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RESEARCH PAPER

Effect of different light intensities, different light duration patterns and different temperatures on growth and sclerotial development of *Rhizoctonia solani*

UPMA DUTTA*, C.S. KALHA AND J.N. SRIVASTAVA[1]
Department of Plant Pathology, Sher-e-Kashmir University of Agricultural Science and Technology, JAMMU (J&K) INDIA

Abstract **:** At low light intensity (500 lux), the radial growth of *R. solani* was 45 mm and sclerotia were formed after 7th day of inoculation whereas at high light intensities (1000, 1500 and 2000 lux), the mycelial growth was restricted at 35 mm, 30 mm and 25 mm, respectively and the no scelortia formation was noticed. In different light duration patterns *viz.,* Continuous light, alternate light-dark, alternate dark -light and continuous dark, there was no difference in mycelial colour, growth pattern and radial growth of the pathogen. Similarly, the sclerotial characters had also not shown variation in terms of position, size and shape but only the number of sclerotia varied whereas at 15^{0}C, there was no growth of *Rhizoctonia solani* but at 20^{0}C, the radial growth was 5.62 µm but the sclerotia were not formed. At 25 and 30^{0}C, the colour of the mycelium, growth pattern and the radial growth did not show any difference, but the hyphal width at 25^{0}C (5.62 µm) and 30^{0}C (7.00 µm) differed significantly. Similarly the position and size of sclerotia did not show any marked difference but the size and number of sclerotia differed significantly.

Key Words **:** Genotypes, Micronutrient, Tillering behavior, Direct seeding, Seed treatment

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INTRODUCTION

Rhizoctonia solani Kuhn. is most destructive fungus and also caused sheath blight on paddy crops. The disease is known in East and South East Asia since 1910 (Ramakrishnan, 1971). In India, the disease was first reported by Pracer and Chahal (1963) from Gurdaspur (Punjab). *Rhizoctonia solani* which is capable of attacking a tremendous range of host plant through out the world, causing a variety of diseases including root rots, cankers,damping off, fruit decay and foliage disease (Alexopoulas *et al*., 2007). 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.

The fungus exhibits considerable amount of variability in its morphological and physiological characters. The variability has been expressed in terms of colony colour, growth pattern, rate of colony growth and anastomosis groups by various workers (Meena *et al*., 2001; Yang *et al*., 2002; Basu *et al*., 2004). *Rhizoctonia solani* isolates from high temp. regions yielded growth on PDA at 35^{0}C but tended to grow poorly at 12^{0}C, whereas those from low temp. regions grew poorly at 35^{0}C and well at 12^{0}C (Hashiba *et al.*, 1974). Lokesha and Somashekar (1988) studied the influence of light on growth pattern of *Rhizoctonia solani* and reported that the growth of the sclerotia of *R. solani* under visible light was greater with higher sclerotial production than cultures under UV and

*** Author for correspondence.**
[1]Regional Horticultural Research Sub-Station, Gwari Bhaderwah, DODA (J&K) INDIA, Email : j.n.srivastava1971@gmail.com

darkness. They further suggested that in darkness, growth from sclerotia and mycelium was equal whereas in light sclerotial growth was greater while the growth from mycelium was almost uniform under all conditions and was noticed no sclerotial production. Lakpale *et al.* (1997) made an *in vitro* studies on growth and sclerotia formation of *Rhizoctonia solani* Kuhn and observed that, of the temperatures tested, 30^{0}C was best for mycelial growth and sclerotia formation of an isolate of *Rhizoctonia solani* from rice and desiccation of sclerotia and compactness of basal medium did not influence mycelial growth and sclerotia formation. The present studies were carried *in vitro* to find out the effect of different light intensities, different light duration patterns and different temperatures on the growth and sclerotial development of the pathogen.

