Sheath blight disease (*Rhizoctonia solani*) in Paddy (*Oryza sativa)*

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ABSTRACT

Sclerotial development of *R. solani* showed that there was variation in radial growth, growth pattern and hyphal width of *R. solani*. Maximum growth was recorded in Potato Dextrose Agar (45.0 mm) followed by Oat meal agar (44.5 mm), where as the least growth was observed in Richard's medium (26.0 mm). Mycelial colour of *R. solani* varied from creamish white to off-white in different media. Field experiments conducted to determine the influence of sowing dates on development of sheath blight disease revealed that crop sown on 23rd June recorded significantly less disease severity as compared to the crop sown on 3rd and 13th June but the highest yield was recorded in the crop sown on 13th of June than the crop sown on 3rd and 23rd June.

Keywords: Sowing dates, sheath blight, paddy, media

INTRODUCTION

Sheath blight disease caused by *Rhizoctonia solani* Kuhn is presently becoming a serious threat to rice cultivation in both tropical and temperate areas owing to the ability of its pathogen to adjust in different climatic conditions. Sheath blight of rice is known in East and South East Asia since 1910 but was considered a minor disease (Ramakrishnan, 1971). However, built in inoculum and less attention paid has made this disease to know world-wide which ultimately registered serious losses in temperate as well as tropical rice producing countries including Brazil, Venezuela, Surinam, Madagascar, USA, Fiji, Papua, Nigeria and Iran (Singh, 1998). In India, the disease was first reported by Paracer and Chahal (1963) from Gurdaspur (Punjab). Economic importance of the disease is tending to increase because of excessive use of fertilizers and introduction of high yielding varieties, which yield large number of tillers there by increasing the humidity under the plant canopy thus making the plant prone to the sheath blight. The disease is characterized by the formation of lesions on leaf sheaths and

culms at the water level, which become confluent giving characteristic banded appearance. The infection may spread up to the culms, killing all the leaves under favourable weather conditions. Losses up to 20 per cent in grain yield has been reported when disease invades at flag leaf stage (Singh, 1990) however, the resultant losses have been related with rice varieties cultivated. On artifical media, the fungus produce a dense pale to dark brown mycelium. The light shades of brown changes to darker colour with age. Sectoring of colony of this fungus on agar media is frequent (Singh, 1994). The present studies were carried *in-vitro* to find out the effect of different media on the growth and sclerotial development of the pathogen. The present studies were carried *in-vitro* to find out the effect of different media on the growth and sclerotial development of the pathogen and the influence of sowing dates on the development of disease at Jammu.

MATERIALS AND METHODS

To study the variation in growth of the fungus, *Rhizoctonia solani*, grown on ten different media, viz. Potato dextrose agar (PDA), Oat meal agar (OMA), Czpecks dox agar (CDA), Asthana and Hawker agar, Malt and yeast extract, Corn meal agar, Richard medium, Host extract, Sabourand's agar and Malt extract peptone dextrose agar. Sterile petriplates containing 25ml of each medium with three replications were inoculated with 5mm culture discs of *R. solani* taken from the periphery of actively growing colony on PDA, incubated at 28±2^{0}C in BOD incubator. The radial growth of different treatments was recorded after three days of incubation and/or till when the growth of any one of the competitive treatments reached up to 45 mm.

Field experiment in RBD (Randomized Block Design) was carried out at the University research farm, SKUAST-J, Main Campus, Chatha, Jammu during the Kharif season of 2005-06 and 2006-07. Varity Jaya was sown at 10 days intervals in plot (2x2m) 30 cm apart with plant to plant distance of 15 cm and replicated thrice as per recommended package of practices for the crop (Anonymous, 2005). The sowing dates were 3rd June, 13th June and 23rd June. Observation on percent disease incidence and intensity were recorded by the formula

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

$$\text{Degree of severity (\%)} = \frac{3N_1 + 2N_2 + N_3 + 0N_4}{3N} \times 100$$

Where in:

N_1 = Number of tillers with all the uppermost sheaths infected.
N_2 & N_3 = Intermediatory
N_4 = Number of tillers with four uppermost healthy sheaths.
N = Total number of tillers

The observations were taken at fifteen days interval starting from the time of transplanting. The crop was harvested in the 2nd week of November in each cropping season and yield recorded for each date of sowing.

