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Phytotoxicity of *Rhizoctonia solani* on rice seedlings

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The phytotoxic effect of the culture filtrate of *Rhizoctonia solani* on rice seedlings was first manifested as flaccidity of the leaves followed by necrosis. Ultimately, the leaves were killed In the culture filtrate germination of the seeds was reduced and there was a reduction in root and shoot length as compared to control. The susceptible rice cultivar, Ratna, was affected more than the resistant cv. Dudswar. Sowing of seeds in soil, previously inoculated with bits of sheath blight affected rice plant, resulted in reduction in germination, infection of the seedlings (in the form of leaf necrosis) and reduction in root and shoot length as compared to the uninoculated control.

Key Words : Phytotoxicity, Rice seedlings, *Rhizoctonia solani*

INTRODUCTION

Toxins secreated in the culture medium by *Rhizoctonia solani* and their involvement in the pathogenesis causing diseases of various crops have been reported by several workers (Kerr, 1956 : Sherwood and Lindberg, 1962 ; Wyllie, 1962 ; Nour and Sharkas, 1965).

Sheath blight of rice, caused by *Rhizoctonia solani* Kuhn., is a widespread and destructive disease. Studies were undertaken on phytotoxic effects of the culture filtrates of *R. solani* on symptoms and on growth of rice seedlings.

MATERIALS AND METHODS

For collection of culture filtrate, still culture of the isolate R_2 of *Rhizoctonia solani*, isolated from sheath blight of rice sample, was grown in 50 ml potato

dextrose broth (pH 6.0) in 250ml Erlenmeyer flasks. After 10 days incubation at 28°C cultures in the flasks were thoroughly shaken in an electric shaker for 10 minutes and filtered through Whatman No. 3 filter papers. The filtrate was centrifuged at 1500 rpm for 5 minutes. The supernatant was collected and passed through a sintered glass filter(Pyrex, UF). A portion of the filtrate was kept as such and the remaining portion autoclaved at 15 lbs psi for 20 minutes. The filtrates were stored at 4°C and were tested for their phytotoxic effects on 21 days old rice seedlings of cultivars Ratna (moderately susceptible) and Dudswar (moderately resistant). Uninoculated sterilized potato dextrose broth was used as control.

Five seedlings, at 4 leaf stage, of each of the cultivars were taken as a single replication and 6 replications were taken for each treatment. The roots of the seedlings were kept in the culture filtrate or PD broth in different dilutions for 24 hours in small black bottles after which the symptom expression was assessed.

Symptoms varied from flaccidity of the leaves to ultimate necrosis and killing. Symptoms were assessed by visual observations using the following 5 grades: No symptom—O, flaccid leaves—1, chlorosis or yellowing of leaves—2, chlorosis plus flaccid leaf tips—3, necrosis covering upto half of the leaf length—4, necrosis of the entire leaf—5.

Individual leaves of a plant was assessed and the symptom index (Si) was calculated using the following formula :

$$Si = \frac{\Sigma G}{N},$$

where Si = symtom index, G = grade of the individual leaves of a seedling, N = total number of leaves assessed.

Seed germination and elongation of roots and shoots of the seedlings were studied with unautoclaved culture filtrate only. Sterilized filter papers in petridishes were soaked with 20 ml of different concentrations of the culture filtrate. Rice seeds were surface sterilized for 1-1.5 minutes in sodium hypochlorite solution and then seeded in the petidishes @10 seeds per petridish. Sterilized PD broth served as control. Five replications were taken for each treatment. The petridishes were incubated at 28°C. Counts for seed germination and root and shoot elongation were measered after 3 and 5 days incubation respectively.

For studying the effect of surface soil inoculation on rice seedlings, sheath blight infected plant parts were collected from the field, cut into pieces of 2-3 cm length and spread over soil in three polythene buckets (20 cm diameter, height 25 cm)

having small pores at the bottom. Pieces of healthy plant parts spread over soil in buckets served as control. The buckets were kept in natural condition in the field for 12 months, after which seeds of cv. Ratna were sown in the soil of the buckets. The soil was regularly watered. Data were recorded on seed germination, nature of symptoms, as well as, root and shoot lengths.

RESULTS AND DISCUSSION

In the present study phytotoxic effect of the culture filtrate of *R. solani* on rice seedlings was quite evident. Treatment of rice seedlings with the culture filtrate resulted in chlorosis of the leaves and later necrosis. Ultimately the entire leaf became necrotic and killed (Tables 1 and 2). Phytotoxic effects of the culture filtrate was more pronounced on the seedling of the susceptible cv. Ratna than on cv. Dudswar, Dilution of the culture filtrate reduced its phytotoxicity. Phytotoxicity was detected upto 10% and 25% dilutions of culture filtrate on cvs Ratna and Dudswar respectively. On autoclaving, phytotoxicity of the culture filtrate was reduced to some extent but not completely indicating its heat tolerance.

Table 1. Phytotoxic effect of the culture filtrate of *R. solani* on rice seedlings

Cultivar	Concentration (%)	Symptom index			
		Culture filtrate		P D broth	
		Unauto-claved	Autoclaved	Unauto-claved	Autoclaved
Ratna	100	3.57	2.53	0.13	0.03
	50	2.10	1.82	0 00	0.00
	25	1.50	0.80	0.00	0.00
	10	1.05	0.57	0.00	0.00
	5	0.00	0.00	0.00	0 00
Dudswar	100	1 60	1.37	0.13	0.03
	50	1.50	0.67	0.00	0.00
	25	1.05	0.37	0.00	0.00
	10	0 00	0.00	0.00	0.00
	5	0.00	0.00	0.00	0.00

On surface soil inoculation with sheath blight infected stubbles the emerging seedlings were infected, but did not show typical symptoms of sheath blight as

Table 2. Effect of culture filtrate of *R. solani* on seed germination and root and shoot elongation of rice seedlings

Cultivar	Concentration	Seed germination (%)		Root elongation (cm)		Shoot elongation (cm)	
		Culture filtrate	P D broth	Culture filtrate	P D broth	Culture filtrate	P D broth
Ratna	100	10	50	0.2	0.7	0.5	0 9
	50	30	60	0.5	1.0	0.9	1.4
	10	60	80	0.7	1.4	1.2	1.9
Dudswar	100	20	50	0 4	0.7	0.6	1.0
	50	40	65	0.6	0.9	1.0	1.5
	10	60	90	0.9	1.5	1.2	2.0

Table 3. Effect of surface soil inoculation with *R. solani* on seed germination, plant infection, and root and shoot elongation of rice seedlings (cv. Ratna)

Parameters	Inoculated soil	Control
Seed germination (%)	31.5	90.0
Infected plants (%) after : 7 days	27.6	0.0
10 days	100.0	0,0
Length (cm) after 10 days : Root	1.6	7.6
Shoot	4.0	18.5

observed on older plants. The symptoms consisted of reduction in seed germination, stunting of seedlings, yellowing and browning of the seedlings leaves due to necrosis and ultimate death of the seedlings (Table 3). Lengths of the roots and shoots were shorter in inoculated soil as compared to the control. The symptoms were thus, somewhat similar to those produced when the seedlings were treated with the culture filtrate of *R. solani*, suggesting at least a partial involvement of toxin (s) in the early stages of pathogenesis of rice sheath blight.

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