MATERIALS AND METHODS

For these studies, the Potato dextrose agar (PDA) medium was made and this medium was sterilized at 15 psi for 20 minutes. Steriled Petriplates containing 25 ml of medium with three replications were inoculated with 5 mm culture disc of *Rhizoctonia solani*, taken from the Periphery of actively growing colony on PDA. The inoculated Petriplates were kept under four different light intensities *viz*., 500, 1000, 1500 and 2000 lux. The Petriplates were kept in incubator at 28±2^{0}C and the radial growth of different treatments were recorded till the growth of any one of the competitive treatments reached up to 45mm whereas to study the effect of different light duration pattern on the growth and sclerotial development of *Rhizoctonia solani*, the inoculated Petriplates were kept under four illumination regimes: continuous light, continuous dark, alternate light-dark and alternate dark-light. In continuous illumination conditions, light or darkness was maintained during the entire incubation time. In alternate illumination conditions, light or darkness was maintained after 12 hr of the incubation period (diurnal illumination). In all experiment, the average light intensity was 500 lux. Darkness was achieved by covering the Petriplates with opaque black coloured paper. The radial growths of different treatments were recorded till the growth of any one of the competitive treatments reached up to 45 mm and to study the temperature requirement of *Rhizoctonia solani* for their growth, steriled Petriplates containing 25 ml medium with three replications were inoculated with 5mm culture disc of *R. solani* taken from periphery of actively growing colony on PDA. The inoculated Petriplates were kept in incubator at 15, 20, 25 and 30^{0}C temperatures. The radial growth of different treatments was recorded till the growth of any one of the competitive treatments reached up to 45 mm.

RESULTS AND DISCUSSION

Data presented in Table 1 revealed that at low light intensity (500 lux), the radial growth of *R. solani* was 45mm, mycelial colour was buff white, growth pattern was fluffy, hyphal width was 8.43µm and the sclerotia were formed 7th day after the inoculation, position of sclerotia formation was central, size of sclerotia were 1.9 mm, number of sclerotia were 150 and shape of sclerotia were round and rough, whereas, at high light intensities (1000, 1500 and 2000 lux), the mycelial growth of *R. solani* was restricted at 35, 30 and 25mm, respectively and the sclerotia were not formed (Fig. 1).

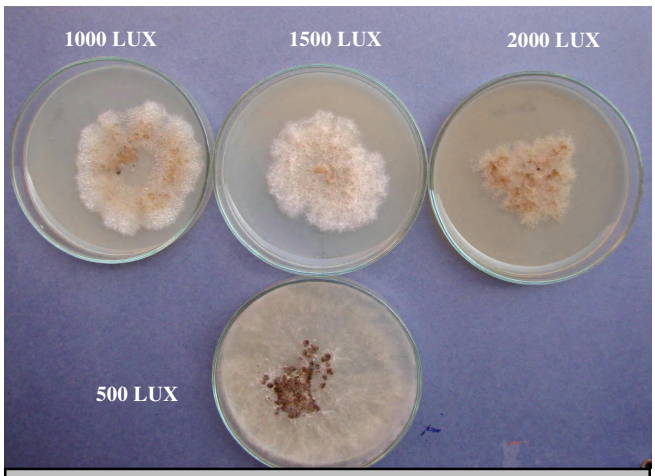

Fig. 1: Effect of different light intensities on mycelial growth and sclerotial development of *R. solani*

Four different light duration patterns *viz*., continuous light, alternate light-dark, alternate dark-light and continuous

Table 1 : Effect of different light intensities on growth and sclerotial development of *Rhizoctonia solani*

Light intensity (Lux)	Mycelial colour	Growth pattern	Hyphal width (µm)	Radial growth after 5days (mm)	Time taken for sclerotia formation (days)	Position of sclerotia	Size of sclerotia (mm)	No. of sclerotia	Shape of sclerotia
500	Buff white	Fluffy	8.43	4.5	7	Center	1.9	150	Round and rough
1000	Creamish white	Fluffy	7.0	3.5	-	-	-	-	-
1500	Creamish white	Fluffy	5.9	3.0	-	-	-	-	-
2000	Brownish	Fluffy	5.62	2.5	-	-	-	-	-
C.D.(P=.0.05)			1.43	1.08					

