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Research article

ROLE OF SCLEROTIA, PLANT DEBRIS AND DIFFERENT HOSTS ON SURVIVAL OF RICE SHEATH BLIGHT PATHOGEN, *RHIZOCTONIA SOLANI*

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ABSTRACT: The survival of sclerotia stored under different conditions revealed that when they were kept in laboratory survived fully up to 7 months. However in soil at 5 cm and 10 cm depth, it survived 100 percent up to 8 and 10 months. The pathogen was viable in the sclerotial form for 17 months in the lab conditions however; it survived for 19 months and 20 months when kept at 5 cm and 10 cm depth in soil respectively. The survival of pathogen along with plant debris stored under different conditions revealed that it survived fully up to 3 months under lab conditions. However in soil at 5 cm and 10 cm depth, it survived 100 percent up to 5 and 6 months respectively. The pathogen survived in diseased plant debris for 9 months in lab conditions. However, the pathogen survives in plant debris up to 11 months and 13 months when kept at 5 cm and 10 cm depth of soil respectively. The viability of pathogen in plant debris was lost gradually. This states sclerotia and plant debris served as source of primary inoculum. Out of fourteen plant species belonging to three families tested, the pathogen produced disease symptoms on all the tested plants and stating pathogen has wide host range.

Key words: Sclerotia, Sheath Blight, *Rhizoctonia solani*

INTRODUCTION

Banded leaf and Sheath blight of rice caused by *Rhizoctonia solani* Kuhn is one of the most widely distributed and destructive disease of rice, now a day's followed by rice blast. It is causing concern to the farmers of major rice growing states of India. The management of this disease is possible only after the detailed study of different aspect of the pathogen. Recognizing the importance of the problem, the mode of survival of pathogen in the sclerotia, diseased plant debris, host-range of the fungus was studied in the conditions where crop is not sown for a season. This article represents the need for going to various management practices.

MATERIALS AND METHODS

Sclerotia formed in Petri plates and on plants were collected and kept in muslin cloth bags during September, 2010. Three sets were prepared for studying in three different conditions. One set of muslin cloth bag having sclerotia was kept in laboratory at room temperature and the other two sets were kept in muslin cloth bags and were buried in soil at 5 cm and 10 cm depth in earthen pots. These pots were kept in net house to provide natural environmental conditions. From the three sets (kept at room temperature in lab and buried in soil at 5 cm and 10 cm depth in earthen pots), isolations were made at monthly intervals up to 21 months. The sclerotia collected from three different conditions were grown on PDA and regular observations were made for the viability of sclerotia through mycelial development. Diseased plant debris were collected from severely affected rice fields and kept in muslin cloth bags. One set of muslin cloth bags having diseased plant debris were kept in laboratory at room temperature and the other two sets were kept in muslin cloth bags and were buried in soil at depth of 5 cm and10 cm in earthen pots. These pots were kept in net house to provide natural environmental conditions. From the three sets (kept at room temperature in lab and buried in soil at 5 and 10cm depth in pots), isolations were made at monthly intervals up to 14 months. The plant debris collected from three different conditions grown on PDA medium and regular observations were made for the viability of fungus in plant debris through mycelial development.

In order to find out the host range of rice isolate of *R. solani,* 14 species belonging to three different families i.e. Amaranthaceae, Graminaceae, Leguminaceae were sown in pots. These pots were kept in net house. 30 days old plants were inoculated with mycelial suspension of *R. solani* grown on PDA for 7 days at 28±1˚C. These inoculated plants were kept in nets at 80-90% RH maintained through fogging device. The humidity was maintained regularly. These plants were regularly observed for the development of disease symptoms. The plant species which showed disease symptoms were marked (+) and those which did not show disease symptoms were marked (-).

RESULTS AND DISCUSSION

Survival of Sclerotia in Different Conditions and Its Role as a Source of Primary Inoculum

Sclerotia produced on the diseased plant parts and on PDA medium, collected during September, 2010 to find out the role of sclerotia as a source of primary inoculum and its survival period. Three sets were prepared for studying in three different conditions. One set of muslin cloth bag having sclerotia was kept in laboratory at room temperature and the other two sets were kept in muslin cloth bags and were buried in soil at 5cm and10cmdepth in earthen pots. These pots were kept in net house to provide natural environmental conditions. Observations were recorded by isolation of sclerotia from different conditions at monthly intervals to know the viability of fungal sclerotia for 21 months (Table-1). It is evident that up to first seven months of the storage, all the sclerotia from lab conditions used for isolation yielded the pathogen. However, all the sclerotia kept at 5 cm and 10 cm depth produced 100 percent mycelial production on PDA medium up to 8 months and 10 months respectively. Then onwards, the survival of sclerotia in all conditions reduced gradually. Pathogen survived up to 19 and 20 months in sclerotia kept at 5cm and 10 cm depth in the soil in earthen pots. While sclerotia kept in laboratory survived up to 17 months. Mostly sclerotia smaller in sizes were not viable. It is clearly indicated that the pathogen mainly survives in the form of sclerotia in soil and can survive up to 17 months in room conditions. However, the sclerotia survived up to 19 months when kept in 5 cm depth and 20 months when kept in 10 cm depth in soil. These findings are in agreement with Muller (1924) who reported that sclerotia of *Rhizoctonia solani* remained viable for more than 18 months. The studies on survival of sclerotia stored under different conditions revealed that when they were kept in laboratory survived fully up to 7 months and in soil at 5 cm and 10 cm, it survived 100 percent up to 8 and 10 months respectively.