RESULTS

Evaluation of Suitable medium

There was variation in radial growth, growth pattern and hyphal width of *R. solani* on different media. Maximum growth of *R. solani* was recorded in PDA (45.0 mm) followed by oat meal agar (44.5 mm), malt and yeast extract (44.0 mm), malt extract peptone agar (43.0 mm) and Sabourand's agar (42.0 mm) whereas, least growth was observed in Richard's medium (26.0 mm). Mycelial colour on different media varied from creamish white (PDA, oat meal agar, Richard's medium, malt and yeast extract and Asthana & Hawker agar) through white (Czpeckdox agar, corn meal agar, malt extract peptone agar and Sabourand's agar) to off-white (host extract). Growth pattern of mycelium also varied from fluffy (PDA, oat meal agar, Sabourand's agar, malt and yeast extract and malt extract peptone agar) to suppressed (Czpeckdox agar, corn meal agar, Richard's medium, host extract and Asthana and Hawker agar). Hyphal width on PDA (8.14 µm) and oat meal agar (7.0 µm) were statistically at par but differed significantly from malt extract peptone agar (5.6 µm), Czpeck dox agar (5.62 µm) corn meal agar (5.9 µm), Richard's medium (5.9 µm), Asthana and Hawker agar (5.9 µm) and host extract (6.5 µm) (Plate).

The mycelium congregated after 5th day, which finally developed in full fledged sclerotia on 7th day (oat meal agar, Sabourand's agar, malt and yeast extract), on 8th day (malt extract peptone agar and Asthana and Hawker agar) and on 9th day (Czpeck dox agar, corn meal agar and Richard's medium). Similarly, sclerotial position in petri plates, size of sclerotia, and number of sclerotia and shape of sclerotia on different media also varied considerably. The position of sclerotia on PDA, Richard's medium, host extract, Sabourand's agar, malt extract peptone agar and Asthana & Hawker agar were in center of petri plates where as the position of sclerotia on oat meal agar, Czpeck dox agar, corn meal agar and malt and yeast extract were towards the periphery of petri plates (Fig. 1).

The maximum size of sclerotia was found on PDA (2.06 mm) which significantly differed from the rest of the sclerotial sizes formed on various other media tested. The minimum sclerotial size was found on host extract (0.31mm) and Asthana and Hawker agar (0.31 mm) which were statistically at par with malt and yeast extract (0.34 mm) and Sabourand's agar (0.52 mm). The maximum number of sclerotia were also found on potato dextrose agar (183) followed by oat meal agar (160) and the least number of sclerotia were found on host extract (18) followed by Sabourand's agar (20). The shape of sclerotia

varied from round and rough (PDA) through round and smooth (oat meal agar, Czpeck dox agar, Richard's medium, host extract Sabourand's agar and Asthana and Hawker agar) to serrated (corn meal agar, malt and yeast extract and malt extract peptone agar). Significant differences were recorded in the cultural characteristics of *R. solani* grown on different media. *R. solani* has been reported to grow well on carbohydrate rich media like Potato dextrose agar, Oat meal agar, Czpeck dox agar and Corn meal agar findings are in agreement with Behera *et al*., 1984; Dubey, 1997; Meena *et al*., 2001 and Premlatha, 1984.