dark were taken to see their effect on growth and sclerotial development of *R. solani*. Table 2 revealed that there was no difference in mycelial colour, growth pattern and radial growth of the pathogen. The maximum radial growth of the pathogen was found in alternate light-dark (45mm) followed by alternate dark-light (42mm) whereas, the hyphal width was found maximum in alternate light-dark (8.43µm) which was statistically at par with alternate dark-light (7.0µm) and the minimum hyphal width of the pathogen was found in continuous light (5.9µm) which was significantly different from the rest of the treatments. The sclerotia were formed on 7th day (alternate light-dark and alternate dark-light) and on 8th day (continuous light and continuous dark) after inoculation, and the data presented in Table 2 revealed that there was no difference in the position of sclerotia, size of sclerotia and shape of sclerotia, whereas, the number of sclerotia varied. The maximum numbers (200) of sclerotia were found in continuous light followed by in continuous darkness (180) and the minimum (153) sclerotia were found in alternate dark-light followed by in alternate light-dark (160). To study the effect of different temperature regimes on the growth behavior of *R. solani* was grown on potato dextrose agar (PDA) in petriplates at 15, 20, 25, and 30^{0}C with three replications. The average growth was recorded after 5 days of inoculation. Data presented in Table 3 revealed that the *R. solani* could grow between 20 - 30^{0}C in varying degrees. At 15^{0}C, there was no growth of *R. solani*. At 20^{0}C, the radial growth was 9 mm and hyphal width was 5.62 µm but sclerotia were not formed at all. At 25 and 30^{0}C, the colour of mycelium and growth pattern did not show any difference but the radial growth of the pathogen at 25^{0}C (40 mm) and 30^{0}C (45 mm) was statistically at par whereas, the hyphal width at 25^{0}C (5.62µm) and 30^{0}C (7.0µm) differed significantly. The sclerotia were formed on 8th day (25^{0}C) and on 7th day (30^{0}C) of inoculation (Fig. 2). Regarding position of sclerotia, there was not much difference among the treatments but the size of sclerotia and number of sclerotia differed significantly, whereas, shape of sclerotia at 25^{0}C was round and smooth and at 30^{0}C the shape was round and rough.

In the present studies, different light intensities on growth and sclerotial development of *R. solani* revealed that except for light intensity of 500 lux all other light intensities *viz.,* 1000, 1500 and 2000 lux were not favourable for sclerotial production. At light intensity of 500 lux, mycelial colour was buff white, hyphal width recorded was 8.43ìm, the total duration in sclerotial formation was 7 days, most of the sclerotia formed were in centre having average size of 1.9 mm and average

Table 2 : Effect of light duration patterns on growth and sclerotial development of *Rhizoctonia solani*

Light duration patterns	Colour of mycelium	Growth pattern	Hyphal width (µm)	Radial growth after 6 day (mm)	Time taken for sclerotia formation (days)	Position of sclerotia	Size of sclerotia (mm)	No. of sclerotia	Shape of sclerotia
Continuous light	Creamish white	Fluffy	5.9	37.0	8	Periphery	1.16	200	Round and smooth
Alternate light-dark (Diurnal)	Creamish white	Fluffy	8.43	45.0	7	Periphery	1.03	160	Round and smooth
Alternate dark-light (Diurnal)	Creamish white	Fluffy	7.0	42.0	7	Periphery	1.32	153	Round and smooth
Continuous dark	Creamish white	Fluffy	6.7	40.0	8	Periphery	1.15	180	Round and smooth
C.D.(P=0.05)		Fluffy	1.57	NS			NS	1.9	

NS=Non-significant

Table 3 : Effect of different temperatures on growth and sclerotial development of *Rhizoctonia solani*

Temperature (^{o}C)	Colour of mycelium	Growth pattern	Hyphal width (µm)	Radial growth after 5 day (mm)	Time taken for sclerotia formation (days)	Position of sclerotia	Size of sclerotia (mm)`	No. of sclerotia	Shape of scleortia
15	-	-	-	-	-	-	-	-	-
20	-	-	5.62	9.0	-	-	-	-	-
25	Creamish white	Fluffy	5.62	40.0	8	Centre	0.6	10	Round and Smooth
30	Creamish white	Fluffy	7	45.0	7	Centre	1.03	180	Round and Rough
C.D.(P=0.05)			1.08	1.26			0.12	1.3	

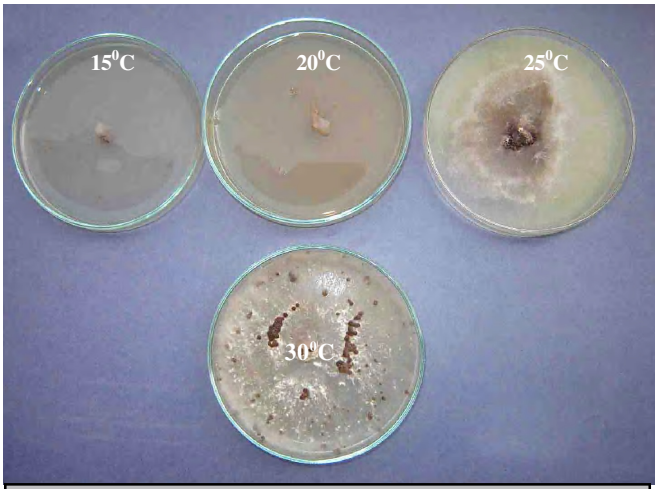

Fig. 2: Effect of different temperature on mycelial growth and sclerotial development of *R. solani*