Table 1: Survival of Sclerotia under Different Storage Conditions During September, 2010 to may, 2012

S.No.	Month of isolation	No sclerotia used for isolation	Germination percentage of sclerotia buried in soil		
			Room condition	5cm depth	10cm depth
1.	SEP, 2010	15	100	100.00	100.00
2.	OCT, 2010	15	100	100.00	100.00
3.	NOV, 2010	15	100	100.00	100.00
4.	DEC, 2010	15	100	100.00	100.00
5.	JAN, 2011	15	100	100.00	100.00
6.	FEB, 2011	15	100	100.00	100.00
7.	MAR, 2011	15	100	100.00	100.00
8.	APR, 2011	15	93.30	100.00	100.00
9.	MAY, 2011	15	86.60	93.33	100.00
10.	JUN, 2011	15	73.33	93.33	100.00
11.	JUL, 2011	15	73.33	86.60	93.33
12.	AUG, 2011	15	66.66	86.60	93.33
13	SEP, 2011	15	60.00	73.33	93.33
14.	OCT, 2011	15	53.33	73.33	86.66
15.	NOV, 2011	15	40.00	66.66	73.33
16.	DEC, 2011	15	33.33	60.00	73.33
17.	JAN, 2012	15	26.66	53.33	66.66
18.	FEB, 2012	15	00.00	40.00	53.33
19.	MAR, 2012	15	00.00	33.33	53.33
20.	APR, 2012	15	00.00	00.00	40.00
21.	MAY,2012	15	00.00	00.00	00.00

Beyond that viabilityof sclerotia was lost due todesiccation of the sclerotia kept at 5 cm than they were kept at 10 cm(Park(1932), Kulkarni(1967), MahendraPradhat*et al.* (1974), Kanniyan and Prasad (1978), Tu*et al.* (1979), Dash (1985), Tan Genjia*et al.* (2000). The sclerotia when inoculated in the portion between sheath and culm, the sheath blight symptoms were observed which were reported by Hyakumachiand Ui (1982). These findings indicated that sclerotia served as potent source for the infection and disease development.

Survival of Pathogen in Plant Debris in Different Conditions and Its Role as a Source of Primary Inoculum

The viability of pathogen in diseased plant debris was studied in different conditions. In the view to find perpetuation of the pathogen in three different conditions, diseased plant parts collected from field kept in the muslin cloth bags and one set was kept in the laboratory and another two sets of the muslin cloth bags buried in earthen pots at 5 and10 depth. At monthly intervals, 15 pieces were used for isolation and the percentage of pieces yielding the pathogen in culture medium was worked out (Table 2).

Table 2: Survival of Pathogen in Plant Debris under Different Storage Conditions During September, 2010 to may, 2012

S.No.	Month of isolation	No. Plant debris pieces used for isolation	Germination percentage of plant debris giving culture		
			Room condition	5cm depth	10cm depth
1.	SEP, 2010	15	100	100.00	100.00
2.	OCT, 2010	15	100	100.00	100.00
3.	NOV, 2010	15	100	100.00	100.00
4.	DEC, 2010	15	93.33	100.00	100.00
5.	JAN, 2011	15	80.00	100.00	100.00
6.	FEB, 2011	15	66.66	93.33	100.00
7.	MAR, 2011	15	53.33	80.00	93.33
8.	APR, 2011	15	40.00	73.33	86.60
9.	MAY, 2011	15	26.66	66.66	80.00
10.	JUN, 2011	15	00.00	40.00	60.00
11.	JUL, 2011	15	00.00	26.66	33.33
12.	AUG, 2011	15	00.00	00.00	26.66
13.	SEP, 2011	15	00.00	00.00	13.33
14.	OCT,2011	15	00.00	00.00	00.00