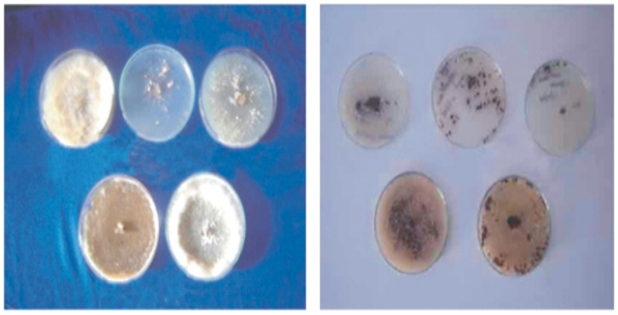

Fig. 1: Growth of *R. solani* on different media

Severity on growth stages

The lowest per cent disease incidence and severity was recorded for the 3rd sowing date, i.e. 23rd of June during both the years 2005 and 2006, followed by 2nd sowing date of 13th of June. The per cent disease intensity and incidence recorded during the year 2006 was higher than the per cent disease intensity and incidence during 2005. The maximum disease incidence was recorded during the crop sown on 3rd of June (50.7 %) followed by 13th of June (43.1%) and the minimum disease incidence was recorded during the crop sown on 23rd of June (39.1%). All the sowing dates differed significantly from each other. In case of severity, the maximum disease severity was recorded during the crop sown on 3rd of June (30.5%) followed by 13th of June (23.9 %) and minimum disease severity was found at 23rd of June (21.4%) whereas, the yield was maximum during the crop sown on 13th of June (51.0 q ha^{-1}) followed by 3rd of June (46.3q ha^{-1}) and the minimum yield was found on 23rd of June (31.0 q ha^{-1}) (Table 1). In the present study, lowest disease intensity and lowest yield was recorded in the crop sown on 23rd of June in both the years whereas, the highest yield was recorded in the crop sown on 13th of June than the crop sown on 3rd and 23rd of June (Table 2). Our findings are erratic to the past findings where late varieties were found to be less susceptible than early and tall varieties with few tillers were resistance than short ones with many tillers (Yang *et al*., 2002).

Table 1. Cultural characteristics and sclerotial development of *Rhizoctonia solani* on different media.

Medium	Colour of mycelium	Growth pattern	Hyphal Width(µm)	Radial growth after 5 day (mm)	Position of sclerotia	Size of sclerotia (mm)	Number of sclerotia	Shape of sclerotia
PDA	Creamish white	Fluffy	8.14	45.0	Centre	2.06	183	Round and rough
Oat meal agar	Creamish white	Fluffy	7.00	44.5	Periphery	1.16	160	Round and smooh
Czpeckdox agar	White	Hypha uppressed	5.62	30.0	Periphery	0.62	153	Round and smooth
Corn meal agar	White	Hypha Suppressed	5.90	38.0	Periphery	0.63	20	Serrated
Richard's Medium	Creamish white	Hypha Suppressed	5.92	26.0	Centre	1.03	90	Round and smooth
Host extract	Off white	Hypha Suppressed	6.53	38.0	Centre	0.31	18	Round and smooth
Sabourand 's agar	White	Fluffy	6.20	42.0	Centre	0.52	20	Round and smooth
Malt and Yeast extract	Creamish white	Fluffy	5.90	44.0	Periphery	0.34	92	Serrated
Malt extract peptone agar	White	Fluffy	5.62	43 .0	Centre	0.60	103	Serrated
Asthana and Hawker agar	Creamish white	Hypha Suppressed	5.90	39 . 0	Centre	0.31	81	Round and smooth
C.D. (p=0.05)			1.01	0.64		0.21	1.70	

Table 2. Effect of different dates of sowing on sheath blight of rice

Treatment	**Disease incidence (%)**			**Disease severity (%)**			**Yield (q ha^{-1})**		
	2005	**2006**	**pooled**	**2005**	**2006**	**pooled**	**2005**	**2006**	**pooled**
3rd of June	48.9 (44.37)	52.4 (46.38)	50.7 (45.40)	29.5 (32.90)	31.4 (34.08)	30.5 (33.52)	45.0 (42.13)	47.5 (43.57)	46.3 (42.88)
13th of June	40.6 (39.58)	45.5 (42.42)	43.1 (41.03)	22.6 (28.39)	25.2 (30.13)	23.9 (29.27)	50.0 (45.00)	52.0 (46.15)	51.0 (45.57)
23rd of June	35.9 (36.81)	42.3 (40.57)	39.1 (38.70)	20.4 (26.85)	22.3 (28.18)	21.4 (27.56)	30.0 (33.21)	32.0 (34.45)	31.0 (33.83)
C.D. (p=0.05)	2.5	2.7	1.46	2.05	3.37	2.23	2.61	1.44	1.3

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