numbers of sclerotia formed were 150 which were round and rough in shape. It is inferred that during continuous cloudy weather, light intensity remains around 500 lux which favoured the sclerotial development and multiplication of fungus and ultimately played a pivotal role in escalating disease incidence and severity in rice plants. Scanty or no work has been done on this aspect which needs further validation. There was no significant difference in growth and sclerotial development of *R. solani* when Petriplates containing *R. solani* were exposed to continuous light, alternate light-dark, alternate dark-light and continuous dark except for maximum production in the number of sclerotia in the continuous light. Our results are in conformity with the results of Yuno *et al.* (1978) who reported that no significant differences were observed in the growth of *R. solani* held in the dark or light, but lesion developed more rapidly in the light. Temperature being one of the component of the weather plays a pivotal role in growth and sclerotial production of *R. solani*. There was no mycelial growth and sclerotial production at 15^{0}C but was maximum at 30^{0}C followed by 25^{0}C. As per the meteorological data available, the temperature from 2nd fortnight of August to 1st fortnight of October remained between 27-29^{0}C which was conducive for the mycelial growth and production of sclerotia in *Rhizoctonia solani* which may be one of the major reasons that the disease is changing its status from minor to major in all rice growing areas. Our studies are in conformity with Hashiba *et al.* (1974), Xu *et al.* (1997) and Lakpale *et al.* (1997).

REFERENCES

Alexopoulos, C.J., Mims, C.W. and Black well, M. (2007). *Introductory Mycology*. 4th Ed., Wilex India (P) Ltd., New Delhi pp. 670.

Basu, A., Mita, P. and Sengupta, P.K. (2004). Variability and anastomosis among the rice sheath isolates of *Rhizoctonia solani*. *Indian Phytopathol*., **57**: 70-72.

Hashiba, T., Modi, S. and Yagi, S. (1974). The relation between the mycelial growth of rice sheath blight fungus isolates and the air temperature of the collecting regions. *Proc. Assoc. Plant Prot. Hokuriku*, **22**: 8 -14.

Lakpale, N., Khare, N., Thrimurty, V.S. and Agrawal, K.C. (1997). *In vitro* studies on growth and sclerotia formation of *Rhizoctonia solani* Kuhn causing sheath blight of paddy. *J. Soils & Crops*, **7**: 43 – 45.

Lokesha, S. and Somashekar, R.K. (1988). Influence of light on growth pattern of *Rhizoctonia solani*. *Curr. Sci*., **57**: 614-615.

Meena, B., Ramamoorthy, V. and Muthusamy, M. (2001). Morphological and pathological variations in isolates of *Rhizoctonia solani* causing sheath blight of rice. *Plant Disease Res*., **16**: 166-172.

Paracer, C.S. and Chahal, D.S. (1963). Sheath blight of rice caused by *Rhizoctonia solani* Kuhn, a new record in India. *Curr. Sci*., **32**: 320-329.

Ramakrishnan, T.S. (1971). *Disease of rice*. Indian Council of Agriculture Research, New Delhi. 150 pp.

Singh, R.S. (1990). *Plant Diseases*. 6th Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. pp. 444 - 447.

Xu, J.L., Zhou, B.Y., Liu, Y.Q., Li, M. and Li, J.M. (1997). Biological characteristics of *Rhizoctonia solani* Kuhn. *Plant Prot*., **23** : 29 - 30.

Yang, G.H., Dong, W.H., Li, M., Wan, B., Wang, X.Y., Naito, S., Ogoshi, A. and Chen, H.R. (2002). Studies on the strains of pathogens of rice sheath blight in Yunnan Province. *Mycosystema*., **21**: 274-279.

Yuno, I., Hashiba, T. and Mogi, S. (1978). Effect of temperature on disease development of rice sheath blight caused by *Rhizoctonia solani*. *Proc. Association Plant Prot. Hokuriku*., **26**: 4 - 9.

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