It is evident from data presented in table 2 that the pathogen could be isolated on PDA medium up to 9 months from the diseased plant debris when kept under laboratory conditions. However pathogen could grow on PDA medium up to11 and 13 months from the diseased plant debris buried in earthen pots at 5 and 10 cm depths. In the observations recorded up to 5 months and 6 months of storage, all the pieces used for isolation from diseased plant debris buried at 5 and 10 cm depth in earthen pots yielded the culture of the pathogen. But, there after the percentage of recovery gradually decreased with increase in the storage period. Up to 3 months of storage, all the pieces kept in the laboratory yielded the culture of the pathogen on the PDA and after that it gradually reduced with the increase in the storage period. Field (buried) conditions was more suitable for survival of the pathogen as the percentage of the pieces yielding culture under this conditions was higher. It is clear that pathogen survives in the plant debris and can survive up to 9 months when kept in lab conditions. However the pathogen survives along with the plant debris up to 11 months and 13 months when kept in 5 cm depth and 10 cm depth of soil respectively. These findings resembling with findings of earlier workers Baker (1947), Neergaard (1958), Herzog (1961), Deniels (1963) and Oshima*et al.* (1963). The studies on survival of the pathogen in plant debris stored under different conditions revealed that when they were kept in lab survived fully up to 3 months. In soil at 5 cm and 10 cm, it survived 100 percent up to 5 and 6 months respectively. Beyond that, viability of pathogen in plant debris was lost due to antagonism from surrounding microorganisms and due to disintegration of plant debris. It is found in accordance with the (Onesirosan and Sagay (1975), Lishi Dong (2004), Singh and Singh (2008).

HOST RANGE OF PATHOGEN

The pathogen, *R. solani* has a wide host range infecting crops and weed plants. In order to find out the host range of *R. solani* isolate obtained from infected rice plant parts, 14 plant species belonging to three families were grown in pots filled with sterilized soil were inoculated with the mycelia suspension of test fungus grown on PDA for 7 days at 28±1˚C. The inoculated plants were kept under high humid conditions and were observed regularly for the appearance of the disease symptoms. Typical sheath blight symptoms started appearing 7 days after inoculation (Table-3 &4). Host range studies indicated that pathogen (*Rhizoctonia solani)* successfully infected all the 14 species belonging to three families. This proves that weeds and plants serve as collateral hosts and helped in the spread of the disease in next season. So, it is better recommended that weeding at timely intervals during crop season and selection of non suitable crop helps in minimizing the disease in the next crop season. This was supported by Tsai (1974), Singh and Saksena (1980), Kanniyan and Prasad (1980), Goswami*et al.* (2010).

Table 3: List of plant Species Included in Host Range Studies

S. No.	Common Name	Botanical Name	Family
1.	Tandal	*Digera arvensis Forsk*	Amaranthaceae
2.	Maize	*Zea mays L.*	Graminaceae
3.	Sugarcane	*Saccharum officinarum L.*	Graminaceae
4.	Jowar	*Sorghum bicolor L.*	Graminaceae
5.	Doob grass	*Cynodon dactylonL.*	Graminaceae
6.	Rhodes grass	*Chloris giana*	Graminaceae
7.	Motha	*Cyperus rotundus*	Graminaceae
8.	Coast Finger Grass	*Dactylactenium aegyptium*	Graminaceae
9.	Hairy crab grass	*Digitaria sanguinalis*	Graminaceae
10.	Barnyard Grass	*Echinochloa colonum*	Graminaceae
11.	Cockspur Grass	*Echinochloa crusgalli*	Graminaceae
12.	Soya bean	*Glycine max (L.) Merril.*	Leguminaceae
13.	Black gram	*Vigna mungo (L.) Hepper*	Leguminaceae
14.	Green gram	*Vigna radiate (L.) Wilezek*	Leguminaceae

Table 4: List of Plants Species Included in Host Range Studies

S. No.	Common Name	Botanical Name	Symptoms
1.	Tandal	*DigeraarvensisForsk*	+
2.	Maize	*Zea mays L.*	+
3.	Sugarcane	*Saccharumofficinarum L.*	+
4.	Jowar	*Sorghum bicolor L.*	+
5.	Doob grass	*CynodondactylonL.*	+
6.	Rhodes grass	*Chlorisgiana*	+
7.	Motha	*Cyperusrotundus*	+
8.	Coast Finger Grass	*Dactylacteniumaegyptium*	+
9.	Hairy crab grass	*Digitariasanguinalis*	+
10.	Barnyard Grass.	*Echinochloacolonum*	+
11.	Cockspur Grass	*Echinochloacrusgalli*	+
12.	Soya bean	*Glycine max (L.) Merril.*	+
13.	Black gram	*Vignamungo(L.) Hepper*	+
14.	Green gram	*Vigna radiate (L.) Wilezek*	+

+: Susceptible; -: Resistant

From the above table 3, it was confirmed that all the plants tested were susceptible to the pathogen.

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