90.00	61.99	43.63	34.49	

Table 1c : Mean table for depth × mulching

Depth (in cm)	Condition		
	Unmulched	Mulched	Mean
5	65.32	30.24	47.78
10	71.38	41.90	56.64
15	70.50	65.83	68.17
	69.07	45.99	

Table 1d : Mean table for duration × mulching

Days	Condition		
	Unmulched	Mulched	Mean
0	90.00	90.00	90.00
7	68.35	55.63	61.99
14	63.04	24.23	43.63
21	54.89	14.10	34.49
Mean	69.07	45.99	

	S. Em (±)	C.D. at 5%
Depth	0.95	2.70
Duration	1.09	3.12
Mulching	0.77	2.21
De × Du	1.90	5.41
De × Mu	1.34	3.83
Du × Mu	1.55	4.42
De × Du × Mu	2.68	7.66

56.67 % loss in sclerotial viability was observed at 15 cm depth after 21 days. However, total elimination in viability of sclerotial population was not achived. Reduction in sclerotial population under mulched condition was due to increase in temperature. As sufficient heat generated through the process of solarization to kill the sclerotia at 5 cm depths, but it was insyfficient at deeper layer (15 cm).

The solarization of moist soil is much more effective in eradication of the soil borne plant pathogenic propagules, than dry soil, (Pullman *et al.*, 1981). The optimum solarization effect has been observed by the time-temperature combination and reduction in temperature may be compensated by time (Kodama and Fukui, 1982) and the mechanism for inactivation of pathogenic propagules through moist heat is achieved by denaturation of protein (Horiuchi, 1984).

The effects of solarization on the seeding moratality were also studied (Table 2). Under solarized condition, a very low mortality rate of the chilli plant was observed after 60 days. On the contrary under unsolarized condition a very high rate of mortality was observed from initial 15 days leading to the mortality of 52% plant after 60 days.

Table 2 : Mortality of chili plant at different days

Treat.	15 days	30 days	45 days	60 days	Mean
Solarized	0.00	5.31	13.16	26.32	11.20
Non-solorized	21.25	31.63	41.54	43.84	34.57
Mean	10.63	18.47	27.35	35.08	

	S. Em (±)	C.D. at 5%
Solarization	2.50	7.26
Duration	3.34	10.27

The explanation of the reason is that under solarized soil majority of the sclerotia were killed, a few are remained viable under deeper layer. They come up on surface at the time of planting, germinate and cause diseases. On the contrary in mulched condition soil majority of the selerotia remained viable, which germinate and cause infection. So, the rate of seeding mortality is very high under unmulch condition.

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