Survival of *Rhizoctonia solani* in soil under varying temperature regimes*

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Sheath blight of rice caused by *Rhizoctonia solani* Kühn is a serious disease in many rice growing regions of Uttar Pradesh. The occurrence and severity of rice sheath blight in northern India was reported by Kohli (3). The pathogen is known to survive in soil as sclerotia as well as thick walled lobate mycelium. Little information is available about the effect of temperature on the perpetuation of this fungus. Richards (6) reported that *R. solani* remains in active stage, much longer at lower temperature than that at higher temperature. Basu and Gupta (1) observed that at higher temperature viability of sclerotia gradually decreased.

In the present study, an attempt has been made to investigate the survival of mycelium and sclerotia of *R. solani* at various temperature regimes.

Plastic pots (6" size) filled with natural soil were used in this study. In the first set of experiment, rice leaf sheath showing disease symptoms were collected from field during November 1997. They were cut into small pieces of approximately 4 to 5 cm size and sclerotia were collected from 15 day old culture of fungus grown on PDA medium. They were placed in nylon bags and buried in natural soil. These pots were stored at room temperature, where the maximum temperature recorded up to 41°C (during May and June) and minimum 16°C (during December and January). The moisture content was maintained at 50 per cent level by periodic addition of tap water. Isolation of fungus from leaf sheath pieces and viability of sclerotia was done at monthly intervals on PDA medium. The infected bits/ sclerotia were removed at monthly intervals, washed with distilled water, surface sterilized with 0.1% mercuric chloride solution and transferred to petri plates containing PDA. The number of infected pieces/ sclerotia yielding colonies was recorded and percentage recovery (percent survival) calculated.

In the second set of experiment, infected leaf sheath pieces (4-5 cm size)/ sclerotia filled in nylon bags were buried in natural soil in plastic pots and then incubated at different temperatures, i.e., 0, 10, 28 and 40°C. Three replications were maintained for each treatment. Samples were taken at monthly intervals and viability of the pathogen on the debris/ sclerotia was tested as described in previous case.

The results revealed that the fungus survived in infected plant debris up to 150 days and in the form of sclerotia up to the next crop season. The percentage of infected plant pieces/ sclerotia yielding colonies decreased with increase in time of storage. An initial recovery of 100 per cent from infected plant debris in December 1997 dropped down up to 83.3 per cent in January 1998. However, during February to March, there was a sharp decline in the recovery of the fungus, it dropped down up to 20 per cent within period of one month. Whereas, slight decrease in the recovery of pathogen from 5.8-10.4 per cent was observed during March-April and April-May. An initial recovery of 96.6 per cent from sclerotia in September, dropped down up to 63.3 per cent in the first five months, i.e., September to January, but the decline in the survivability of the sclerotia was gradual. However, during January to April, there was sharp decline in the recovery of the fungus from buried sclerotia, it dropped down up to 31.5 per cent in the period of 4 months. From April to July, reduction in the survivability was maximum, i.e., 61.4 per cent (Fig. 1).

It appears that high temperature during April to June did reduce the survival of the fungus, but it was not altogether eliminated as the recovery of the colonies continued up to July. Steady, gradual or sharp decline in the recovery of the fungus from infected plant debris and sclerotia have been observed. Richard’s (6) also observed that *R. solani* remains in active state...
Fig. 1. Per cent survival of \( R. solani \) in infected plant debris and in the form of sclerotia buried in soil stored at room temperature much longer at lower temperature than at higher. Park and Berteus (5) had found that the sclerotia remained viable for 130 days in air dried soil kept at room temperature (30°C). Reports are also on hand indicating viability of sclerotia up to 10 months (4) and 12 months (2). Basu and Gupta (1) reported that at higher temperature viability of sclerotia gradually decreased.

Exposure at a particular temperature did affect the length of survival of \( R. solani \) in infected crop debris having mycelium and in the form of sclerotia. Mycelium of \( R. solani \) survived for 150 days in infected crop debris incubated at 10-40°C and for 120 days at 0°C. It is evident from Fig. 2 that an initial recovery of 100 per cent from infected crop debris at the beginning of the experiment in the sample incubated at 40°C dropped down to 33.3 per cent after four months. This indicates that constant exposure at 40°C was lethal to the fungus. However, in the infected leaf sheath pieces incubated at 10 and 28°C, there was steady reduction in the per cent recovery of the fungus as the period of incubation increased from an initial recovery of 100 per cent to 60 and 63.3 per cent, respectively after 6 months, that is up to February. The survivability of sclerotia was much better at 10 and 28°C temperature as the per cent recovery was found to be 13.3 and 36.7 per cent, respectively, after 11 months.

The results indicate that the survival of the pathogen in the form of sclerotia stored at low temperature is particularly good enough for the transmission of the primary inoculum for the next crop season, even it can survive at high temperatures. Survival of the fungus at 28°C is practically good enough for the transmission of primary inoculum. Basu and Gupta (1) demonstrated that sclerotia were more resistant to heat than mycelia. In the present study, also viability of sclerotia continued up to 270 days, whereas survivability of the mycelium in crop debris was observed till 150 days only.

Fig. 2. Per cent survival of \( R. solani \) in infected plant debris placed in soil and incubated at different temperatures

as the period of incubation increased from an initial recovery of 100 per cent to 53.3 and 63.3 per cent, respectively, after five months. The survivability of fungus was minimum (4 months) at low temperature, i.e., 0°C and it increased gradually up to 28°C temperature. After 120 days of incubation, significant (47.3 per cent) reduction in survivability of the fungus was recorded at 0°C compared to 28°C. The survivability of fungus decreased by 42 per cent at 40°C over 28°C temperature.

It is evident from the Fig. 3 that \( Rhizoctonia solani \) in the form of sclerotia survived for 330 days at different temperature. At 40°C, the survival of sclerotia dropped from 100 per cent to 20 per cent after 9 months. Whereas survivability of sclerotia buried in soil at 0°C, dropped down to 10 per cent after 11 months. However, in sclerotia incubated at 10 and 28°C, temperature, there was steady reduction in the per cent recovery of the fungus as the period of incubation increased from an initial recovery of 100 per cent to 60 and 63.3 per cent, respectively after a period of 6 months, that is up to February. The survivability of sclerotia was much better at 10 and 28°C temperature as the per cent recovery was found to be 13.3 and 36.7 per cent, respectively, after 11 months.
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